# Predictors of e-Government Adoption in Mauritius: An Extended version of the Technology Adoption Model (TAM)

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## Introduction

Acceptance of technology by users has obtained widespread interest since the introduction of information systems in organisations (Rogers, 1983; King and He, 2006). Technology Acceptance has been defined by Gattiker (1990) as "an individual's psychological state with regard to his or her voluntary and intended use of a technology".

Researchers have expended considerable research effort determining the factors which affect users' beliefs and attitudes towards the Information Systems acceptance decision, and what factors contribute to user resistance (Lucas and Spitler, 1999). The size of Information Systems investments and the inherent degree of uncertainty they incorporate has made it critical to uncover and understand factors which affect behavioural intention to use a system, and the latter's role in obtaining successful implementation (Jackson *et al*, 1997).

In a similar vein, Governments are nowadays faced with the challenge of being able to provide high quality services in an efficient and effective fashion using technologies. As a result, there is a growing interest in the factors which will contribute to the smooth acceptance and sustained usage of the governmental information systems. Based on such research concerns, the research objectives of the current study are as follows:

(i) to understand and explore the acceptance and diffusion approach, and
(ii) to identify factors leading to the acceptance and diffusion of e-Government systems

## Literature Review

The goals and objectives of national governments in small and island states vary across the world. For example, the Jamaican strategy seems to emphasize on the economic return while Malta's policy accentuates on the connection of government and its citizens. Several types of variations exist in the way countries put into practice their policies. Certain nations adopt a "top-

down" approach, while countries such as Brazil have been successful with a "bottom-up" style (Workshop for Sectoral Planning in IT, 2001).

In spite of the world wide diffusion of e-Government initiatives, the transition to an electronic form of government will take time. To get the claimed benefits of e-Government has not been easy for various technological as well as organisational reasons. This is true for both industrialised as well as developing countries (Strejeek and Theil, 2002).

In the public sector domain, many studies have been undertaken to investigate how the introduction of information systems have improved (or not) the efficiency and effectiveness of public institutions (Norris, 1999). More recent studies are undoubtedly focusing on the rising fashion of e-government development (Moon, 2002).

Studies performed on e-government have focused on 'performance' by appraising the services available to citizens on government web portals (Moon, 2002). In comparison, the emphasis on online services (transactional e-citizens) is less researched; few studies have made a preliminary examination of the characteristics of citizens who tend to interact with government (Thomas and Streib, 2003).

Previous studies on the consequence of new technology adoption on organisational change in government have shown that computing technologies do not always come with a change in the existing process and structure of the organisation. In her study, Fountain (2001) claims that the acceptance of a new technology is not dependent on the objective technology designed by technical people. However, he argues that the technology is built to be in line with environment of the institution.

Several authors (Moon and Kim, 2001; Gefen and Straub, 1997) have acknowledged that factors of the TAM and DOI models influence users' acceptance of e-commerce. Consequently, it is foreseen that they will also affect user adoption of e-government (Warkentin *et al.,* 2002; Carter and Bélanger, 2005). The construct 'trustworthiness' has been found to be particularly important as it is expected to impact on citizen's intention to use state e-government services. Bélanger *et al.,* (2002) define trustworthiness as 'the perception of confidence in the electronic marketer's reliability and integrity'. Privacy and security are issues which keep coming up in e-commerce

and e-government research (Miyazaki and Fernandez, 2001; Bélanger *et al*., 2002, Bélanger and Hiller, 2005).

As was seen in the reviewed literature the TAM and DOI share common features. TAM however, stresses on two key factors: psychological predispositions and social influences. The model goes beyond the demographic classification of adopters to expound two important psychological dimensions that impacts on the adoption process, that is, PU and EOU. The TAM model hypothesises the following: the higher the perceived usefulness of the new technology, the more likely it is to be adopted by the consumer. This proposition points to the decisions that to adopt a new technology service (e.g. electronic government) is based on a subjective perception on the part of the user. The reviewed diffusion and TAM literature have derived the main components of the conceptual framework used in this study.

Two foremost classes of theories have transpired from the acceptance and diffusion literature: firstly, the intention-based models of adoption of IT namely, TAM (Davis 1989; Davis, *et al*., 1989; Venkatesh and Davis, 1996, 2000) and TPB (Mathieson, 1991; Taylor and Todd, 1995b; Venkatesh and Brown, 2001) which point towards the fact that the adoption and usage of an IT innovation is influenced by personal beliefs and attitudes towards the information systems. Secondly, the DOI theory which hypothesises that user's perceptions of the characteristics of an innovation influence the latter's adoption (Moore and Benbasat, 1991; Plouffe, *et al*., 2001 and Rogers, 1995).

Diffusion of Innovations provides a great deal of information concerning the process of user acceptance and the conditions under which they are likely to be implemented and adopted. As highlighted in the discussions in the earlier sections of this chapter, the TAM is short of being able to provide this type of information. Specifically critical factors such as social norm, voluntariness or compatibility are missing in TAM. Several authors (Agarwal and Prasad, 1997 and Lopez-Nicolas, 2008) have discussed the appropriateness of the various characteristics of the outcomes of both innovation diffusion research and technology acceptance models individually though both assume a hypothesized relationship between the user perceptions of the system and the subsequent adoption behaviour. However, they provided validation for the theoretical relationship between perceived characteristics of an innovation and adoption behaviour. They

supported the view that user perceptions were influential in explaining a significant proportion of the variance in both current and future use (Agarwal and Prasad, 1997).

Given that fact that both models are empirically strong on their own, the selection of antecedents of each model is even more complex. TAM provides a fast and economical means to collect information about individual's perceptions of a system. DOI offers precise information and considerably more insight into why an individual or group might be dissatisfied. In sum this section has compared TAM using the DOI and considerable attention was given to yield an unbiased comparison. The base models used for this study were the TAM and DOI coupled with other constructs from the extant literature.

**Conceptual Framework**

The fundamental constructs of the TAM, that is 'Ease of Use' and 'Perceived Usefulness' were both retained for the theoretical framework (Appendix A). The construct 'attitude' from the TRA was deemed important and included in the model, since one of the main criticisms of the TAM has been the lack of consideration for the component 'attitude'. From the DOI, the constructs voluntariness, compatibility, complexity (in lieu of ease of use) and relative advantage (equivalent of perceived usefulness) were found to be applicable to the research question and were retained for testing. Literature revealed that technology acceptance has been measured by 1) usage behaviour and 2) behavioural intention (Szajna, 1996).

**Methodology**

A quantitative methodology has been used to gather information. Quantitative methods were developed in the natural sciences to study natural phenomena. Examples, commonly used in the social sciences are: survey methods, laboratory experiments, mathematical modelling. Quantitative methods are founded on traditional scientific method which is characterised by repeatability, reductionism and refutability (Galliers, 1992a). The reductionism concept assumes that a problem can be broken down into controllable parts without any alteration to the essence of the problem. Reductionism is complex in the instance when a researcher has evidence only about a few individuals and is attempting to make use of this information to explain macro-level events (Galliers, 1992a). Refutability, on the other hand, takes as a fact, that the forecasted outcomes can be reasonably predicted (Galliers, 1992b).

Quantitative research has been criticised, for bearing the following weaknesses: the researcher passes over a phenomena happening because too much emphasis is laid on theory or hypothesis testing rather than on theory or hypothesis generation; knowledge created may possibly be too abstract and wide-ranging for direct relevance to local situations, contexts and individuals (Johnson and Onwuegbuzie, 2004).

**The Cautionary Tale**

The Structural Equation Modelling (SEM) fits statistics which allow valuable conclusions to be drawn about the model being studied. The fit indices are used to appraise the model fit for the data being investigated. The noteworthy contribution of SEM lies in the following features: the position of the hypothesis vis-à-vis the theory, how well constructs have been operationalised, and the 'match' between the hypothesis and the statistical method used to test it (Smith, 1983). The fit indices (absolute and incremental fit indices) used in this study were determined and summarised in Appendix B.

**Structural Path and Hypothesis Testing**

The hypotheses formulated for the study were tested and the results are summarised in Appendix C. The findings indicate that the following relationships were highly significant, namely the influence of 'attitude' on 'intention' (ß = 0.50), the impact of 'compatibility' on 'ease of use' (ß = 0.46) and the effect of 'trust' on 'perceived usefulness' is (ß = 0.36). A couple of moderately significant relationships were also observed, namely the impact of 'social influence' on users' 'attitude', the influence of 'facilitating conditions' on the 'ease of use' of the system and the effect of the 'ease of use' of the system on users' 'attitude'. It was observed that the impact of 'civic mindedness' on 'behavioural intention' was negative and significant.

**Multiple Stepwise Regression**

A Multiple Stepwise Regression was performed and results showed that only Attitude (AT), Civic Mindedness (CVM) and Trust (TRS) were retained as influential factors. The results were confirmed by the SEM analysis.

**Table 1 Model Summary**

| Model | R | $R^2$ | Adjusted $R^2$ | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $R^2$ Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .588(a) | .345 | .339 | .620 | .345 | 55.938 | 1 | 106 | .000 | |
| 2 | .670(b) | .448 | .438 | .572 | .103 | 19.618 | 1 | 105 | .000 | |
| 3 | .689(c) | .474 | .459 | .561 | .026 | 5.125 | 1 | 104 | .026 | 1.846 |

a Predictors: (Constant), AT
b Predictors: (Constant), AT, TRS
c Predictors: (Constant), AT, TRS, CVM
d Dependent Variable: BI

The table presents a description of the model. The 'stepwise' method was selected so each set of summary statistics is reiterated for each stage of the hierarchy. From the SPSS output above, it can be observed that there are three models. Model 1 denotes the first stage in the hierarchy when only 'attitude' is seen as a predictor. Model 2 refers to the second stage where 'trust' as well as 'attitude' have been used as predictors. Model 3 represents the final phase when all three predictors are presented. This table was produced using the 'model fit' option. The option is selected by default in SPSS because it makes available some very important information about the model, namely, the values of R, $R^2$, adjusted $R^{2,}$ $R^2$ Change and the Durbin-Watson value.

The model summary table provides the results for the multiple regression analysis. SPSS convey information about the dependent variable (outcome) and the predictors in each of the three models. The column labelled R provides the values of the multiple correlation coefficients between the predictors and the outcome: when only 'attitude' is used as predictor, this is the simple correlation between 'attitude' and 'behavioural intention' is (0.588). All of the statistics for model 1 are the same as a simple regression model. The next column provides the value of $R^2$, which is a measure of how much the variability in the outcome is accounted for by the predictors. For the first model its value is 0.345, which means that 'attitude' accounts for 34.5% of the variation in 'behavioural intention'. When the other predictor 'trust' is also included (model 2), this value increases to 0.448 or 44.8% of the variance in 'behavioural intention'. When all three predictors are integrated (model 3), the value rises to 0.474 or 47.4%. So, inclusion of the two new predictors has explained a relatively large amount of the variation in 'behavioural intention'.

The adjusted $R^2$ gives us some idea of how well the conceptual model generalizes and ideally one would like its value to be same or close to, the value of $R^2$.

$$BI = 1.932 + 0.638\ A + 0.270\ TRS - 1.87\ CVM$$

The multiple regression model takes the form of the above equation. The latter has several unknown quantities, namely the *b*-values. The first part of the table provides approximations for the *b*-values and these values point to the particular input of each predictor to the model.

The *b*-values signal the relationship between 'behavioural intention' and each predictor. When the value is positive, it is referred to as a positive relationship between the predictor and the outcome, whereas a negative coefficient stands for a negative relationship. For the data on hand, two of the predictors have positive *b*-values indicating positive relationships, namely 'attitude' and 'trust' while one of the predictor 'civic mindedness' has a negative *b*-value, hence a negative relationship. So, as 'attitude' towards the system improves, the 'behavioural intention' to use the system will increase; as 'trust' in the system increase, 'behavioural intention' to use the e-tax filing enhances; on the other hand, as 'civic mindedness' improves the 'behavioural intention' decreases. The *b*-values demonstrate more than this. They indicate the degree each predictor shapes the outcome '*if the effects of all other predictors are held constant'*.

**SEM using R Lavaan**

The hypotheses were further tested using the R package. The overall fit of the model is summed up in Appendix C. The figure 1 below shows the results of the structural model. The findings shoe that Pos_Att is firstly dependent on 'trust' with $\beta = 0.46$ and to a much lesser extent to the variable Perceived Usefulness with $\beta = 0.29$. None of the other factors were found to be significant. In addition, the variable 'facilitating conditions' does, in fact, assist PU and EOU with $\beta = 0.19$ and $\beta = 0.21$ respectively. The measurement model also exhibits positive correlations between Facilitating Conditions and Civic Mindedness (and Trust). EOU and PU are also correlated, as would be expected and interestingly that CVM and VOL are also correlated with $\beta = 0.48$. The last correlation prompts us to believe that given the possibility to make a choice the user would be more likely to use the system.

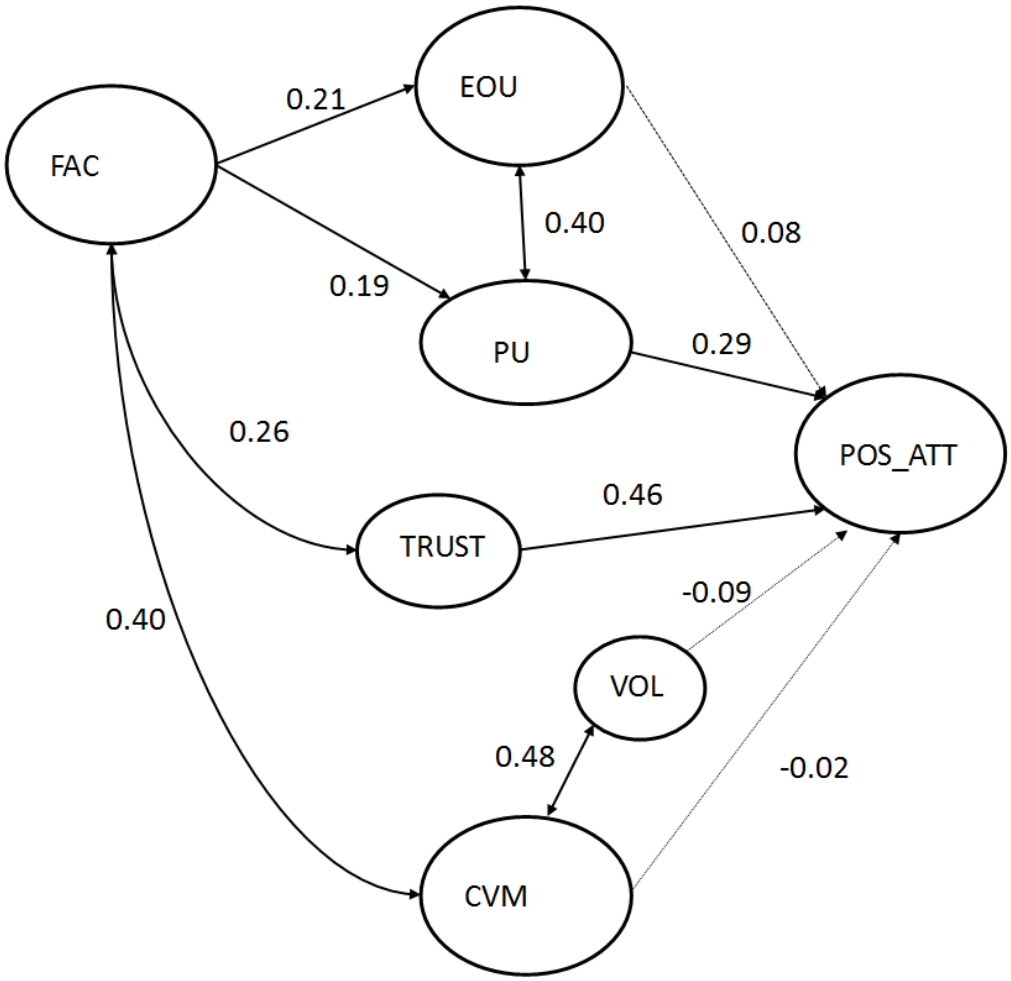


**Figure 1: Results of the Structural Model**

**Discussion and Conclusion**

Interestingly, the findings point to the fact that none of the major constructs, namely, ease of use or perceived usefulness were retained after regression using SPSS 11.5 and structural equation modelling was performed with LISREL 9.0 and R Lavaan.

Firstly, the quantitative results showed that the users' '**attitude**' towards the e-Tax filing and payment system has been the most powerful predictor for user intention. Attitude is a construct of important magnitude of the base model, Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980) which theorises that attitude towards a technological innovation is presumed to be established by the users' perception of the usefulness and ease of use of the system. Both the

TRA and TAM argue that, "all other conditions constant, individuals execute behaviours towards which they have a positive affect" (Ajzen and Fishbein, 1980).

The variable '**trust**' has been regarded as an influential factor of on-line commerce usage which is as largely acknowledged as the two technology acceptance model use-antecedents (Ha and Stoel, 2009). Studies have uncovered that trust is an antecedent of PU; and EOU as an antecedent of trust, and trust has a direct bearing on behavioural intention to usage. The findings of this study do not coincide with other research on e-Government which suggests that e-government services have been offering greater convenience and flexibility to those citizens who ought to use government services anyway (Thomas and Streib, 2003).

The results of the current investigation show that the construct '**civic mindedness**' has a significant and negative influence on the user's decision to accept the system. As a result, it can be foreseen that e-government users will be similar to those who already use face to face services and are more engaged in civic affairs. It is important to be cautious with the interpretation of findings since only business users have been surveyed. The results prompt us to believe that though the users are civic minded they are not ready to liaise with the government electronically. It is also vital to note that this variable was not measuring the e-tax filing system but e-government systems in general.

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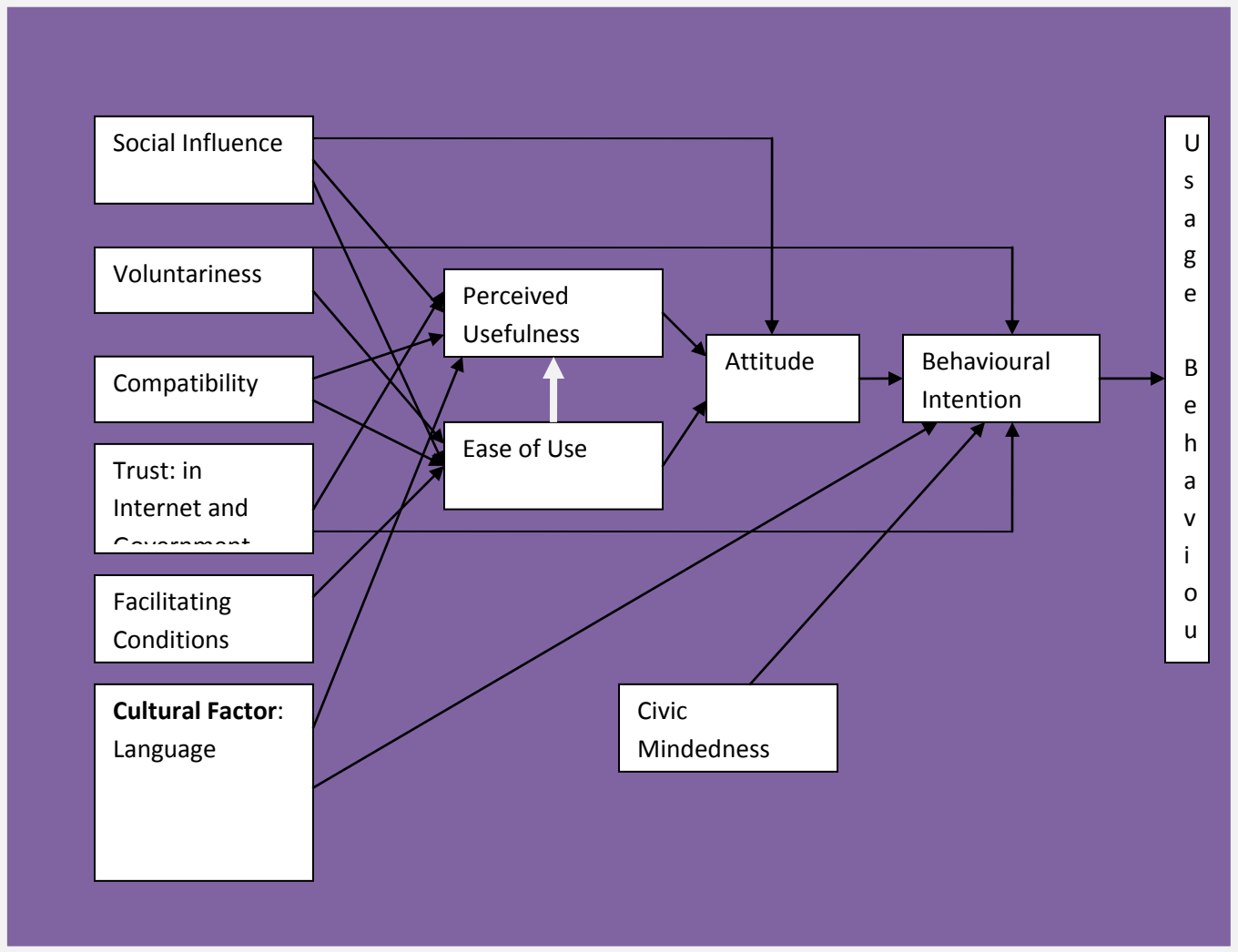
Appendix A


Social Influence
Voluntariness
Compatibility
Trust: in Internet and
Facilitating Conditions
Cultural Factor: Language
Perceived Usefulness
Ease of Use
Attitude
Behavioural Intention
Civic Mindedness
Usage Behaviou

Appendix B

| **Fit Index** | **Recommended Value** | **Observed Value** |
|---|---|---|
| $X^2$ | | 28.66 at p = 0.37752 |
| $X^2$/degrees of freedom | ≤ 3.00 | 28.66/27 = 1.061 |
| GFI | ≥ 0.90 | 0.96 |
| AGFI | ≥ 0.80 | 0.88 |
| NFI | ≥ 0.90 | 0.94 |
| NNFI | ≥ 0.90 | 0.99 |
| CFI | ≥ 0.90 | 0.99 |
| RMR | ≤ 0.10 | 0.046 |
| SRMR | ≤ 0.10 | 0.046 |
| RMSEA | ≤ 0.05 or ≤0.08 | 0.025 |

Appendix C

| | |
|---|---|
| Number of observations | 108 |
| Estimator | ML |
| Minimum Function Test Statistic | 744.836 |
| Degrees of freedom | 310 |
| P-value (Chi-square) | 0.000 |
| | |
| **Model test baseline model:** | |
| Minimum Function Test Statistic | 1943.404 |
| Degrees of freedom | 351 |
| P-value | 0.000 |
| | |
| **Full model versus baseline model:** | |
| Comparative Fit Index (CFI) | 0.727 |
| Tucker-Lewis Index (TLI) (NNFI) | 0.691 |
| | |
| **loglikelihood and Information Criteria:** | |
| Loglikelihood user model (H0) | -3036.953 |
| Loglikelihood unrestricted model (H1) | -2664.535 |
| | |
| Number of free parameters | 68 |
| Akaike (AIC) | 6209.906 |
| Bayesian (BIC) | 6392.291 |
| Sample-size adjusted Bayesian (BIC) | 6177.431 |
| | |
| **Root Mean Square Error of Approximation:** | |
| RMSEA | 0.114 |
| 90 Percent Confidence Interval | 0.104 0.124 |
| P-value RMSEA <= 0.05 | 0.000 |
| | |

| | |
|---|---|
| **Standardized Root Mean Square Residual:** | |
| SRMR | 0.126 |
| | |
| **Parameter estimates:** | |
| Information | Expected |
| Standard Errors | Standard |