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Extending the Technology Acceptance Model with Personal Innovativeness and Technology Readiness: *A Comparison of Three Models*

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Abstract

This study concentrates on the role of personal traits in technology acceptance by comparing which of the two personal trait constructs commonly used in IS research, personal innovativeness in the domain of information technology (PIIT) or technology readiness index (TRI), performs better in terms of promoting the explanatory power of the technology acceptance model (TAM). The comparisons are conducted in the case context of online services offered by electric suppliers, and the study is based on the data collected from 1,176 consumers through an online survey and analysed by using structural equation modelling (SEM). The findings of the study show that the inclusion of both PIIT and TRI into basic TAM promotes the explanatory power of the model especially in terms of perceived ease of use but also in terms of perceived usefulness and use intention. At the end of the paper, practical implications for electric suppliers and the adoption of their online services are also discussed.

Keywords: Technology Acceptance Model, Personal Innovativeness in the Domain of Information Technology, Technology Readiness Index, Online Service, Electric Supplier

1 Introduction

In information systems (IS), technology acceptance has traditionally been one of the most prominent research topics with high relevance for both theory and practice. For theoreticians, the main target has typically been to understand the antecedents that affect the acceptance decisions in general or in specific contexts, whereas practitioners have been more interested in applying this understanding to their offered products and services in order to advance their adoption and sales. One of the most influential theories of technology acceptance in IS has been the technology acceptance model (TAM) by Davis (1989), which postulates that our acceptance or use intentions and behaviours are determined by two antecedents: the perceived usefulness and the perceived ease of use of the technology. Over the years, several extensions to TAM have been suggested and the set of antecedents vastly augmented. However, these additional antecedents have typically been very similar to the original ones in terms that they have concentrated either on our perceptions of the technology or how we perceive ourselves in relation to it. In contrast, less attention has been given to the personal traits of the potential acceptors or users. Although these personal traits are not typically directly related to the technology, they often have a significant indirect influence on our perceptions of it, or at least how these perceptions ultimately affect our acceptance or use intentions and behaviours.

The two personal traits that seem to have so far gained most attention in IS research are the personal innovativeness in the context of information technology (PIIT) by Agarwal and Prasad (1998) and the technology readiness index (TRI) by Parasuraman (2000), which both basically refer to the propensity of an individual to accept new technologies. Both of these constructs have been successfully integrated into TAM and found to promote its explanatory power (e.g., Agarwal & Prasad, 1998; Yi, Fiedler & Park, 2006; Yi et al., 2006; Lin, Shih & Sher, 2007; Walczuch, Lemmink & Streukens, 2007; Jackson, Yi & Park 2013). However, no comparative studies have been made on which of them actually performs better in this respect. The present study aims to address this gap in prior research by conducting such a comparison in the case context of self-service technologies (SST), which have been a very common application context of both TAM and TRI (e.g., Dabholkar & Bagozzi, 2002; Curran & Meuter, 2005). As the specific SST, we selected the online services offered by electricity suppliers, which allow their customers, for example, to manage their electricity contracts or track their electricity consumption online. Such services have become increasingly common in the recent years and, thus, act an interesting and important research context also *per se* in addition to offering an excellent case context for our aforementioned comparisons.

This paper is sectioned as follows. After this brief introductory section, the theoretical foundation of the paper and the compared theoretical models are discussed in Section 2. After this, the methodology and results of the study are reported in Sections 3 and 4. The results are discussed in more detail in Section 5. Finally, Section 6 considers the limitations of the study and potential paths of future research.

2 Theoretical Foundation

2.1 Technology Acceptance Model

Deriving from the theory of reasoned action (TRA) by Fishbein and Azjen (1975, 1980), TAM explains the use intention and actual use of information systems by concentrating on the personal beliefs of their potential users about the perceived characteristics of the technology. According to TAM, as already mentioned in the introduction, use intention is determined by perceived usefulness (PU), defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", and perceived ease of use (PEOU), defined as "the degree to which a person believes that using a particular system would be free of effort". In addition to use intention, PEOU also acts as an antecedent of PU. Use intention, in turn, determines actual use. (Davis, 1989; Davis, Bagozzi & Warshaw, 1989.) In many prior studies, TAM has been shown to be a valid and a very robust predictive model and, together with its simplicity, this has resulted in it becoming one of the most well-known and widely used theories in information systems (King & He, 2006). Because of its parsimony, the basic TAM illustrated in Figure 1 was chosen as the base model of our study over its extensions. For example, TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008) include numerous additional antecedents whose effects on use intention and actual use are typically mediated by PU or PEOU. In turn, UTAUT (Venkatesh et al., 2003) and UTAUT2 (Venkatesh, Thong & Xu, 2012) include numerous moderating effects. Thus, they are all inherently more complex models, and their use would make it more difficult to isolate and compare the effects of the two constructs that we are mainly interested in this study: PIIT and TRI.

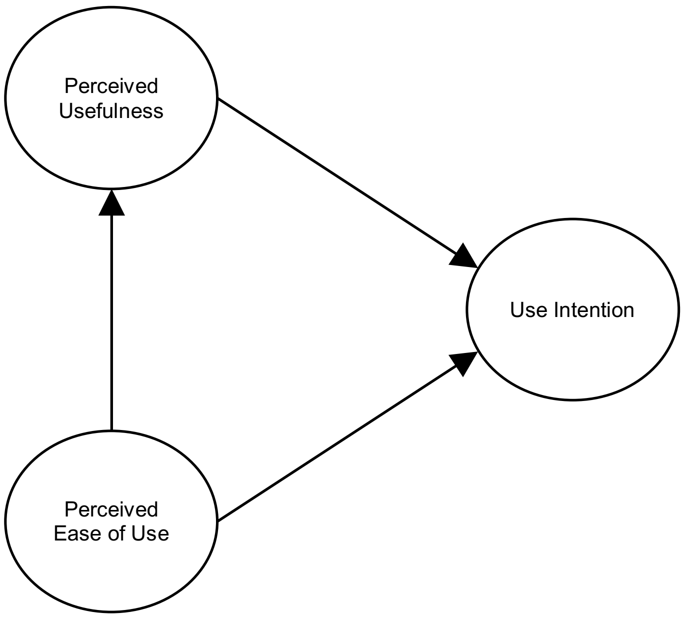

Figure 1: Technology acceptance model (TAM)

2.2 Personal Innovativeness in the Domain of Information Technology

Drawing from the innovation diffusion theory by Rogers (2003), Agarwal and Prasad (1998) have proposed a construct termed personal innovativeness in the domain of information technology (PIIT), which they define as "the willingness of an individual to try out any new information technology". The construct measures the innovativeness of an individual in a continuum from high to low, thus helping to identify individuals who are likely to adopt information technology innovations earlier or later than others. Although PIIT was originally proposed as a moderator of the effects of innovation characteristics on use intention (Agarwal & Prasad, 1998), the findings of Yi, Fiedler and Park (2006) have shown that individual innovativeness is actually an antecedent of PU, PEOU, perceived compatibility, and use intention rather than just a moderator of the effects between the constructs. Also Lewis, Agarwal and Sambamurthy (2003) as well as Jackson, Yi and Park (2013) have suggested PIIT to be an antecedent of innovation characteristics. Based on this, in our first comparison model illustrated in Figure 2, we hypothesise PIIT to act as a direct antecedent of all the three constructs of our base model: PU, PEOU, and use intention.

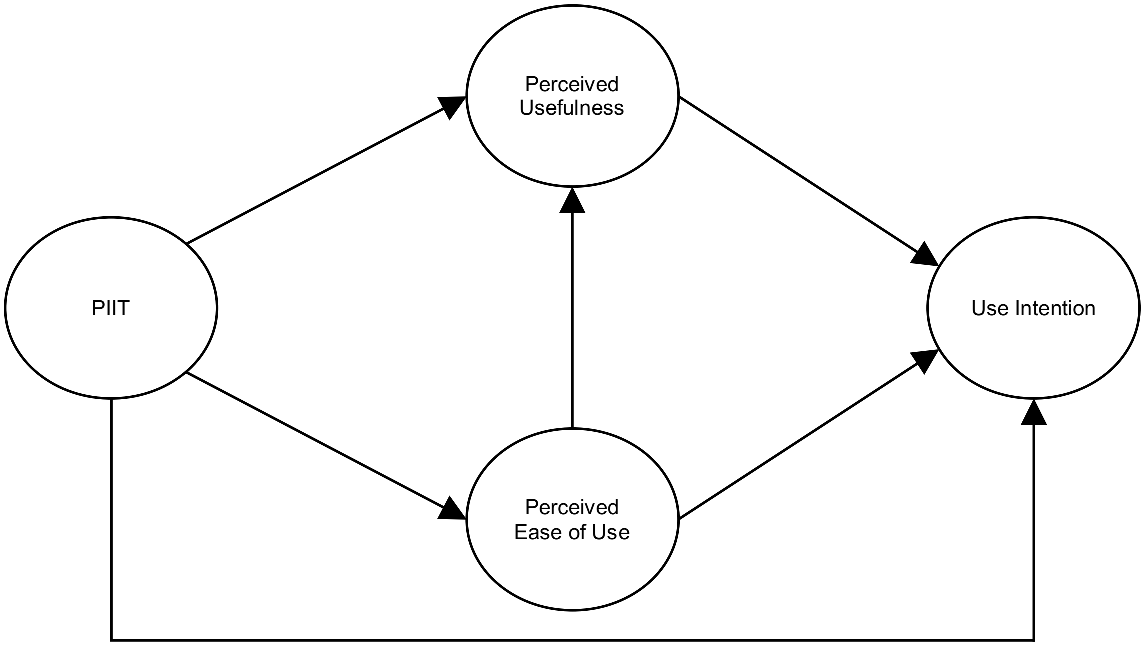

Figure 2: Integrative model of TAM and PIIT (TAM + PIIT)

2.3 Technology Readiness Index

TRI measures the readiness of an individual to use technology through a combination of positive and negative personal beliefs about technology in general, and it has been found to be a very robust predictor of technology-related intentions and behaviour, particularly in the e-services domain (Parasuraman & Colby, 2015). Proposed originally by Parasuraman (2000) and defined as "people's propensity to embrace and use new technologies to accomplish goals in home life and at work", technology readiness is typically seen as comprising of four co-existing dimensions, which in combination determine a person's general predisposition to use new technologies (Parasuraman & Colby, 2015):

- Optimism: "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives"
- Innovativeness: "a tendency to be a technology pioneer and thought leader"
- Discomfort: "a perceived lack of control over technology and a feeling of being overwhelmed by it"
- Insecurity: "distrust of technology, stemming from scepticism about its ability to work properly and concerns about its potential harmful consequences"

Of these, optimism and innovativeness are seen as drivers that increase technology readiness, whereas discomfort and insecurity are seen as deterrents that decrease it. TRI has also been successfully integrated into TAM in the technology readiness and acceptance model (TRAM) by Lin, Shih and Sher (2007), who examined the effects of the aggregate TRI construct on PU and PEOU and found the explanatory power of this integrative model to be superior in comparison to its component models. In some later studies, the effects of the four component constructs of TRI on TAM constructs have also been examined individually by hypothesising that optimism and innovativeness have a positive effect on PU and PEOU, whereas discomfort and insecurity have a negative effect on them (Godoe & Johansen, 2012; Walczuch, Lemmink & Streukens, 2007). In this study, we follow this latter approach by concentrating on the effects of the four component constructs rather than the effects of the aggregate TRI construct. Although Lin, Shih and Sher (2007) suggest that the effect of technology readiness on use intention is fully mediated by PU and PEOU, Lin and Chang (2011) have found that technology readiness affects use intention not only indirectly through PU and PEOU, but also directly. Based on this, in our second comparison model illustrated in Figure 3, we hypothesise the four component constructs of TRI to act as direct antecedents of not only PU and PEOU, but also use intention.

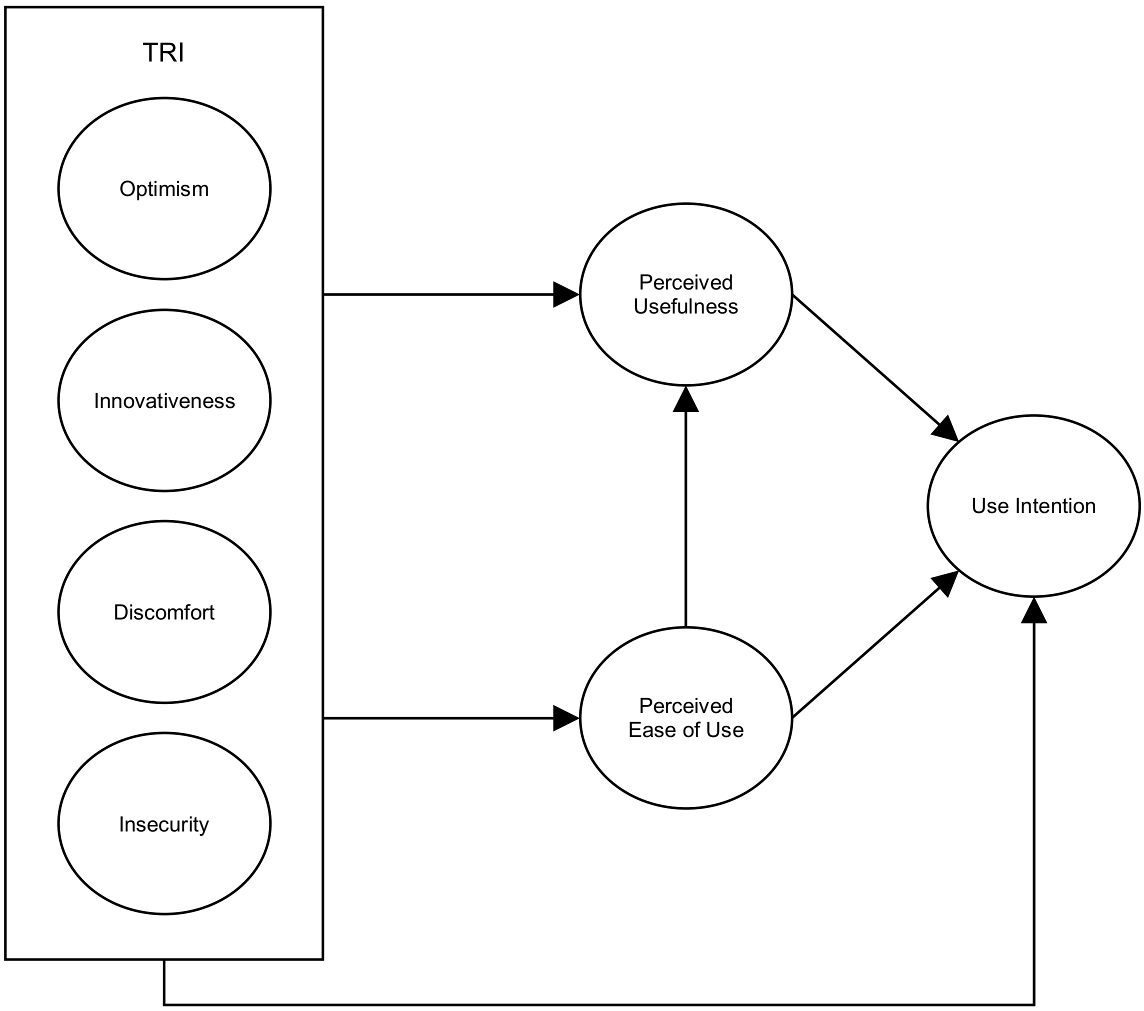

Figure 3: Integrative model of TAM and TRI (TAM + TRI)

3 Methodology

To compare the basic TAM model as well as the TAM + PIIT and TAM + TRI models, we conducted a self-administered online survey targeted at Finnish consumers between December 2015 and January 2016. Due to the case context of the study, the survey was promoted via the online channels of two electric suppliers (e.g., websites, social media, and newsletters) as well as via the internal communication channels of our university and several discussion forums. To raise the response rate, also several gift cards with a total worth of 356 € were raffled among the respondents.

The survey questionnaire contained three main sections related to TAM, PIIT, and TRI as well as questions concerning demographics and technology use experiences. The items measuring perceived usefulness, perceived ease of use, and use intention were derived from Davis (1989) as well as Davis, Bagozzi and Warshaw (1989), whereas the items measuring PIIT were derived from Agarwal and Prasad (1998) and the items measuring TRI were derived from the TRI 2.0 scale by Parasuraman and Colby (2015). However, a few minor wording changes were made to the items in order for them to better fit the case context of the study. The exact wording of each item, translated from Finnish to English, is presented in Appendix A. All the items were measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The respondents were also able to skip individual items, which resulted in a missing value.

We analysed the collected data with the IBM SPSS Statistics 22 and Mplus version 7.11 software. SPSS was mainly used for data preparation and preliminary analysis, whereas Mplus was used for SEM analysis. As the model estimator, we used the MLR option of Mplus, which stands for maximum likelihood estimator robust to non-normal data. The potential missing values were handled by using the FIML option of Mplus, which stands for full information maximum likelihood and uses all the available data in the model estimation. More details about Mplus and the exact estimation methods can be found in the user's guide and technical appendices of Mplus (Muthén & Muthén, 2016).

4 Results

The conducted online survey was completed by a total of 1,370 respondents. However, to promote the quality of responses, 194 of them were excluded from the final sample in two phases. We first excluded 124 respondents who had not reported being customers of any electric supplier (e.g., adolescents living in student apartments) and, thus, were not likely to be able to give reliable assessments on their online services. This was followed by an exclusion of additional 70 respondents who had reported missing values in all the items that measured the basic TAM constructs. This resulted in a final sample size of 1,176 respondents to be used for model estimations. Descriptive statistics of this sample are reported in Table 1. All in all, the gender and age distributions of the sample corresponded quite well with those of the adult Finnish population in 2015 (Statistics Finland, 2016), which are also reported in Table 1. The main deviations were that the age group of 50–69 years was overrepresented and the age groups of 18–39 years and 70 years or older were slightly underrepresented. This was likely caused by how the survey was promoted. The age of the respondents ranged from 18 to 83 years, with the mean age being 50.4 years (SD = 15.5 years).

	Sample (N = 1,176)		Finland
	N	%	%
Gender			
Male	631	53.7	48.8
Female	545	46.3	51.2
Age			
18–29 years	171	14.5	18.3
30–39 years	137	11.6	15.9
40–49 years	153	13.0	15.1
50–59 years	319	27.1	16.8
60–69 years	313	26.6	17.1
70– years	83	7.1	16.8
Monthly net income			
–999 €	213	18.1	
1000–1999 €	351	29.8	
2000–2999 €	343	29.2	
3000– €	180	15.3	
No response	89	7.6	
Socioeconomic status			
Employed	532	45.2	
Unemployed	97	8.2	
Student	155	13.2	
Pensioner	332	28.2	
Other	60	5.1	

Table 1: Sample statistics

In the next three sub-sections, we first assess the reliability and validity of the construct indicators and the eight constructs included in the three compared models: use intention (INT), perceived usefulness (PU), perceived ease of use (PEOU), personal innovativeness in the domain of information technology (PIIT), optimism (OPT), innovativeness (INN), discomfort (DIS), and insecurity (INS). These assessments are based on a model that contains all the aforementioned constructs but does not yet hypothesise any regression relationships between them. This is followed by the actual comparison of the models in terms of their explanatory power as well as goodness of fit with the data.

4.1 Indicator Reliability and Validity

Indicator reliabilities and validities were evaluated by using the standardised loadings and residuals of the indicators, which are reported in Appendix B. In a typical case where each indicator loads on only one construct, it is commonly expected that the standardised loading (λ) of each indicator should be statistically significant and greater than or equal to 0.707 (Fornell & Larcker, 1981). This is equal to the standardised residual ($1 - \lambda^2$) of each indicator being less than or equal to 0.5, meaning that at least half of the variance of each indicator is explained by the construct on which it loads. As can be seen, the three indicators that were furthest from meeting this criterion were DIS1, INS4, and PIIT3, which all had standardised loadings of less than 0.6. Thus, after assessing that there would be no adverse effects on the content validity of the three constructs that they were measuring, we decided to eliminate them and to re-estimate the model. In the re-estimated model, all the indicators now met the criterion or at least were very close to meeting it (INN3 was furthest away from meeting it with a standardised loading of 0.665), meaning that the re-estimated model could be considered to exhibit satisfactory indicator reliability and validity.

4.2 Construct Reliability and Validity

Construct reliabilities were evaluated by using composite reliabilities (CR – Fornell & Larcker, 1981), with which it is commonly expected that each construct should have a CR greater than or equal to 0.7 in order for it to exhibit satisfactory reliability (Nunnally & Bernstein, 1994). The CR of each construct is reported in the first column of Table 2, and as can be seen, all the constructs met this criterion. Construct validities were evaluated by examining the convergent and discriminant validity of the constructs, which were evaluated by using the two criteria proposed by Fornell and Larcker (1981). They are both based on the average variance extracted (AVE) of the constructs, which refers to the average proportion of variance that a construct explains in its indicators. In order to exhibit satisfactory convergent validity, the first criterion requires that each construct should have an AVE greater than or equal to 0.5, meaning that, on average, each construct should explain at least half of the variance of its indicators. The AVE of each construct is reported in the second column of Table 2, and as can be seen, all the constructs except for DIS and INS met this criterion. However, their values were so close to meeting it that we decided not to eliminate them. After all, both the criteria proposed by Fornell and Larcker (1981) can be considered more as rules of thumb, the violations of which do not automatically have to result in any actions. However, if the violations are considerable, caution must be used when interpreting the results.

	CR	AVE	INT	PU	PEOU	OPT	INN	DIS	INS	PIIT
INT	0.951	0.865	**0.930**							
PU	0.881	0.712	0.722	**0.844**						
PEOU	0.894	0.738	0.594	0.870	**0.859**					
OPT	0.835	0.559	0.384	0.531	0.470	**0.748**				
INN	0.821	0.537	0.329	0.301	0.359	0.590	**0.733**			
DIS	0.730	0.474	-0.125	-0.288	-0.397	-0.397	-0.379	**0.689**		
INS	0.739	0.486	-0.152	-0.182	-0.200	-0.458	-0.420	0.638	**0.697**	
PIIT	0.847	0.648	0.334	0.316	0.372	0.620	1.006	-0.336	-0.450	**0.805**

Table 2: CRs, AVEs, square toots of AVEs and correlations of the model constructs

In order to exhibit satisfactory discriminant validity, the second criterion requires that each construct should have a square root of AVE greater than or equal to its absolute correlation with the other constructs. This means that, on average, each construct should share at least an equal proportion of variance with its indicators than it shares with the other constructs. The square root of AVE of each construct (on-diagonal cells) and the correlations between the constructs (off-diagonal cells) are reported in the remaining columns of Table 2. As can be seen, all the constructs met also this criterion with the exception of PU and PEOU, which correlated too strongly with each other. However, this cannot be considered dangerous because, as already mentioned in Section 2.1, TAM hypothesises PEOU to act as an antecedent of also PU in addition to INT. In addition, there was also an extremely strong correlation between INN and PIIT, which was expected and also cannot be considered dangerous as these constructs are not intended to be included into the same model.

4.3 Model Comparisons

Figure 4 presents the standardised estimation results of the basic TAM model, which was able to explain 52.9 % of the variance of INT. As expected, PU had a statistically significant and positive effect on INT. Contrary to expectations, the effect of PEOU on INT was negative, but quite weak and not statistically significant. However, PEOU had a statistically significant and positive effect on PU and was able to explain 75.8 % of its variance. In terms of the fit of the model with the data, the χ^2 test rejected the null hypothesis of the model fitting the data. However, instead of actual misfit, this may have been caused by the tendency of the χ^2 test to underestimate the fit especially in the case of large samples (Bentler & Bonett, 1980). For this reason, also four different fit indices were used to evaluate the fit: the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardised root mean square residual (SRMR). Their values clearly surpassed the commonly accepted cut-off criteria for a satisfactory fit (CFI ≥ 0.95, TLI ≥ 0.95, RMSEA ≤ 0.06, and SRMR ≤ 0.08 – Hu & Bentler, 1999), meaning that the model could be considered to exhibit a good fit with the data.

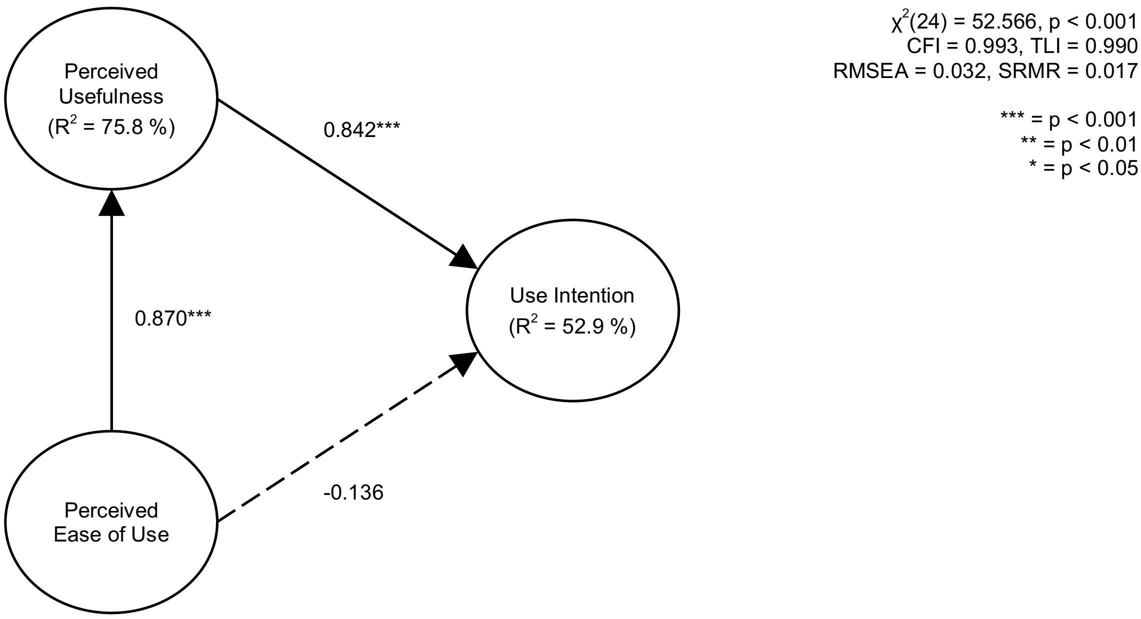

Figure 4: Standardised estimation results of TAM model

Figure 5 presents the standardised estimation results of the TAM + PIIT model. The performance of this integrative model was a bit better as compared to the TAM model in terms of explaining the variance of INT, with an explanatory rate of 54.2 %. PU had an approximately as strong an effect on INT as in the case of the basic TAM model, and also the effect of PEOU on INT was now slightly stronger and statistically significant, but still negative. In addition, PIIT had a statistically significant and positive effect on INT, although a weak one. PIIT additionally had a statistically significant and a somewhat stronger positive effect on PEOU, and it was able to explain 14.2 % of its variance. In contrast, PIIT did not have a statistically significant effect on PU, but PEOU still remained as an approximately as strong an antecedent of PU as in the case of the basic TAM model and was able to explain 75.8 % of its variance. Also the fit of the model with the data remained as approximately as good as in the case of the basic TAM model.

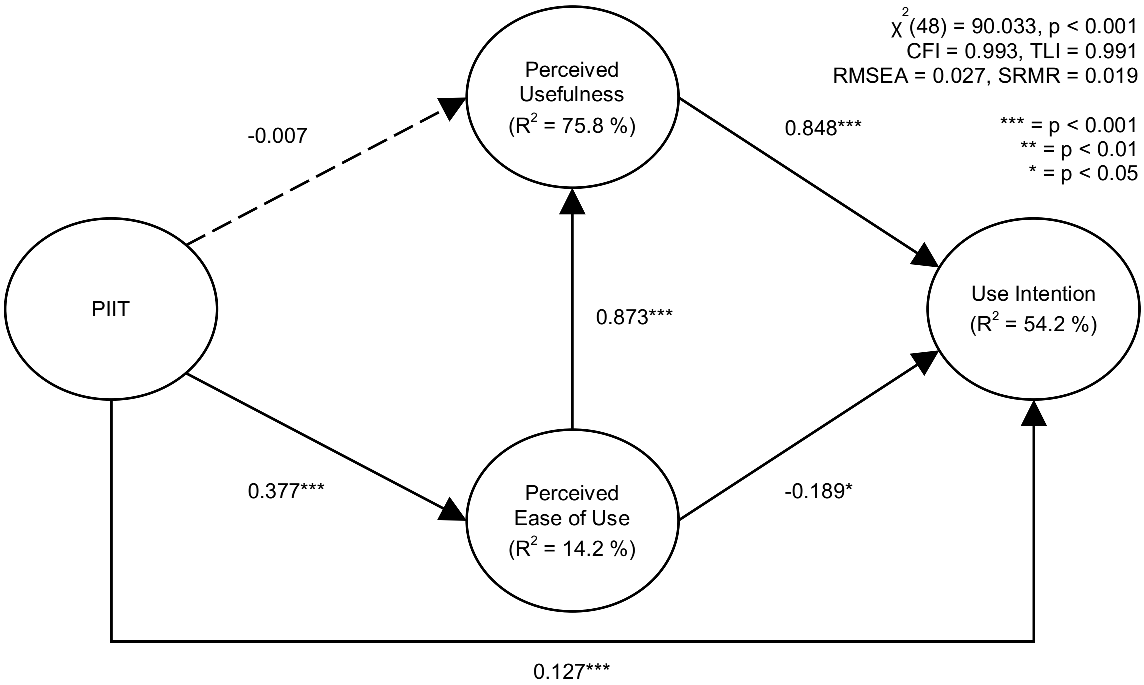

Figure 5: Standardised estimation results of TAM + PIIT model

Figure 6 presents the standardised estimation results of the TAM + TRI model, which performed best in terms of explaining the variance of INT, with an explanatory rate of 56.4 %. The effects of PU and PEOU on INT remained as approximately as strong as in the case of the basic TAM model. In addition, OPT, INN, and DIS of the TRI constructs were found having statistically significant effects on INT. The effect of INN was positive and about as strong as the effect of PIIT on INT in the case of the TAM + PIIT model. However, surprisingly, OPT had a negative and DIS had a positive effect on INT, although both of these effects were quite weak. An aspect in which the TAM + TRI model performed considerably better than the TAM + PIIT model was its ability to explain the variance of PEOU, with an explanatory rate of 31.2 %. All the four TRI constructs were found to have a statistically significant effect on PEOU, with OPT and DIS having the strongest effect and being followed by INS and INN. As expected, OPT and INN had a positive effect and DIS had a negative effect. However, the effect of INS was surprisingly positive. Three of the TRI constructs were also found to have a statistically significant effect on PU, with OPT having the strongest effect and being followed by INN and DIS. As expected, OPT had a positive effect, but surprisingly the effect of INN was negative and the effect of DIS was positive. However, both of these two latter effects were weak. PEOU still remained as an approximately as strong an antecedent of PU as in the case of the basic TAM and TAM + PIIT models and, together with the TRI constructs, they were able to explain 79.3 % of its variance. The fit of the TAM + TRI model with the data deteriorated slightly in comparison to the basic TAM and TAM + PIIT models, but remained at a good level in terms of all the four fit indices.

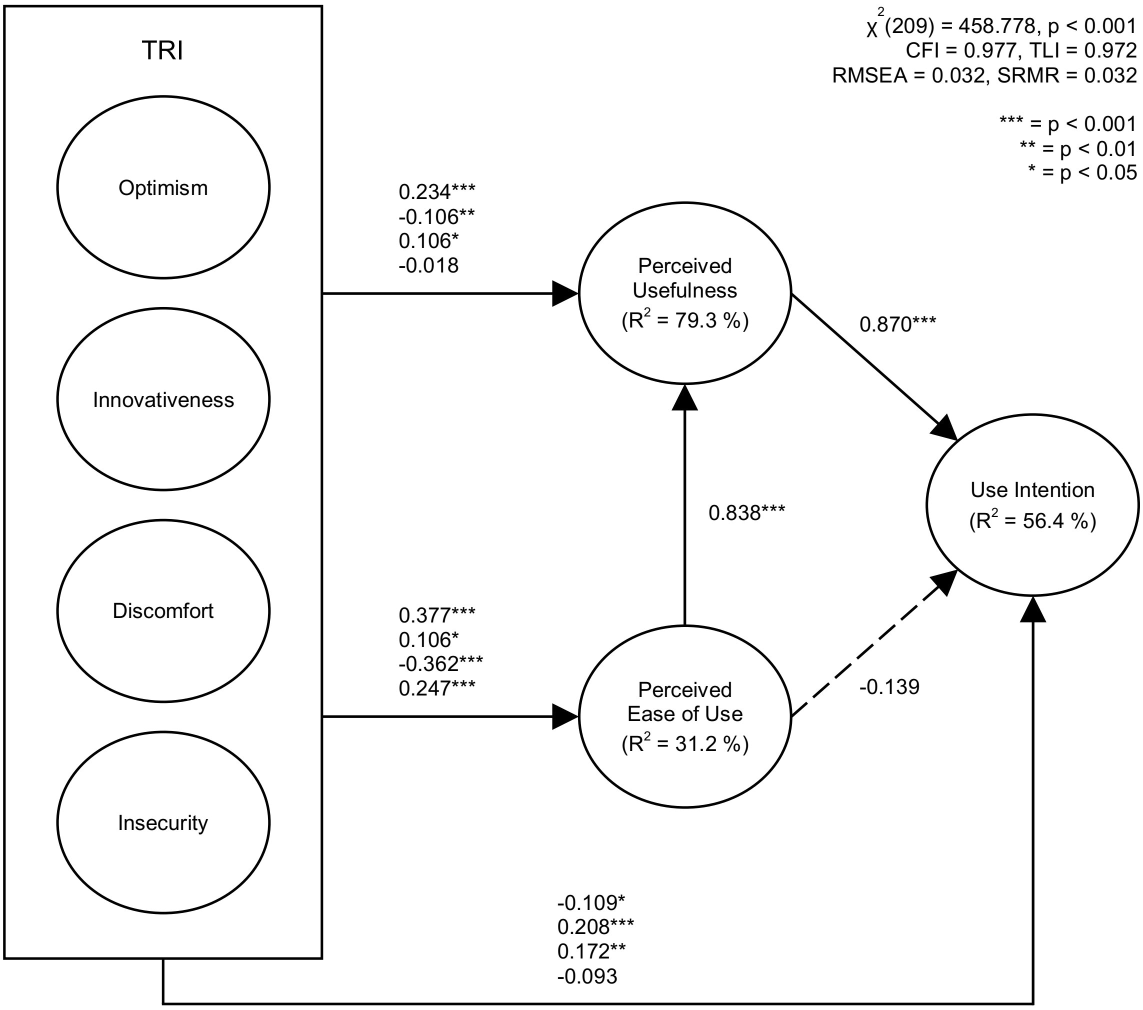

Figure 6: Standardised estimation results of TAM + TRI model

5 Discussion and Conclusions

From a theoretical perspective, this study contributes to technology acceptance research by comparing which of the two personal trait constructs commonly used as antecedents of technology acceptance or use intentions and behaviour in IS research, PIIT or TRI, actually performs better in terms of promoting the explanatory power of TAM. This was done by comparing the basic TAM model to the TAM + PIIT and TAM + TRI models, which comprise also the PIIT and TRI constructs, respectively. Of the three models, we found the TAM + TRI model having the best explanatory power in terms of use intention and perceived usefulness as well as a better explanatory power in terms of perceived ease of use in comparison to the TAM + PIIT model. Thus, in terms of pure explanatory power, TRI would seem to be a better choice than PIIT when thinking about which one of the constructs to add to the basic TAM model. However, at the same time, one must also consider whether the promotions in explanatory power are actually significant enough to justify the trade-off of having to use a more complex measurement instrumentation for the model. For example, in comparison to the basic TAM model, the TAM + TRI model with the four-dimensional TRI construct typically requires 4 x 4 = 16 additional items if using the TRI 2.0 scale by Parasuraman and Colby (2015), whereas the TAM + PIIT model with the one-dimensional PIIT construct typically requires only four additional items if using the original PIIT scale (Agrawal & Prasad, 1998). When taking this into consideration, our conclusion is that if one is interested in explaining only the use intention and perceived usefulness constructs, then the basic TAM model seems to be a sufficient option because both the TAM + PIIT and the TAM + TRI models were able to promote the explanatory in terms of these two constructs by only a few percentage points. In contrast, if one is interested in explaining also the ease of use construct, then the usage of the TAM + TRI model instead of the basic TAM model seems to be a justifiable option. However, if a simple measurement instrumentation is a priority, then also the usage of the TAM + PIIT model may suffice.

In addition, the study also makes a contribution to service research in which prior TRI studies have encountered problems in terms of identifying all the four dimensions of the TRI construct, especially discomfort and insecurity, thus questioning the validity of the original TRI scale (Gelderman, Ghijsen & van Diemen, 2011; Liljander et al., 2006; Taylor, Celuch & Goodwin, 2002). Being able to identify all the four dimensions in our present study provides support for the argument that Parasuraman and Colby (2015) have succeeded in their recent update of the scale and encourages the use of the TRI 2.0 scale in future studies.

From a practical perspective, the main contribution of this study is that it provides electric suppliers several valuable insights on the acceptance of their online services, which they can aim to use in supporting the future adoption these services among consumers. All in all, most of the effects observed in the compared models were found to be in line with the hypotheses of TAM and the findings of prior studies on PIIT and TRI. However, there are a few findings that merit a more detailed discussion. First of these concerns the positive effect of perceived ease of use on perceived usefulness. Although this effect is hypothesised also in TAM, we found it to be exceptionally strong in our case context, which suggests that even though perceived ease of use was found having only a weak direct effect on use intention, it can still be considered a critical indirect antecedent of use intention. This implies that electric suppliers should pay special attention on the usability and user friendliness of their online services in order to support their future adoption among consumers.

The second set of findings that merits a more detailed discussion concerns some of the effects of the PIIT and TRI constructs on the basic TAM constructs that were actually found to be opposite to what could have be expected based on the hypotheses and findings of prior studies. For example, we found the effects of discomfort on both perceived usefulness and use intention to be positive instead of negative. This seems to imply that the online services of electric suppliers have actually succeeded very well in addressing the needs of those consumers who are not so “technologically savvy” and are less comfortable with new technologies, because these consumers perceived the services as more useful and were more motivated to use them. In contrast, the more “technologically savvy” consumers, who are typically also more comfortable with new technologies, perceived the services as less useful and less motivating to use, suggesting that for them, a more advanced set of features beyond the current basic functionalities, such contract management and consumption tracking, should be added to the services in order to address their more sophisticated needs. Respectively, we found the effect of insecurity on perceived ease of use to be positive instead of negative. This could be explained by the fact that consumers who feel themselves less secure when using new technologies typically use them more cautiously and, for example, pay more attention to reading their instructions and manuals. This, in turn, may cause them to learn using these technologies, such as the online services of electric suppliers, more easily in comparison to those who just rush into using them by relying more on their own intuition as well as trial and error type of approaches. Finally, we also found the effects of innovativeness on use intention and perceived usefulness to be negative instead of positive. Of these, the finding concerning the effect of innovativeness on perceived usefulness is actually in line with the findings of Godoe and Johansen (2012) as well as Walczuch, Lemmink and Streukens (2007), who explain it with the fact that more innovative individuals typically also tend to be more critical towards new technologies, which causes them to have higher expectations towards them and perceiving their usefulness lower in comparison to less innovative individuals. A similar explanation can also be applied to the finding concerning the effect of innovativeness on use intention.

6 Limitations and Future Research

The main limitation of this study is that we concentrated on conducting the model comparisons only in the case context of online services offered by electric suppliers and by relying only on the responses from Finnish consumers, which obviously limits the generalisability of our findings and calls for replications of the present study in other case contexts and countries. In terms of SST, interesting case contexts could be, for example, e-banking and ticket self-purchasing services. In addition, the future studies may also benefit from conducting the model comparisons not only in the case of the basic TAM model, but also its extensions, such as UTAUT (Venkatesh et al., 2003) or UTAUT2 (Venkatesh, Thong & Xu, 2012).

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Appendix A: Indicator Wordings

INT1 I intend to use the e-services in the following year.

INT2 I plan to use the e-services in the following year.
INT3 It is likely that I will use the e-services in the following year.
PU1 Using the e-services to manage my electricity affairs would be convenient.
PU2 Using the e-services would make it easier for me to manage my electricity affairs.
PU3 I would find the e-services useful in managing my electricity affairs.
PEOU1 I would find the e-services easy to use.
PEOU2 My interaction with the e-services would be clear and understandable.
PEOU3 Learning to use the e-services would be easy for me.
PIIT1 If I hear about a new information technology, I look for ways to experiment with it.
PIIT2 Among my peers, I am usually the first to try out new information technologies.
PIIT3 In general, I am hesitant to try out new information technologies.
PIIT4 I like to experiment with new information technologies.
OPT1 New technologies contribute to a better quality of life.
OPT2 Technology gives me more freedom of mobility.
OPT3 Technology gives people more control over their daily lives.
OPT4 Technology makes me more productive in my personal life.
INN1 Other people come to me for advice on new technologies.
INN2 In general, I am among the first in my circle of friends to acquire new technology when it appears.
INN3 I can usually figure out new high-tech products and services without help from others.
INN4 I keep up with the latest technological developments in my areas of interest.
DIS1 When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do.
DIS2 Technical support lines are not helpful because they do not explain things in terms I understand.
DIS3 Sometimes, I think that technology systems are not designed for use by ordinary people.
DIS4 There is no such thing as a manual for a high-tech product or service that’s written in plain language.
INS1 People are too dependent on technology to do things for them.
INS2 Too much technology distracts people to a point that is harmful.
INS3 Technology lowers the quality of relationships by reducing personal interaction.
INS4 I do not feel confident doing business with a place that can only be reached online.

Note: The questions of OPT, INN, DIS and INS comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors.

Appendix B: Indicator Loadings and Residuals

	Loading	Residual
INT1	0.952***	0.093***
INT2	0.903***	0.184***
INT3	0.935***	0.125***
PU1	0.868***	0.247***
PU2	0.837***	0.299***
PU3	0.825***	0.319***
PEOU1	0.887***	0.212***
PEOU2	0.871***	0.241***
PEOU3	0.817***	0.333***

	Loading	Residual
OPT1	0.750***	0.438***
OPT2	0.733***	0.462***
OPT3	0.761***	0.422***
OPT4	0.746***	0.444***
INN1	0.722***	0.479***
INN2	0.832***	0.307***
INN3	0.676***	0.543***
INN4	0.695***	0.516***
DIS1	0.582***	0.662***
DIS2	0.691***	0.522***

	Loading	Residual
DIS3	0.692***	0.521***
DIS4	0.650***	0.578***
INS1	0.690***	0.524***
INS2	0.695***	0.517***
INS3	0.667***	0.555***
INS4	0.511***	0.739***
PIIT1	0.779***	0.393***
PIIT2	0.834***	0.304***
PIIT3	0.503***	0.747***
PIIT4	0.791***	0.375***

*** = $p < 0.001$, ** = $p < 0.01$, * = $p < 0.05$