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The theory of planned behavior and knowledge sharing

A systematic review and meta-analytic structural equation modelling

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Abstract

Purpose – The theory of planned behavior (TPB) is the most frequently used model in knowledge sharing. However, the empirical results are inconclusive on whether TPB can provide reasonable prediction of knowledge sharing behavior (KSB). This study aims to examine TPB in knowledge sharing and identify potential moderators of relationships among constructs in TPB.

Design/methodology/approach – This study conducted a systematic review and meta-analysis of 26 studies examining TPB in knowledge sharing. A meta-analytical structural equation model (MASEM) was used to test original and modified TPB models and examine potential moderators.

Findings – The results show that attitude has the strongest relationship with intention, followed by perceived behavior control and then subjective norms. Intention shows the strongest association with KSB, followed by perceived behavior control. The moderator roles of culture, economic wealth and information technology support are found in the model.

Originality/value – This study is the first attempt to provide a systematic review and MASEM in TPB in knowledge sharing.

Keywords Theory of planned behavior, Knowledge sharing, Systematic review, Meta-analytic structural equation modeling

Paper type Research paper

Introduction

Knowledge sharing has received increasing attention from researchers for more than a decade. Knowledge sharing is an individual action where acquired knowledge is disseminated to others. It includes both transmission and absorption processes: the knowledge poster externalizes the knowledge while the knowledge collector internalizes the

knowledge Hendriks (1999), Ho *et al.* (2011). Because of sharing behavior, knowledge can be transmitted from individual to group and from one generation to another (Pai and Tsai, 2016). From a knowledge-based viewpoint, knowledge is identified as the most strategically important resource and a principal source of value creation, which brings many benefits in the forms of performance and innovation at individual, organizational and at wider macro levels of association (Alsharo *et al.*, 2017).

Knowledge sharing relies on a number of factors, particularly motivation and social environment (Ryu *et al.*, 2003). As it is considered voluntary behavior, not all individuals are inclined to share knowledge with others. For instance, in a highly competitive environment, individuals may be reluctant to share knowledge because they feel a sense of threat to their competitive advantage, power, or status. Consequently, successful knowledge sharing can be difficult to achieve and encouraging an individual to share knowledge is not an easy task.

Literature review

Previous literature has attempted to use several theories to understand knowledge sharing behavior (KSB) (Chiu *et al.*, 2006; Hau *et al.*, 2013). Among them, theory of planned behavior (TPB) is used most often to predict KSB (Chen *et al.*, 2009; Chen, 2011). Indeed, TPB with its solid theoretical framework has been considered the foundational backbone with which to examine the psychological factors driving KSB. Therefore, the number of studies using TPB as a means to understand KSB has increased significantly over the last decade.

TPB was developed by Ajzen (1991), and was an extension of the theory of reasoned action (TRA) (Fishbein and Ajzen, 1981). According to TPB, KSB can be adequately predicted by intentions which reflect the amount of individual effort devoted to perform a type of behavior. In turn, intention is determined by three antecedents: attitude, subjective norms (SN) and perceived behavior control (PBC) (Figure 1). PBC is included in TPB but not in TRA as TRA assumes that most social actions are volitionally controlled (Ajzen, 1991).

Most applications of TPB in predicting KSB provide empirical examinations of the strengths of correlations among constructs and the order of the relative strength of the three antecedents in the relationship with intention to share knowledge. However, empirical results reported in the literature present a relatively high level of variation. For instance, So and Bolloju (2005) found a strong correlation between attitude and intention to share knowledge among information technology professionals in Hong Kong ($r = 0.88$) but Jolaee *et al.* (2014) reported a medium association ($r = 0.3$). Ho *et al.* (2011) suggested a strong relationship ($r = 0.66$) between PBC and intention while Shah and Mahmood (2013) showed an insignificant correlation for middle managers of five industrial units in Pakistan. Similarly, Park *et al.* (2012) reported a strong correlation ($r = 0.66$) between SN and intention while Papadopoulos *et al.* (2012) found a small correlation ($r = 0.12$) and Shah and Mahmood
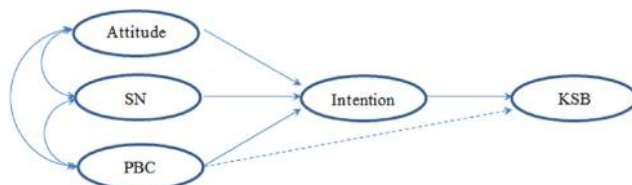
Notes: SN = subjective norm; PBC = perceived behavior control;
KSB = knowledge sharing behavior
Source: Ajzen (1991)

(2013) and Sihombing (2011) found insignificant correlations. Furthermore, there is no consensus on the relative strength of correlation among the three antecedents with respect to intention to share knowledge. For example, Ryu *et al.* (2003) showed that attitude had the strongest correlation with intention, followed by SN and then PBC, but an opposite order was found in the study of Ho *et al.* (2011).

The empirical literature has grown in the last ten years with studies examining more relationships among constructs such as the direct effect from PBC on KBS examined in the study of Chennamaneni *et al.* (2012) and the direct influence of SN on attitudes toward knowledge sharing examined in the studies of (Chow and Chan, 2008); Ramayah *et al.* (2013). Overall, TPB has been validated and modified in many settings further advancing the understanding of knowledge sharing mechanism among individuals. However, the differences in results have caused uncertainty regarding the relationship and strength of association among constructs of TPB as well as a concern about modified TPB models.

The meta-analysis literature also acknowledges the importance of examining moderators (McEachan *et al.*, 2011; Witherspoon *et al.*, 2013). In the context of knowledge sharing, moderators help moderate the strength of effects of antecedents on knowledge sharing intentions or of the effect of intentions on KSB. Some studies in the literature of knowledge sharing (Simmie, 2003; Witherspoon *et al.*, 2013; Kumari and Takahashi, 2014) have shown the existence of the moderator roles of national culture, economic wealth, and information technology support. However, little effort has been made to investigate the roles of these moderators in the empirical application of TPB in knowledge sharing.

The present article has three aims. The first aim is to summarize and examine the relationships between attitude, SN and PBC and intention and between intention and KSB. To do so, a random effect meta-analysis of the correlations in the studies examining TPB in knowledge sharing is conducted. The second aim is to test the significance of the original TPB model proposed by Ajzen (1991) and some modified models of TPB proposed in the literature. The third aim is to identify potential moderators of relationships among constructs in TPB in knowledge sharing. A meta-analytical structural equation modeling is implemented to achieve these two latter aims.

The remainder of this paper is as follows. The research method is described in the next section, followed by the summary of the results of the review. The next section consists of discussion, identified research gaps and gives suggestions for future research. The conclusion outlines final remarks and research limitations are raised in the last section.

Method

The selection process

This study applies the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) (Moher *et al.*, 2009) to select studies. Eight academic databases (Google Scholar, Springerlink, ScienceDirect, Emerald, ProQuest, Sage, IEEE and Web of Science) were searched using the keywords ("theory of planned behavio*" OR "theory of reasoned action") AND ("knowledge sharing" OR "knowledge share" OR "information sharing" OR "information share" OR "knowledge exchange" OR "exchange of knowledge" OR "information exchange" OR "exchange of information"). The eight databases used in this review are consistent with databases reported in previous systematic literature reviews in the knowledge sharing literature (Charband and Navimipour, 2016).

The search was conducted up to December 31, 2017, and a total of 1,678 records were initially retrieved. After duplicates were removed, the titles and abstracts of the remaining 1,509 records were screened to ensure relevance. According to PRISMA, to formulate selection criteria, the PICOS (population, intervention, comparison, outcome, study design)

approach was applied. Peer-reviewed quantitative studies which were published in the English language and explicitly applied the TRA or the TPB in knowledge sharing were included.

Journal articles tend to publish results with statistical significance while other forms of publications such as working papers, papers from conference proceedings or dissertations are likely to report results with less statistical significance. Hence, including only published articles in the meta-analysis could lead to biases (Rothstein *et al.*, 2006). To avoid such biases, in the filtering process, we included conference papers.

Empirical studies should report Pearson's correlations at least between:

- attitudes and intention;
- SN and intention for those studies which involve applications of TRA; and additionally
- PBC and intention for those studies which involve applications of TPB.

Two team members independently conducted the selection and review of articles with support from university librarians. Any discrepancies were discussed and resolved by consensus.

Only 26 studies with a total sample of 5,311 participants remained after all exclusion criteria were applied (Figure 2). For coding, to ensure the reliability of our findings, two raters coded independently to ensure the reliability of the findings. The inter-rater reliability for the codes was 88.5 per cent, demonstrating a high level of agreement. Before the meta-analysis was proceeded, we ensure that we coded consistently and all disagreements were resolved through discussion until reaching consensus. Sample sizes and correlation coefficients between three antecedents (attitude, SN and PBC) and knowledge sharing intention and between intention and KSB were collected to code for each study. When a study measured two types of variables, correlation coefficients for the same relationship reported were averaged. All 26 fully provide correlations among attitude, SN and intention while only ten studies reported correlations between intention and KSB.

Meta-analytic structural equation modelling
A random-effects model was used to calculate sample-weighted average correlation (r_+). The choice of the random-effect model is justified mainly because of significant
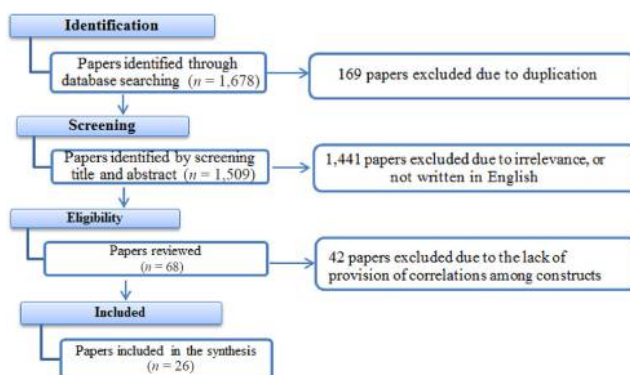

Figure 2.
Results of the paper
selection process

heterogeneity between effect sizes where surveyed studies were independently carried out by different researchers in different settings with samples drawn from different populations (Bamberg and Möser, 2007; McEachan *et al.*, 2011). A random-effect model is also appropriate to the three aims of this study.

Summary effects for correlations

The stem-and-leaf plots for the main correlations of each pair of variables in TPB are summarized in Table I. Following Cohen (1992), the correlation was divided into small (r = 0.10), medium (r = 0.30) or large (r = 0.50) groups. In such groups, small values mean constructs may be independent, medium values suggest the covariance is partially built, and large values indicate an almost perfect covariance. If the sign of correlation is positive, these constructs vary in the same direction. In contrast, if the sign of correlation is negative, these constructs go in opposite directions. In addition, the skewness of data was explored using graphical procedures. If an extreme value was found, analyses were conducted both including and excluding the outlier. The funnel plot statistics and the Fail-safe N technique were calculated to avoid the file drawer problem in which researchers tend to not submit papers with insignificant results as well as the robustness of the meta-analysis (Rothstein *et al.*, 2006).

The method provided by Hedges (1983) was applied to estimate summary effects using the random-effect model. This method takes into account the variance within and between studies. The open source software R and the Metaphor package (Viechtbauer, 2010) were used to conduct the meta-analysis on correlations. The effect size was calculated based on correlation and sample size of studies. The statistical significance of effect size, 95 per cent confidence intervals being calculated for each mean of the examined effect sizes. I^2 and Q-statistic are used to examine the heterogeneity among studies. Where I^2 is found to be above 75 per cent, this suggests a high level of heterogeneity while I^2 being below 25 per cent suggests low heterogeneity (Scalco *et al.*, 2017). If p-value of Q-statistic is below the threshold of 0.05, there is heterogeneity among studies (Cheung, 2015).

Meta-analytical structural equation model analysis

The strengths of the correlations among constructs of TPB in knowledge sharing were examined by a meta-analytical structural equation model (MASEM) using the metaSEM R-package (Cheung, 2015). This study applies MASEM because it can bring the best of meta-analytical techniques into studies using a structural equation model as the research tool. First and most important, MASEM enables a test of the fit of the proposed models (Hankins *et al.*, 2000). Second, MASEM can estimate parameters where other variables are present in the model. Third, MASEM can provide estimates of the direct and indirect effects, which are particularly important in a mediation analysis. As specified in TPB, intention functions as a mediator of attitudes, SN and PBC to KSB; in this study, this role needs to be reexamined. As the interest of this review lies in synthesizing research using structural equation model to examine TPB in knowledge sharing, the MASEM approach is deemed an appropriate tool. In particular, correlations among constructs in studies were formed in 5×5 matrices. Then all variance, covariance and regression coefficients were calculated using the structural equation model.

Our aim is to test original and modified TPB models. Model A is the original TPB proposed by Ajzen (1991). Model B, a modified model of TPB, examines the additional direct effect of PBC on KSB suggested by Chennamaneni *et al.* (2012), and Model C, another modified model, suggested by Ramayah *et al.* (2013) and Chow and Chan (2008) tests an

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No.	Author (year)	Sample size	Male (%)	Female (%)	Country	Collectivism	GDP per capita	IT support	Sample characteristics
1	Akhavan et al. (2015)	257	66	34	Iran	Lower	Lower	Yes	257 employees from 22 high-tech companies including Companies in the pharmaceutical, nano technological, Biotechnological, aviation, and aerospace industries
2	Bock et al. (2005)	154	88	12	South Korea	Higher	Higher	No	Managers from 27 Korean organizations
3	Chen (2011)	200	53	47	Taiwan	Higher	Higher	No	High school teachers in southern Taiwan
4	Chennamaneni et al. (2012)	180	55	45	The USA	Lower	Higher	No	Students enrolled in MBA and senior level classes in the College of business at a large state university in the Southwest United States
5	Erden et al. (2012)	531	97	3	South Korea	Higher	Higher	Yes	online communities
6	Ho et al. (2011)	206	NA	NA	Taiwan	Higher	Higher	Yes	Wikipedia users
7	Hsu and Lin (2008)	212	60	40	Taiwan	Higher	Higher	Yes	Blog participants
8	Huang et al. (2008)	159	75	25	China	Higher	Lower	No	Second year MBA students from a university located in eastern China
9	Hung et al. (2010)	423	80	20	Taiwan	Higher	Higher	Yes	Three information technology-related professional virtual communities in Taiwan
10	Ibragimova et al. (2012)	220	NA	NA	The USA	Lower	Higher	Yes	Information technology professionals
11	Jeon et al. (2011)	282	87	13	South Korea	Higher	Higher	Yes	Employees of four large Korean high-tech production companies
12	Jolaee et al. (2014)	117	53	47	Malaysia	Lower	Lower	No	Academic staff of three social science faculties at one university
13	Kuo and Young (2008)	264	NA	NA	Taiwan	Higher	Higher	Yes	Members of SCTNet (http://SCTNet.edu.tw), a virtual Professional community of teachers in Taiwan
14	Lin and Huang (2013)	167	72	28	Taiwan	Higher	Higher	Yes	Participates who were highly participative were from the levels of knowledgist, expert, master, and postgraduate on Knowledge+
15	Lin and Lee (2004)	154	NA	NA	Taiwan	Higher	Higher	No	Senior managers in Taiwanese companies
16	Papadopoulos et al. (2012)	175	40	60	Thailand	Lower	Lower	Yes	Employees in Thai organizations which have used or have the potential for knowledge sharing through employee weblogs from a directory of Thai organizations registered in the Thai Stock Exchange
17	Park et al. (2012)	144	76	24	South Korea	Higher	Higher	Yes	Employee data collected from five public organizations

(*continued*)

Table I.
Summary of
included studies in
the meta-analysis

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Table I.

No.	Author (year)	Sample size	Male (%)	Female (%)	Country	Collectivism	GDP per capita	IT support	Sample characteristics
18	Ranasinghe and Dharmadasa (2013)	123	NA	NA	Sri Lanca	Lower	Lower	Yes	Information technology based knowledge workers in Sri Lanca
19	Ryu *et al.* (2003)	286	NA	NA	South Korea	Higher	Higher	No	Physicians practising in 28 types of subunits in 13 tertiary hospitals in South Korea
20	Safa and Von Solms (2016)	482	70	30	Malaysia	Lower	Lower	Yes	Employees of several Malaysian organizations whose main activities were in the domain of banking, insurance, e-Commerce and education
21	Sihombing (2011)	127	NA	NA	Indonesia	Lower	Lower	No	Full-time and part-time faculty members in a private university
22	Shah and Mahmood (2013)	57	90	10	Pakistan	Lower	Lower	No	Middle managers (with professional qualifications) from five industrial units in Pakistan
23	So and Bolloju (2005)	40	73	27	Hong Kong	Higher	Lower	Yes	Working information technology professionals who were studying on a part-time master degree program at a large university
24	Teh and Yong (2011)	116	61	39	Malaysia	Lower	Lower	Yes	Information Systems personnel
25	Teh *et al.* (2010)	301	49	51	Malaysia	Lower	Lower	Yes	University students
26	Wu and Zhu (2012)	180	55	45	China	Higher	Lower	Yes	Responses from ten companies in China

additional direct effect of SN on attitude. The goodness of a model is based on indicators of structural equation model where RMSEA ≤ 0.06, CFI ≥ 0.90, TLI ≥ 0.90 and SRMR ≤ 0.08.

Moderator analysis
In knowledge sharing, individuals are often influenced by national culture, economic wealth, and information technology support (Simmie, 2003; Witherspoon *et al.*, 2013; Kumari and Takahashi, 2014). House *et al.* (2004) suggest nations could be classified into cultural groups based on cultural similarities as these may affect perception and behavior. One frequently used dimension of national culture explored to deepen relationship among constructs was collectivism. Collectivist cultures contain individuals who tend to place a higher priority on maintaining group integrity and social cohesion than achieving individual aims. Witherspoon *et al.* (2013) also acknowledge that the degree of collectivism may be a potential moderator.

Individuals are also influenced if not driven by economic wealth. Simmie (2003) argues that economic wealth often stems from the combination of knowledge capital and innovation capacity, in which knowledge is shared by high-quality workers. In this study, we attempt to examine the role of economic wealth by the use of gross domestic product (GDP) per capita. In terms of technological support, we examine the role of information technology (IT) as it enhances knowledge sharing (Shen *et al.*, 2010; Charband and Navimipour, 2016). In fact, interactive IT tools such as blogs or forums facilitate a continuous series of inter-personal interactions that create and share knowledge (Hsu and Lin, 2008).

Included studies in this meta-analysis were categorized into subgroups based on the three moderators. When information about a moderator in a study was not available, the variable was coded as "N/A" in that study and was excluded from the analysis. For collectivism, we collected the information of the country each sample was drawn and then divided as higher and lower subgroups based on scores from the online database of House *et al.* (2004). Samples that were collected from multiple countries were coded as "mixed" and were not used for the moderating analyses. Similarly, for GDP per capita, we divided as higher and lower subgroups based on GDP per capita value on the online database of Worldbank. For IT support, we searched for the sample descriptions of each study to check whether knowledge was shared with IT support or not. MASEM was run using the metaSEM R-package (Cheung, 2015) for each subgroup. The fitness of each model was checked before comparing the parameter estimate of TPB across subgroups of studies.

Results
Study characteristics
The included studies consist of one conference paper and 25 journal articles (see full list in Table I). Ten studies reported all correlations between attitude, SN, PBC, intention and KSB. In all, 16 studies did not examine KSB and seven did not include PBC in the analysis.

Out of 26, 20 studies were published after 2010. Six studies were published from 2003 to 2009. Among the 26 studies, eight retained the original model TPB/TRA whereas 18 extended the model with the addition of supplemental determinants of attitude, SN, and intention. The most frequent determinants of attitude are perceived enjoyment in helping and perceived reciprocal benefits while the most frequent determinants of SN are organizational climate. Surprisingly, the majority of study samples were collected in Asian countries (24 out of 26) including seven in Taiwan, five in South Korea, four in Malaysia, and two in China. Only two studies sampled participants in the USA. All studies applied structural equation modelling and most had a higher percentage of male than female participants.

Table II shows the original correlation in stem-and-leaf plots between attitude and intention (2.a), SN and intention (2.b), PBC and intention (2.c), and intention and KSB (2.d). In general, there were large discrepancies in the correlations retrieved from the included studies. The correlation between SN and intention showed the widest variations with a maximum value of $r_{max} = 0.728$ (So and Bolloju, 2005) and a minimum value of $r_{min} = 0.098$ (Sihombing, 2011).

Summary effects

The I^2 values arranging from 83.61 per cent to 91.14 per cent indicated the discrepancies among the included studies. Q-statistic also reported a high heterogeneity among studies with a p-value < 0.001. Therefore, the application of the random-effect model in this study is appropriate. Table III summarizes the results calculated through the meta-analysis procedures. From the research model, 5 constructs yielded a total of 10 pairwise correlations. The pairwise relationship attitude-intention, SN-intention, and attitude-SN were the most frequent in 27 studies whereas the relationship between PBC and KSB were the least frequent in 10 studies. From the range of correlation coefficients, the relationship of

Stem	Leaf
a- Attitude-intention	
0.2	68
0.3	00, 67
0.4	44, 57, 67, 81, 96
0.5	08, 20, 59
0.6	02, 09, 10, 30, 49, 68, 71, 74, 77, 83
0.7	40, 50, 50, 85
0.8	84
c- PBC-intention	
0.0	56
0.3	36, 38, 81, 89
0.4	42, 73, 76, 90
0.5	20, 20, 21, 50, 60
0.6	53, 58, 82, 83
b- SN-intention	
0.0	98
0.1	17, 50, 60, 76
0.3	12, 36
0.4	46, 67, 72, 79, 83
0.5	04, 10, 24, 30, 30, 62, 65, 98
0.6	25, 26, 50, 83
0.7	28
d- Intention-KSB	
0.2	29
0.3	69
0.4	90, 91
0.5	40, 40, 50
0.6	03, 05, 21
0.7	73
Notes: SN = subject norm; PBC = perceived behavior control; KSB = knowledge sharing behavior	

Table II.
The original correlation in stem-and-leaf plots between attitude and intention (2.a), SN and intention (2.b), PBC and intention (2.c) and intention and KSB (2.d)

Pairwise relationship	No. of studies (k)	Cumulative sample size (n)	Sample-weighted effect size (r_{+})	95% confidence interval		Q statistic for heterogeneity test (d.f.)	I^2 (%)
				Lower bound	Upper bound		
Attitude-SN	26	5,311	0.520	0.442	0.599	170.103***	87.46
Attitude-PBC	18	3,991	0.500	0.400	0.593	143.820***	89.00
SN-PBC	18	3,991	0.500	0.400	0.594	143.820***	89.00
Attitude-intention	26	5,311	0.701	0.615	0.788	192.947***	89.81
SN-intention	26	5,311	0.510	0.427	0.593	194.994***	88.82
PBC-intention	18	3,991	0.546	0.466	0.636	89.619***	83.61
Attitude-KSB	11	2,336	0.430	0.289	0.570	117.049***	91.14
SN-KSB	11	2,336	0.434	0.327	0.541	64.392***	84.52
PBC-KSB	10	2,220	0.435	0.294	0.576	82.677***	90.76
Intention-KSB	11	2,336	0.616	0.498	0.735	76.382***	87.35

Notes: ***$p < 0.001$; SN = subject norm; PBC = perceived behavior control; KSB = knowledge sharing behavior

Table III.
Random-effects
average correlation
and heterogeneity
statistics

each pairwise correlation varied from 0.430 to 0.701. The relationship between attitude and intention yielded the strongest correlation while the attitude-KSB relationship yielded the weakest. Among the antecedents of intention, attitude showed a large effect size ($r_{+\text{attitude-intention}} = 0.701$), followed by PBC ($r_{+\text{PBC-intention}} = 0.546$). The effect size of the SN-intention relationship was shown to be the smallest, but was still in the large group with (r+SN-intention = 0.510). The skewness of data was also explored and no outlier was found. Regarding file drawer problem, all pairwise relationships passed the test, indicating no severe bias in this study.

Test of models
Three models including original and modified models of TPB were evaluated. Model A was tested using 26 studies (sample size = 5.311) with the goodness-of-fit indexes far above the acceptable thresholds (Model A: $\chi^2(3)=25.403$, $p = 0.000$; RMSEA = 0.038, SRMR = 0.057; TLI = 0.962; CFI = 0.989). To ensure the fitness, the model was tested again with ten studies (sample size = 2.220) which provided all correlations between attitude, SN, PBC, intention, and KSB. The goodness-of-fit indexes were particularly good with $\chi^2(3) = 24.862$, $p = 0.000$; RMSEA = 0.057, SRMR = 0.058; TLI = 0.937; CFI = 0.981. These results suggest that TPB is highly supportive in predicting KSB. R^2 in relation to intention and KSB were 0.46 and 0.35, respectively, meaning that the model accounts for about 46 per cent of the explanation power in predicting intention and about 35 per cent for KSB.

Results show that the major influence on intention is attitude toward knowledge sharing ($\beta = 0.39$, 95 per cent CI = [0.032,0.46]) followed by PBC ($\beta = 0.23$, 95per centCI = [0.16,0.30]) and then SN($\beta = 0.21$, 95 per centCI = [0.13,0.29]). The effect of intention on KSB shows a particularly strong relationship ($\beta = 0.60$, 95 per cent CI = [0.54,0.65]).

Mode B was an extension of Model A with the additional direct effect of PBC on KSB. The indexes show the superior fit $\chi^2(2) = 9.629$, $p = 0.008$; RMSEA = 0.027, SRMR = 0.033; TLI = 0.980; CFI = 0.996 for the sample of 26 studies (sample size = 5.311) and a very good goodness-of-fit $\chi^2(2) = 8.102$, $p = 0.017$; RMSEA = 0.037, SRMR = 0.031; TLI = 0.974; CFI = 0.995 for the aforementioned ten studies. This indicates that both intention and PBC can predict KSB. R^2 on intention and KSB show the strong explanation power on intention and KSB (43 per cent and 36 per cent, respectively).

The order of strength of effect on intention for Model B is similar to that of Model A, leading by attitude ($\beta = 0.41$, 95per centCI = [0.34,0.48]), following by PBC ($\beta = 0.21$, 95 per centCI = [0.13,0.28]) and then SN ($\beta = 0.19$, 95per centCI = [0.11,0.28]). The influence of intention on KSB is the strongest ($\beta = 0.45$, 95per centCI = [0.36,0.53]), followed by the influence of PBC on KSB ($\beta = 0.25$, 95per centCI = [0.13,0.36]). To deepen the relationship between PBC and KSB, the mediation analysis was conducted to examine the PBC–attitude–KSB relationship. The significance of indirect effects was tested using likelihood-based confidence intervals. The estimate of the indirect effect shows a significant result because zero is not included in intervals (0.095, 95 per cent CI = [0.06, 0.13]). The result confirmed that intention was a partial mediator between PBC and KSB, suggesting that a direct influence flow from PBC to KSB is plausible.

Model C was a modified model of Model A with an additional direct relationship between SN and attitude. However, results indicated a low level of goodness-of-fit (Model C: $\chi^2(4) = 238.687$, $p = 0.000$; RMSEA = 0.105, SRMR = 0.105; TLI = 0.698; CFI = 0.879). Therefore, Model C with the additional relationship between SN and attitude was empirically falsified.

Test of moderators
Q-statistic and I^2 values showed the existence of moderators. The moderating influence of
national culture, economic wealth and IT support TPB was investigated. The path models
showed acceptable fit, indicating comparable ability for all subgroups. Table IV summarizes
the empirical results.

Regarding national culture, 15 studies examined participants in nations with a higher
level of collectivism. The results indicated that the only differences were in the PBC-
intention relationship between higher and lower dimension of culture. In particular, there
was a much stronger relationship between PBC and intention in studies conducted in
nations with higher collectivism ($\beta = 0.33$, [0.26; 0.40]) than studies conducted in nations
with lower collectivism ($\beta = 0.12$, [0.01; 0.22]).

In terms of economic wealth, 15 studies were conducted in nations having high GDP per
capita, above 10,000 USD/year. The results showed that the association between PBC and
intention were moderated by economic wealth. This means that individuals in nations with
higher GDP per capita were likely to have higher intention to share knowledge.

The moderator role of IT support was examined with 17 studies investigating TPB in
knowledge sharing using IT support. As the results indicate, with IT support, the influence
of intention on KSB was stronger. This strength is shown by the larger estimate for studies
that investigated TPB using support ($\beta = 0.64$, [0.57; 0.70]).

Discussion
As can be seen, the majority of the studies included in the meta-analysis were conducted in
the last seven years. Scholars seem to be more interested in extending the original TPB
model to find supplemental determinants of attitude, SN and intention. Furthermore, the
majority of studies in this meta-analysis collected samples in Asia. We speculate that this
could reflect the increasing role of Asian economics and organizations in the domain of
knowledge sharing or at least the inquiry into knowledge sharing receives increasingly
more attention in Asian countries.

Within 26 surveyed studies, the percentage of male participants was much higher than
that of females. Because of the small number of studies with a higher percentage of female
participants, the moderator role of gender cannot be tested. However, we note there could be
potential differences in knowledge sharing between male and female individuals as shown
in some studies. Connelly and Kelloway (2003) argue that because of the fear of losing
knowledge sharing power, women tend to be hesitant to share knowledge. Furthermore,
women tend to place more value on intimate bonds and make more effort to construct their
social networks. However, such intimate bonds and close networks are only built with
reciprocity (Eagly and Wood, 1991). Therefore, future researchers may wish to examine the
moderator role of gender in knowledge sharing.

Our results demonstrated that attitude has the strongest effect on intention to share
knowledge, followed by PBC while SN had a minor influence on intention. These results
suggest that individual preferences and perceived behavioral control have a major influence
on intention to share knowledge whereas social pressure seems to have less influence. This
is understandable because most valuable knowledge often resides in the human brain
(Chowdhury, 2005; Mafabi *et al.*, 2017), stems from individual experience and action, and
therefore it cannot be easily conveyed (Lee, 2001; Hislop, 2003). Thus, it is almost impossible
to share such knowledge without the active participation and cooperation of the knower
(Nonaka and Takeuchi, 1995), which often depends upon the willingness of individuals
rather than social pressure. Social norms often direct individuals and encourage individual
intention to share knowledge but individual preferences seem to be more important in

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Pairwise relationship	Estimate [lower bound; upper bound]		Estimate [lower bound; upper bound]		Estimate [lower bound; upper bound]	
	Higher collectivism	Lower collectivism	Higher GDP per capita	Lower GDP per capita	IT support	Non-IT support
Attitude-intention	0.35[0.26; 0.44]	0.44[0.33; 0.54]	0.36[0.27; 0.45]	0.43[0.31; 0.54]	0.41[0.33; 0.50]	0.37[0.26; 0.47]
SN-intention	0.19[0.09; 0.27]	0.25[0.11; 0.37]	0.19[0.10; 0.27]	0.24[0.10; 0.37]	0.24[0.13; 0.33]	0.16[0.04; 0.26]
PBC-intention	0.33[0.26; 0.40]	0.12[0.01; 0.22]	0.33[0.25; 0.40]	0.13[0.01; 0.22]	0.21[0.11; 0.30]	0.29[0.19;0.38]
Intention-KSB	0.60[0.53; 0.67]	0.59[0.51; 0.68]	0.60[0.53; 0.67]	0.59[0.51; 0.68]	0.64[0.57; 0.70]	0.50[0.43; 0.57]

Table IV.
Parameters estimate and 95 confidence intervals for subgroups of the three moderators

individual decision-making. Therefore, there should be a stronger focus on individual interest and resource facilitating conditions to encourage knowledge sharing rather than relying on social norms.

Intention showed the strongest effect on KSB, suggesting that intention is the best predictor of KSB. However, as 11 studies provided correlations between intention and KSB, the validation of TPB in KSB was compromised because of the interruption at the stage of intention to share knowledge. This issue is common in studies conducting a meta-analysis of TPB in other settings. For example, in the study of Scalco *et al.* (2017) on organic food consumption, only six out of 23 studies reported intention-behavior correlation. Out of 25, 11 studies provided correlations between intention and behavior in the study of Schwenk and Möser (2009) in the field of environmental behavior. The explanation of the interruption is that a strong correlation between intentions and KSB has been proven in previous research Ajzen (1991). Furthermore, intentions suffice to become a proxy to capture overall tendency toward knowledge sharing (Dong *et al.*, 2010; Erden *et al.*, 2012; Eze *et al.*, 2013). In contrast, KSB is not easily captured as knowledge sharing is a longitudinal phenomenon, which is influenced by intended and non-intended behavior as well as contextual factors (Erden *et al.*, 2012).

Although intention is identified as the best predictor of KSB, individuals do not always perform a behavior, which is consistent with their espoused intentions. This "intention-behavior gap" (Kuo and Young, 2008) as documented in the literature could be large as only one-half of intentions translated into behavior (Sheeran and Webb, 2016). The literature argued that the "intention-behavior gap" is rooted in many reasons including detrimental unexpected consequences, unanticipated difficulty in performing a behavior, and a shortage of resolve or willpower (Ajzen, 2002) or quality and properties of intentions, and nature of the goal (Sheeran and Webb, 2016). To bridge the gap, a greater effort is needed such as initiating, maintaining, and closing goal pursuit (Sheeran and Webb, 2016). However, these solutions cannot ensure intention realization. Therefore, future studies should take KSB into account in their analyses rather than stopping at intention. Since there are some difficulties in capturing KSB, future researchers may add items about previous KSB in the KSB construct (Chennamaneni *et al.*, 2012).

Among the three TPB models (Models A, B, and C), our empirical results show that the original TPB seems to provide good support in predicting KSB with goodness-of-fit indices and strong explanation power on intention and KSB. Remarkably, the direct effect from PBC to KSB and the partial mediator role of intention between PBC and KSB were demonstrated. Although intention was the strongest predictor of KSB, PBC also played an important role in predicting KSB. One important implication is that intention being equal, individuals who are more confident in their abilities will be more likely to share knowledge. Furthermore, when individuals perceive information fully and understand a situation, there may be a higher probability that knowledge sharing occurs (Ajzen, 1991). Therefore, establishing a convenient and friendly environment to facilitate knowledge sharing can be particularly important.

The direct effect of SN on attitudes to share knowledge was not proven in this study even though it was supported by some studies such as those by Ramayah *et al.* (2013) and Chow and Chan (2008). There are two points that may stimulate future research to further investigate this relationship. Firstly, the results showed a medium effect size between SN and attitude, thus suggesting potential influence in this relationship. Secondly, the studies which supported this relationship were not included in this meta-analysis as they did not match the selection criteria. For example, the study of Chow and Chan (2008) examined the relationships among attitude, SN and intention to share knowledge and found that SN had a direct effect on attitude. However, this study did not provide correlations among the three constructs; thus, it cannot be included in this meta-analysis.

Three additional moderators were explored to capture the roles of culture, economic wealth and IT infrastructure. Interestingly, results confirmed the significant role of these dimensions; however how these dimensions affect differing moderators, intention and eventually behaviors needs further analysis. Specifically, the moderator role of cultural dimension was found in the relationship between PBC and intention to share knowledge. Chow and colleagues (Chow *et al.*, 1991) were pioneers in investigating the joint influences of national culture on knowledge sharing. The differences in culture were also explored by some meta-analysis studies in general (Schepers and Wetzels, 2007) and in knowledge sharing (Witherspoon *et al.*, 2013). The results of this study show that nations which have higher collectivism report a much stronger effect of PBC on intention to share knowledge. This implies that as perception is adaptive, a collectivist culture will influence individual perception to integrate into a cohesive "in-group"; thus, there is more intention to share knowledge. Therefore, managers in nations with higher levels of collectivism may apply policies to encourage individuals to share knowledge to benefit the group. If individuals know that their knowledge sharing will bring more value to the group, they are more likely to contribute. In contrast, in nations with lower levels of collectivism, there seems to be a greater focus on individual interest; therefore, incentives for individuals may be more effective in encouraging knowledge sharing.

Notably, we also found the role of GDP per capita proxied for economic wealth in moderating the influence of PBC on intention to share knowledge. Our results favor the argument that in nations with higher GDP per capita, individuals have higher intention to share knowledge. However, note that high GDP per capita might be strongly correlated with other aspects of overall economic development, social capital, and institutional factors Hence, caution is required with interpretations. Interestingly, micro-economic foundations would suggest that economic wealth, socio-economic background and economic incentives affect both intention and behaviors. Consequently, ignoring such factors such as income or wealth would lead to biases in empirical studies. In addition, if studies report on income or wealth, then the better the impacts of these factors can be controlled; therefore, we suggest future research should take these factors into consideration.

The results also indicate that IT support can facilitate the transformation from intention to KSB. This finding reconfirms that the emergence of information technology has paved the way for new methods of working or collaborating among individuals as well as bringing novel opportunities to knowledge sharing (Alavi and Leidner, 2001; Mehta *et al.*, 2014). Therefore, the application of IT is also a good way to encourage individuals to perform KSB.

Conclusion

This study provides a systematic review and meta-analysis of the use of TPB to explain individual intention and behavior in knowledge sharing. TPB appears to provide good predictability of KSB. In particular, attitude, SN, and PBC are found to have strong relationships with intention, which, in turn, had a strong association with KSB. PBC also has a direct effect on KSB. The moderator role of national culture and economic wealth were found in the PBC-intention relationship whereas IT support moderates the intention-KSB relationship.

One limitation of the study is the small size of surveyed studies, which is because of the strict criteria used in the selection process. Although there are many papers which examine TRA and TPB in knowledge sharing, unfortunately few provide sufficient information to conduct a meta-analysis. While relaxing the selection criteria could yield more studies for selection, this could come at the cost of the quality of the meta-analysis itself. Furthermore, this study limited the selection of papers to those written in English as resources do not allow us to extend our search to papers written in other languages. However, we suggest future research relax this criterion.

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