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A Study of Using Technology Acceptance Model and Its Effect on Improving Road Pavement Smoothness in Taiwan

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ABSTRACT

Using the technology acceptance model (TAM) as its theoretical foundation, this study intends to explore the use of Travelling Beam devices in road engineerings in Taiwan and offer suggestions based on its findings to encourage industry willingness for device deployment resulting in improving road pavement smoothness in Taiwan. The study subjects were pavement smoothness device operators in Taiwan. A total of 107 valid questionnaires were returned. The questionnaire results were analyzed using descriptive statistics, confirmatory factor analysis and structural equation modeling. Study results show that more training/support and perceived ease of use can lead to more willingness to use travelling beam devices and consequentially help improve pavement smoothness. Structural equation modeling (SEM) analysis results also indicate training/support, perceived ease of use and attitude will give users' positive attitudes towards use of travelling beam devices.

Keywords: technology acceptance model (TAM); pavement smoothness; profilograph devices; confirmatory factor analysis (CFA); structural equation modeling (SEM)

INTRODUCTION

Pavement smoothness can ensure not only a more comfortable driving experience but also longer road life cycles. During the rapid economic growth in Taiwan over the past years, road engineering has become a type of public works that are closely and directly related to the lives of road user, through construction of new roads, renovation, widening, or pipeline/wire installation. Roads are also the arteries of economic development. Poor smoothness in road surfaces poses a threat to transportation safety, increases transportation costs and vehicle maintenance/repair costs.

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State of the literature

- The related literature used instrument equipment to investigate the smoothness of pavement. However, few studied have been carried out on the safety of both pedestrians and drivers for this issue.
- Three types of equipment were used for pavement smoothness detection (e.g. Haas, et al., 1994; Shambhavi Co., 2003). But the lack of studies for equipment operator behavior affect the detected results' validity.
- Equipment operator behavior is an important proper essential of the pavement smoothness devices (e.g. Joao et al., 2010; Losa & Leandri, 2011). These studies should be investigated for the effect of the TAM model on pavement smoothness detection.

Contribution of this paper to the literature

- The main contribution of this paper to the literature is related to how the TAM model influences training/support the respondents' willingness to use the devices during the pavement smoothness detection.
- Using SEM analysis of the TAM model product, users enhance their willingness to use the pavement smoothness devices.
- Since the TAM model is used to analyze connections among users' attitudes and willingness (Ong, et al., 2004), this study can be used to teach road engineering about the devices during pavement smoothness detection.

The smoothness properties of pavement are subject to the influences of temperature, precipitation, and traffic flow; therefore, high-quality road pavement work is key to driving safety (Ongel, et al., 2009). As people are more aware of the importance of their rights and safety, it is an urgent priority to ensure smooth and enduring road pavement. According to a National Cooperative High Research Program report on 200 roads in 10 states in the US, a 50% increase in pavement smoothness can result in an extension of at least 15% of the road lifespan. This indicates smooth pavement increases road lifespans.

Currently, pavement smoothness is measured with the international roughness index (IRI). The IRI has become a standard tool for measuring the comfort level one experiences when walking or driving on a road. However, Kim et al. (2007) used finite-element modeling (FEM) to investigate the smoothness of concrete pavement and they found the IRI unable to represent the slab curvatures caused by temperature differences between the top and bottom of the pavements. In addition, many researchers and experts have developed several methods and tools to measure pavement smoothness. For example, Harris et al. (2010) used novel algorithms to measure pavement profile height and found only a 2% discrepancy between their calculation results and IRI values. The state governments of Florida, Texas and New York directly use ASTM E950 or AASHTO PP49 standards to compare and evaluate pavement profile height data. Lin et al. (2004) used the least square inversion technique to calculate dielectric constants and found the constants in inverse proportion to the pavement roughness. Based on their findings, it can be said that dielectric constants can be used to evaluate pavement roughness or smoothness. Joao et al. (2010) used the scanning prototype machine to achieve 3D characterization of pavement texture and profile depth. Losa and Leandri (2011) applied Butterworth's numerical filters and moving average filters to analyzing pavement texture depths. Wang and Li (2011) built a model that can effectively predict pavement smoothness based on the integration of the gray theory with fuzzy regression analysis.

According to Carry et al. (1960), AASHTO test results indicate pavement smoothness contributes 95% of road serviceability. The most direct method to quantify pavement smoothness is to place the travelling beam device at a point of the pavement and then measure the height difference at the point or calculate the standard deviation of pavement smoothness. Currently, a comprehensive acceptance review mechanism has been gradually introduced into road construction in the US, mainly using the international roughness index (IRI) or the profile index (PI) for the measurement of pavement smoothness. Different states in the US are now using different types of travelling beam devices to measure pavement smoothness. For example, in Washington State, the Department of Transportation (WSDOT) distress data collection vans are used to measure pavement smoothness.

Currently, there are mainly three types of equipment for pavement smoothness (or roughness) measurement: road profilers, profilographs, and response-type devices. (Haas, et al., 1994). In ASTM E950, it is explicitly stipulated that, after the road pavement is completed, pavement smoothness measurement must be conducted as part of the standard acceptance review procedure. The three types of travelling beam devices most commonly seen are high-low detectors, inertial profilers, and three-meter straight edges. High-low detectors consist of double wheel trailers that are towed by operators. The wheel mounted on the trailer was supported by leaf springs. Altitude variations in the pavement surface cause the wheels to move with respect to the frame of the device. A three-meter straight edge approximately 3 meters in length may be used to determine lateral surface regularity of a pavement surface. This lightweight device is equally supported at both ends producing a set height between the pavement surfaces (Shambhavi Co., 2003).

However, since the measuring devices are operated by users, anthropogenic factors such as differences in personal willingness to use the devices or knowledge about the devices or the acceptance review standard functions can result in differences or even errors in the smoothness calculation, which in turn may lead to traffic accidents and damage claims caused by poor pavement smoothness. For example, in Taiwan, there were 16 deaths and 125 injuries in traffic accidents caused by rough pavements from 2005 to 2007 and consequentially 211 damage claims for official tort compensation (worth NT$ 64 million), accounting for 38% of the total amount of claims for national tort compensation during the same time period. In 2008, the Public Construction Commission of the Executive Yuan conducted a survey on the pavement smoothness of the roads in each city and county in Taiwan and found only 13% of the surveyed roads had acceptable smoothness levels. This finding indicates that, despite the existence of governmental regulations about pavement smoothness inspection and the use of the travelling beam devices, the overall pavement smoothness is still unsatisfactory in Taiwan, posing a threat to the safety of both pedestrians and drivers. Therefore, it is necessary to explore further this issue.

The technology acceptance model (TAM) can test the connections among users' attitudes toward, willingness to use, and behaviors of using a certain technology (Ong, et al, 2004). TAM is mainly intended to explore how different factors affect one's perceptions of the usefulness and ease of use of a technology. Proposed by Davis et al. (1989), the TAM is mainly based on the theory of reasoned action developed by Fishbein and Ajzen (1975). The TAM mainly discusses the connections between emotional variables and technology usage. It features such strengths as simple modeling, specific focus on information technology robust theoretic foundations, and sufficient empirical support. The modeling of the TAM is shown in **Figure 1**. According to Chau (1996), since it was proposed, TAM has been very popular and widely applied in information technology and management fields. Therefore, there have been many applications and much empirical support of this model. Succi & Walter (1999) found the TAM capable of explaining the acceptance level of a user toward a new information technology and forging connections between beliefs and attitudes to predict acceptance levels of a new technology. Morris & Dillon (1997) thought, empirically applied or not, the TAM is a successful and easy-to-use system providing predictions that can help researchers and practitioners to save costs.

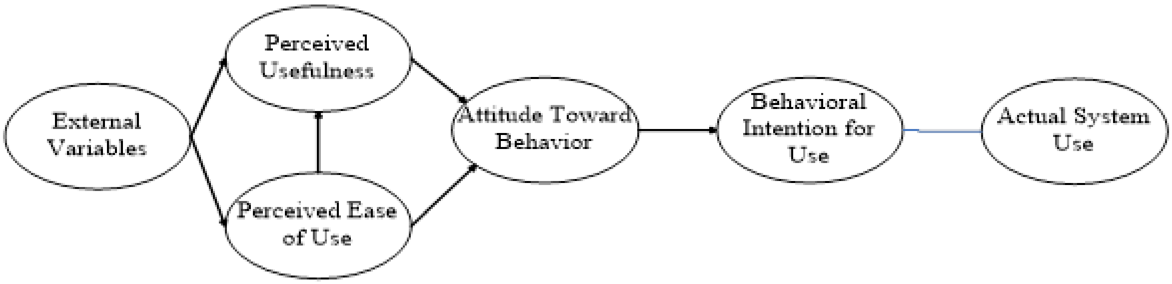

Figure 1. Modeling of the TAM

Using the TAM as its theoretical foundation, this study attempts to explore the effectiveness of using profilograph devices by conducting a questionnaire survey to find out if the respondents' previous experiences and training/support about using the devices affect their perceived usefulness and ease of use of the devices and also to find out if their perceived usefulness and ease of use of the devices affect their actual use of the devices. The purpose of this study is to help the related organizations and the device users in measuring and improving the pavement smoothness by encouraging the users' willingness to use the devices more frequently. In addition, King and He (2006) conducted a meta-analysis on a total of 88 studies and found, even though one's perceived usefulness of a technology has a significant influence on behavioral intention, perceived ease of use of the technology does not have a direct and stable influence on behavioral intention. In other words, it is still necessary in this study to establish that there are positive correlations between the respondents' perceived ease of use of the devices and their attitudes and willingness to use the devices.

According to the previous research (Ong, et al, 2004) (Chau, 1996) etc. The TAM used in this study is composed of four major dimensions: previous experience, training and support regarding the use of the devices, perceived usefulness, and perceived ease of use. Each of the dimensions is explored to find out its connections between the attitudes and willingness of the users to the use of travelling beam devices. The modeling framework of this study is shown in **Figure 2**.

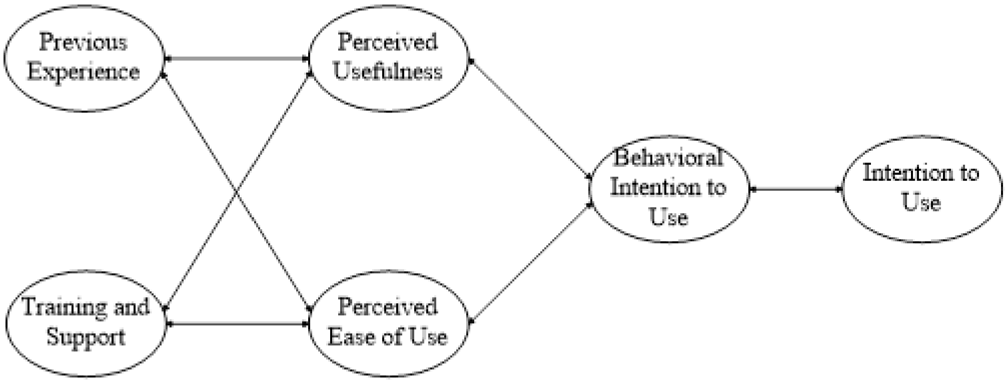

Figure 2. Research Framework of this Study

MATERIAL AND METHODS

The subjects of the questionnaire survey in this research are employees of t construction firms in Taiwan. All the 36 questions in the questionnaire were designed based on references from a literature review of related research. There were three types of questions: (1) questions regarding the respondents' willingness to use the devices; (2) questions regarding the respondents' attitudes toward the use of the devices (using a 7-point Likert scale to measure their attitudes); and (3) open questions regarding the respondents' personal information.

The questionnaire sample for road engineerings were in this study are either people who are pavement smoothness device operators or those responsible for the planning of pavement engineering. The questionnaires were individually sent to each of the subjects. The respondents were asked to fill out the questionnaire anonymously to encourage their willingness to participate in the survey. A total of 150 questionnaires were sent and 121 were later returned (with a return rate of 80.6%), among which 107 were valid samples. The questionnaire survey results were compiled and then statistically analyzed using descriptive analysis method, SPSS, and LISREL to evaluate the reliability and validity of the data.

Finally, SEM was used to conduct a path analysis exploring the connections among the dimensions in the modeling framework of this study.

ANALYSIS RESULTS

Reliability Analysis

Cronbach's α analysis, a common method to measure internal consistency of data, was used to evaluate the reliability of the questions in each of the surveyed dimensions based on the data of the valid samples. When $\alpha < 0.35$, it means low reliability; $0.35 < \alpha < 0.70$ means moderate reliability; and $\alpha > 0.70$ means high reliability. As indicated by **Table 1**, the reliability of the questions in each of the surveyed dimensions was higher than 0.70, indicating high reliability, particularly the questions of the dimensions of training and support (0.818), perceived usefulness (0.863), and willingness to use the devices (0.885).

Table 1. Reliability Analysis of the Dimensions

Dimension	**Cronbach's α**	**Dimension**	**Cronbach's α**
Previous Experience	0.728	Perceived Ease of Use	0.793
Training and Support	0.818	Attitudes	0.784
Perceived Usefulness	0.863	Willingness	0.885

Descriptive Statistics Analysis

In this study, analysis of frequency distribution was used to elucidate a better understanding of the characteristics of the samples by analyzing how the valid samples were distributed in each of the following variables of personal information inquired in the questionnaire survey: types of devices they use, sex, age, education level, major subject, rank of position, years of work experience, types of employers, years of experience in road engineering, number of employer staff, and frequency of using the devices in road paving. **Table 2** lists the sample distribution results in each of the variables.

Experience of using the devices

As indicated in **Table 2**, a total of 41 of the respondents (47.7%) had experience with using high-low detectors and 40 using three-meter straight edges (46.5%). This is probably because high-low detectors and three-meter straight edges are relatively easy to use, which suggests that when selecting among different devices, the respondents found ease of use of the device to be a priority concern.

Sex and Education Background

Among the respondents, 89 were male (83.2%) and 18 were female (16.8%). Their average age was 40.96 years old while those from 30 to 39 accounted for the largest age group (38.3%) among the respondents, followed by those from 40 to 49 (36.4%). As far as education background is concerned, 50 college/university educated respondents accounted for the largest group (47.5%) among the total samples, followed by the junior-college-educated ones (35 respondents accounting for 33.6% of the total samples). There were only six respondents who had received graduate or higher education, accounting for the smallest group (5.7%) among the samples.

Major Subjects and Employer Types

In terms of their major subjects, a total of 84 of the samples (80.0%) majored in construction/civil engineering while 21 majored in subjects other than construction/civil engineering. As indicated in **Table 2**, the employers of the respondents could be divided into four types of organizations: construction companies, design/technology consulting companies, governmental organizations, and other private companies. Most of the respondents (58.6%) are now currently employed by construction companies.

Rank of Position

As indicated in **Table 2**, a total of 75 of the respondents (71%) were basic-level staff, while 25 (23.8%) were basic-level managers. This indicates that most of the respondents that had experiences using the devices were in the basic level positions in their companies.

Table 2. Distribution of Samples in Variables of Personal Information

Variable of Personal Information	Item	Number of Samples	Percentage (%)	Average
Device Used	High-low Detector	41	47.7	-
	3m Straight Edge	40	46.5	
	California Profilograph	5	5.8	
Sex	Male	89	83.2	-
	Female	18	16.8	
Age	≤29	6	5.6	40.96
	30 ~ 39	41	38.3	
	40 ~ 49	39	36.4	
	≥50	20	18.7	
Education Background	High School/Vocational School or Lower	14	13.2	-
	Junior College	35	33.6	
	College/University	50	47.5	
	Graduate School or Higher	6	5.7	
Major Subject	Civil Engineering/Construction	84	80.0	-
	Architecture	5	4.8	
	Environmental Engineering	3	2.8	
	Mechanics	3	2.8	
	Electrical Engineering	5	4.8	
	Fire Control and Prevention	1	1.0	
	General Subject	3	2.8	
	Business	1	1.0	

Years of Working Experiences

As indicated by **Table 2**, the respondents had an average of 11.16 years of working experiences (with a standard deviation of 8.06) in the civil engineering industry and an average of 6.98 years (with a standard deviation of 7.33) in road engineering.

Frequency of Using the Devices in Road Paving

A total of 39 (43.3%) of the respondents indicated they had used the devices in over 50% of their road paving work, accounting for the largest group of the respondents. None of the respondents indicated they had never used the devices. This is probably because of the mandatory use of travelling beam devices in acceptance review of road engineering projects stipulated by governing regulations. In other words, regardless of the respondents' willingness to use travelling beam devices, the devices must be used by the respondents or their colleagues in road construction projects.

Table 2. Distribution of Samples in Variables of Personal Information (*continued)*

Rank of Position	Basic-level Staff	75	71.4	-
	Basic-level Management	25	23.8	
	Mid-level Management	5	4.8	
	High-level Management	0	0	
Years of Experience in Civil Engineering	5 years≥	22	38.6	11.16
	6 ~ 10 years	14	24.6	
	11 ~ 15 years	4	7.0	
	≥16 years	17	29.8	
Years of Experience in Road Engineering	2 years≥	22	38.6	6.98
	3~6 years	14	24.6	
	7~9 years	4	7.0	
	≥10 years	17	29.8	
Type of Employer	Construction Company	61	58.6	-
	Design/Consulting Company	5	4.8	
	Governmental Organization	39	33.7	
	Other Private Company	3	2.9	
Number of Employer's Staff	9≥	9	13.4	16.62
	10 to 19	33	49.3	
	20 to 29	13	19.4	
	≥30	12	17.9	
Frequency of Using the Devices in Road Paving	100%	10	11.2	-
	≥50%	39	43.3	
	<50%	20	22.2	
	Just once or twice	21	23.3	
	0%	0	0.0	

Note: A respondent was included in the subject frequency distribution in a variable only if the respondent answered the question regarding that variable.

Correlation Analysis

Correlation analysis discusses the strength and directionality of the correlation between two variables, using a correlation coefficient to describe the strength of the correlation between them. Pearson correlation analysis was applied to explore the correlations among the dimensions of the theoretical model of this research. The points of all the questions of each dimension were added up and averaged. The average point of each dimension was then used in the Pearson correlation analysis. As indicated by **Table 3** that lists the analysis results:

1. Correlations between experiences of using the devices and the other dimensions are as indicated in **Table 3**. There is a moderate correlation between the respondents' experiences of using the devices and respectively their training and support (r=0.579 , p<0.01), perceived usefulness of the devices (r=0.541, p<0.01), perceived ease of use of the devices (r=0.570, p<0.01), attitudes toward using the devices (r=0.658, p<0.01) and willingness to use the devices (r=0.541, p<0.01). These findings indicated that the respondents, based on their experiences, found the devices useful and easy to use, because the devices provide an instinctive perception of the pavement smoothness by presenting the measurement results in numbers or in curve lines. In addition, all the devices nowadays are capable of automatically recording the measurement results, which makes them more reliable and user-friendly. Because of higher perceived usefulness and ease of use of the devices, the respondents had better attitudes and higher willingness to use the devices.

2. For the correlations between training/support regarding the use of the devices and perceived usefulness of the devices as indicated in **Table 3**, there is a moderate correlation between the respondents' training and the support they received regarding the use of the devices and respectively their perceived usefulness of the devices (r=0.689, p<0.01), perceived ease of use (r=0.652, p<0.01), and attitudes (r=0.611, p<0.01). In addition, there is a high correlation between the training/support the respondents have received and their willingness to use the devices (r=0.735, p<0.01). These findings indicate when the respondents had higher points in the dimension of training and support, they would have higher points in the other above-mentioned dimensions, particularly more significantly so in the dimension of willingness to use the devices. According to Agarwal and Prasad (1999), one's attitudes toward and perceived usefulness of a technology have a direct influence on actual behaviors of use. By training and support, the respondents had more exposure to the devices and gradually found the devices to be useful and easy to use through practice, and then tended to have better attitudes and willingness.

3. Regarding the correlations between perceived ease of use of the devices and the other dimensions (r=0.611, p<0.01). (r=0.654, p<0.01), Szajna (1996) also found one's perceived ease of use of a technology can affect his willingness to use it. As shown in

Table 3, there is a moderate correlation between the respondents' training/support and respectively their attitudes (r=0.654, p<0.01) and willingness (r=0.602, p<0.01).

4. As for correlation between the respondents' attitude and willingness to use the devices according to the analysis results, there is a moderate positive correlation between the respondents' attitudes and their willingness to use the devices (r=0.669, p<0.01). In other words, when the respondents had higher points in the dimension of perceived ease of use, they would probably have higher points in the dimension of willingness to use the devices.

Table 3. Pearson Correlation Analysis Results of the Dimensions

Pearson Correlation	1	2	3	4	5	6
1.Experience of Using the Devices	1					
2. Training and Support	.579**	1				
3.Perceived Ease of Use	.541**	.689**	1			
4.Perceived Usefulness	.570**	.652**	.654**	1		
5.Attitudes	.658**	.611**	.710**	.668**	1	
6.Willingness	.640**	.735**	.751**	.602**	.669**	1

Based on the Pearson correlation analysis results, training/support among the respondents has a high correlation between willingness and use the devices. This means that respondents' training is the most important factor affecting the validity of paving smoothness equipment operation. However, it can be found that the remaining variables of the dimensions in the model of this study are moderately and positively correlated with each other. Respondents completed intensive training. The respondents' perceived ease of use is highly positively correlated respectively with their attitudes toward the devices and their willingness to use the devices.

Currently in the road construction projects in Taiwan, pavement smoothness measurement is used as one of the importance references to ensure good quality. Therefore, to ensure correct use of travelling beam devices, more effort can be invested in the training and support of how to use the devices and also in activities that can promote the perceived ease of use of the devices.

Structural Equation Modeling

In this study, the strength of the correlations between the dimensions was analyzed using LISREL software for structural equation modeling (SEM). The LISREL model is shown in **Figure 3**. As indicated in this figure, Y1 to Y3 belong to the dimension of previous experiences, Y4 to Y8 belong to the dimension of training and support, Y9 to Y14 the dimension of perceived usefulness, Y15 to Y19 the dimension of ease of use, Y20 to Y25 the dimension of attitudes, and Y26 to Y35 the dimension of willingness.

In verifying the reliability and validity of the measuring scale, a confirmatory factory analysis (CFA) was conducted to test the validity of the measuring scale in each of the dimensions. The study comprises two stages about determining the characteristics of motion problems and suggesting the model that providing a solution in line with these characteristics.

Descriptive Statistic Results of Each Variable

Tables 4 lists the average point skewness. The variable with the highest average point is Y31 (4.95), followed by Y30 (4.93), and the variable with the lowest average point is Y11 (3.96), followed by Y16 (4.16). The correlation coefficients of the variables range from 0.201 to 0.712. Only a very few of the coefficients do not reach the level of significance.

Offending Estimates

Figure 3 illustrates the path diagram and the standardized estimates in the model. The coefficient estimate summary is listed in **Table 4**. In addition, the skewness values of all the 35 variables range from -0.18 to 0.53, less than 3 when in absolute value terms, while their kurtosis values range from -0.78 to 0.68, less than 10 when in absolute value terms. These findings indicate the skewness and kurtosis values of the variables are all within a reasonable range.

Overall Model Fit

The overall model fit evaluation results of the LISREL model in this study are listed in **Table 4**. As indicated in **Table 4**, in the absolute fit measures, the RMSEA value is 0.066 (less than 0.08), which indicates very good model fit. In addition, in the relative fit measures, the values of NNFI (0.96), CFI (0.96) and NFI (0.90) are all greater than 0.9【Bentler, 1990】, which also indicates good model fit. In the parsimonious fit measures, the PNFI value is 0.84, greater than 0.5, indicating acceptable model fit. Therefore, it can be said that the model is overall an effective one.

Reliability Analysis

A composite reliability analysis was conducted on the six dimensions of the model in the study. The reliability analysis results of the “previous experiences”, “training and support”, “perceived usefulness”, “perceived ease of use”, “attitude” and “willingness” were respectively 0.728, 0.818, 0.863, 0.793, 0.784 and 0.885. They are all greater than 0.6, indicating all the six dimensions have good reliability.

Convergent Validity

The standardized estimates of λ1 ~λ35 range from 0.54 to 0.86. All these estimates reach the level of significance. Therefore, it can be said these observed variables have convergent validity.

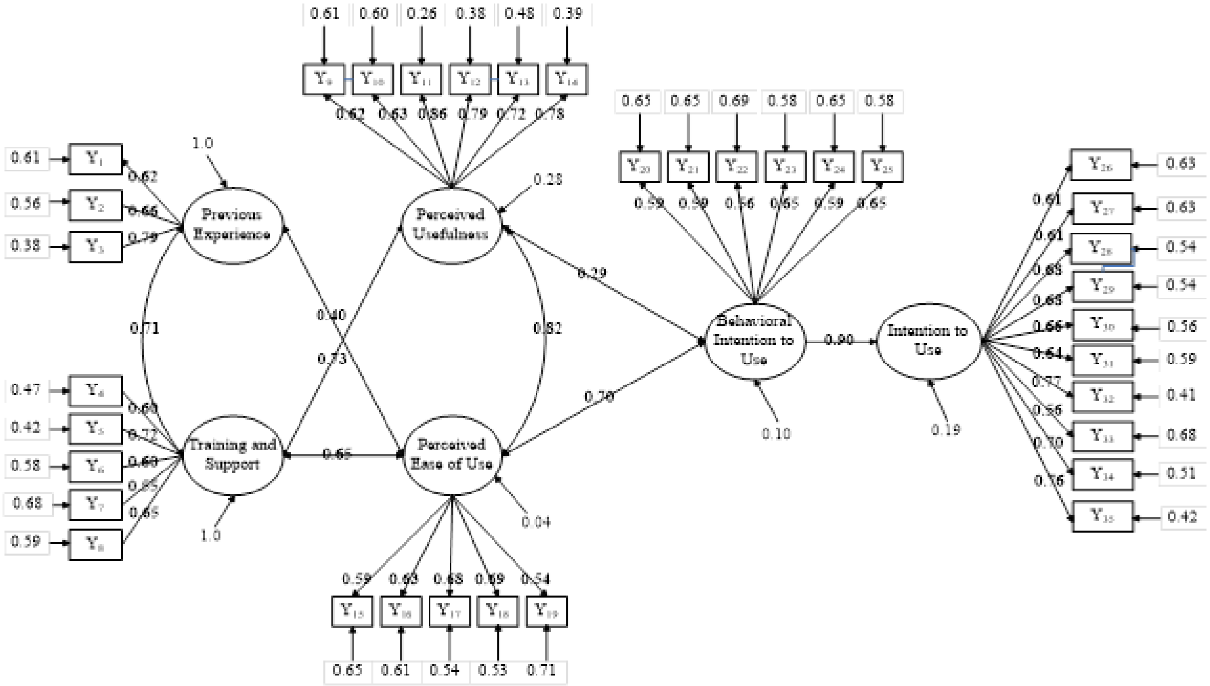

Figure 3. Standardized Estimates of the Variables

Table 4. Evaluation of Overall Model Fit

Overall Model Fit Criteria	Critical Ratio	Model	Evaluation Result
X^2 value	The smaller, the better; p > 0.1	848.76(p = 0.00)	Fair
X^2/df value	< 3	1.54	Good
Absolute Fit Measures			
GFI	> 0.90	0.68	Fair
SRMR	< 0.05	0.077	Fair
RMSEA	< 0.08	0.066	Good
Incremental Fit Measures			
NNFI	> 0.90	0.96	Good
NFI	> 0.90	0.90	Good
CFI	> 0.90	0.96	Good
Parsimonious Fit Measures			
PNFI	> 0.50	0.84	Good
PGFI	> 0.50	0.60	Good

CONCLUSION

Using the TAM theory, this study is intended to explore if previous experience, training and support, perceived usefulness, perceived ease of use, and attitude of road engineering can help to enhance their willingness to use travelling beam devices. Based on its findings, the conclusions of this study are as follows:

1. Factors Influencing the Use of Travelling Beam devices

As indicated by the correlation analysis results in this study, the dimensions of "willingness", "previous experience", "training/support", "perceived usefulness", "perceived ease of use" and "attitude" were all positively correlated with each other. This study also found the dimension of willingness was affected by the other dimensions, particularly by training/support and perceived ease of use. In addition, there is a high correlation between the training/support the respondents have received and their willingness to use the devices. Therefore, it can be said that more training/support and perceived ease of use can lead to more willingness to use travelling beam devices and consequentially helps to improve pavement smoothness.

As to TAM and the Willingness to Use the Travelling Beam Devices, a hierarchical regression analysis was conducted and, according to the analysis results, training/support and perceived ease of use could explain 66.1% of the variances of willingness. Moreover, training/support, perceived ease of use and previous experience could explain 70.7% of the variance in willingness. Therefore, it can be concluded that, to enhance willingness to use travelling beam devices, more emphasis can be placed on giving training/support of how to use the devices before the implementation of road paving and also on providing assistance should any problem occurs during device use.

2. SEM Analysis

This research used LISREL software to conduct a SEM analysis. According to the analysis results, previous experience does not have a direct influence on perceived usefulness while training/support has an indirect influence on previous experience. In addition, the analysis results also indicate training/support, perceived ease of use and attitude will give users positive attitudes toward the use of travelling beam devices and, as a consequence, enhance their willingness to use the devices in the end.

Pavement smoothness has a direct influence on the safety of drivers and pedestrians. Based on the findings of this study, the following suggestions are made regarding how to improve road pavement smoothness:

3. As indicated by the findings of this study, training/support regarding the use of the devices has an indirect influence on willingness to use the devices. Therefore, it is suggested that a series of training and support activities can be given to teach road engineering about the devices, their strengths, and how to use them. Through the training and support, the road engineering can have more knowledge about the devices and their impact on road user safety so that they can develop more willingness to use the devices.

4. Difficulties or problems in using the devices can lead to negative user experiences. It is suggested that an employer build a database that compiles all the problems using the devices and corresponding troubleshooting instructions. Its employees can solve problems using the devices on their own by accessing the databases and finding suitable solutions.

Databases like this can help improve road engineering' willingness to continue using the devices.

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