# CHAPTER 3 : RESEARCH METHODOLOGY

## 3.0 THEORETICAL FRAMEWORK

The theoretical framework proposed in this study is adapted from Technology Acceptance Model (Davis et al., 1989) and Innovation Diffusion Theory (Rogers, 1995). The model provides a strong theoretical base for researching on the behavioural factors contributing to technology acceptance, hence the choice in referring to these theories.

This study integrates the primary constructs of TAM (perceived usefulness and perceived ease of use) with the constructs from IDT (compatibility and triability) with another construct to predict the internet users' attitude towards Cloud Services (as part of information technology), i.e. the Cloud Trust.

The research framework examined in this study is illustrated in Figure 1 below.

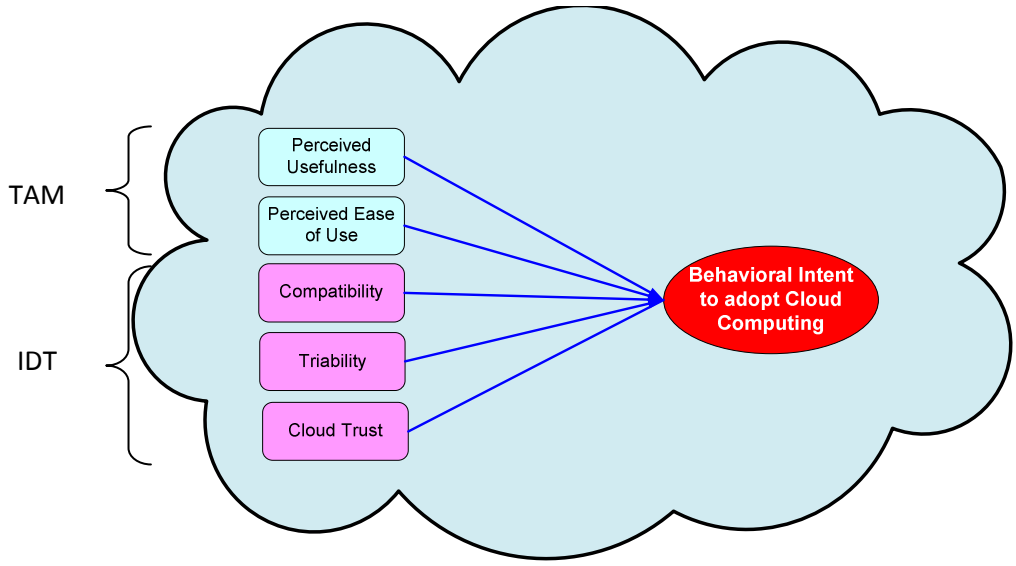


**Figure 3-1 : Theoretical Framework for Determinants to Cloud Computing Adoption**

3.1.1 Justifications for choosing the factors :

The factors or the independent variables are the factors identified in the theories. Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT). TAM's factors portrayed in this study are the **Perceived Usefulness** and **Perceived Ease of Use**. These two factors are the basic factors of TAM theory. IDT factors studied in this research are **Compatibility** and **Triability. Cloud Trust** (anxiety about cloud security and privacy) is adapted from the previous Hebron, 2008 study on wireless technology. These Perceived Characteristics of Innovating (PCI) factors have been adapted into many other TAM factors and are included as the constructive determinants in the different layers of IT adoption intention in the framework. The PCI is more closely related to the users' personality, the characteristics of the specific technology, and the external conditions in the IT adoption environment (Nan Zhang, Xunhua Guo, Guoqing Chen, IDT-TAM Integrated Model for IT Adoption, Tsinghua Science & Technology, Volume 13, Issue 3, June 2008, Pages 306-311). The framework below is used to establish a bridge between the classical TAM theory and actual IT adoption issue and **explore the differences among which the different PCI factors impact user IT adoption.**

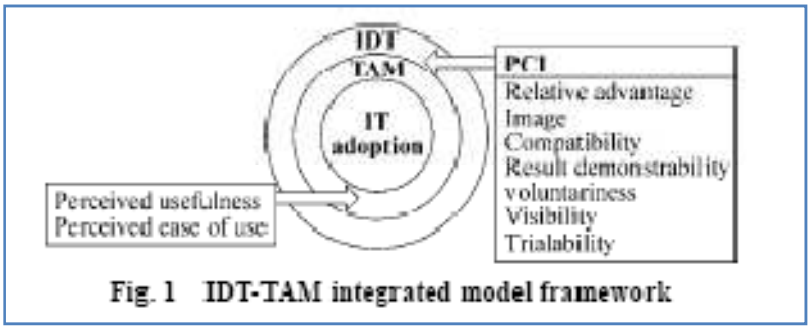

Fig. 1 IDT-TAM integrated model framework

**Figure 3-2 : IDT-TAM Integrated Model Framework**

## 3.2 HYPOTHESIS

The general research question in this study thus, What behavioural factors affect the intent to adopt cloud computing by individuals? For this general research question, theoretically two integrative models were referred to : TAM (Davis, 1989) and IDT (Rogers, 1995). For statistical computations, one dependent variable and five independent variables were considered as follows :

i. The dependent variable is the behavioral intent to adopt cloud computing by organizations.

ii. The independent variables are:

   a. Perceived Usefulness

   b. Perceived Ease of Use

   c. Compatibility

   d. Triability

   e. Cloud Trust (anxiety about system security and privacy)

These variables are adopted from the proposed application of Davis' TAM instruments and the Roger's IDT instruments modified by Udoh, E. (2010) for the study of GRID Computing and Hebron (2008) for the study of wireless data technology on wireless technology security.

**Specific questions and hypotheses proposed :**

1. Research Question 1 : Does perceived usefulness have a positive effect to the user's behavioral intent to adopt cloud computing?

   The related hypotheses are:

   a. $H1_0$ : Perceived usefulness will have a negative effect to adoption of cloud computing.

   b. $H1_A$ : Perceived usefulness will have a positive effect to adoption of cloud computing.

2. Research Question 2 : Does Perceived Ease of Use have a positive effect to the user's behavioural intent to adopt cloud computing?

   The related hypotheses are:

   a. $H2_0$ : Perceived ease of use of Cloud Computing will have a negative effect to adoption of Cloud Computing.

   b. $H2_A$ : Perceived ease of use of Cloud Computing will have a positive effect to adoption of cloud computing.

3. Research Question 3 : Does Compatibility to the current tasks have a positive effect to the user's behavioral intent to adopt cloud computing? The related hypothesis are :

   a. H30 : Compatibility to the current task will have a negative effect to the user's behavioral intention to adopt cloud computing.

   b. H3A : Compatibility will have a positive effect to the user's behavioral intention to adopt cloud computing.

4. Research Question 5 : Does Triability towards an innovation have any effect to the user's behavioral intent to adopt cloud computing?

   The related hypotheses are:

   a. $H4_0$ : Trialability will have a negative effect to the user's intent to adopt cloud computing
   b. $H4_A$ : Trialability will have a positive effect to the user's intent to adopt cloud computing

5. Research Question 4 : Does Cloud Trust (anxiety about security and privacy) towards an innovation have any effect to the user's intent to adopt cloud computing? The related hypotheses are :

   a. $H5_0$ : Cloud Trust (anxiety about security and privacy) will have a negative effect to the user's behavioral intention to adopt cloud computing.
   b. $H5_A$ : Cloud Trust (anxiety about security and privacy) will have a positive effect to the user's behavioral intention to adopt cloud computing.

The theoretical bases in this study are the TAM (Davis., 1989), (IDT) (Rogers, 1983;1995) and Hebron (2008).

The methodology proposed in this study is empirical and quantitative. The data is from the primary data and quantitative method involved quantifying the data collected by putting weight to enable statistical analysis done on the data using SPSS.

## 3.3 UNIT OF ANALYSIS

The unit of the analysis is individuals, among internet users in Malaysia in 2010. According to the Internet World Stats[iii], the site for Usage and Population Statistics, Internet Users in Malaysia was 16,902,600. Below table is referred :

**Table 3.3-1**

**Internet Usage and Population Growth**

| YEAR | Users | Population | % Pen. | Usage Source |
|---|---|---|---|---|
| 2000 | 3,700,000 | 24,645,600 | 15.0 % | ITU |
| 2005 | 10,040,000 | 26,500,699 | 37.9 % | C.I.Almanac |
| 2006 | 11,016,000 | 28,294,120 | 38.9 % | ITU |
| 2007 | 13,528,200 | 28,294,120 | 47.8 % | MCMC |
| 2008 | 15,868,000 | 25,274,133 | 62.8 % | MCMC |
| 2009 | 16,902,600 | 25,715,819 | 65.7 % | ITU |
| 2010 | 16,902,600 | 26,160,256 | 64.6 % | ITU |

The study will determine how the factors are associated to each other and if the Malaysian context is consistent with the previous research done on Grid Computing (Udoh,..E., 2010) adopting research from Wireless Technology and Selamat, Z., & Jaffar, N.. (2011) on Adoption and Acceptance of Information Technology From The Perspective of Malaysian Bankers.

## 3.4 SAMPLING DESIGN

### 3.4.1 Data Collection Procedure

Data Collection was done by using questionnaires (tool), that involve constructs in the area of Perceived Usefulness, Perceived Ease of Use, Compatibility, Cloud Trust and Triability towards adopting new technology i.e. Cloud Computing.

Sending questionnaires out requires permission by the Graduate School Of Business (GSB) and it is only distributed after permission is granted. Please refer to Appendix 2.

Questionnaires were distributed using :

i. Online questionnaire tool which is the Free Online Surveys, found online via http://www.freeonline surveys
ii. via an attachment in emails and
iii. in hardcopies.

Online survey is adopted due to the reason that this study is exploring the adoption in general societal context and it is testing a well established theory where there are instruments that have been tested in the previous researches. For using the online questionnaire and survey tool, a fee was paid due to the reason that the tool required a fee to receive response of more than twenty (20). For this survey, it requires more than twenty (20) respondents. It is expected that a sample size of three hundred (300) is collected. Three hundred (300) samples were assumed from Tabacknick and Fidell (2007) who agreed that 'it is comforting to have at least 300 cases for factor analysis' (p. 613) [iv].

Hardcopies of the questionnaires were also distributed via drop-off method (hand delivery of the questionnaires, followed by personal collection) among working friends, husband's friends, neighbours and siblings. Follow-ups such as phone calls, reminder emails were made to ensure that the samples were aware of the questionnaires sent for their feedback.

Via the snowballing techniques, a three hundred (300) survey response were expected, 120 responses were collected. The responses were from :

i. eight (8) questionnaires were emailed back with responses
ii. eighteen (18) were from hardcopies
iii. ninety-four (94) were collected online

This makes a total of 120 responses, vs the expected **three hundred (300)** of 16,902,600. This is a 40% response rate.

After going through a data cleaning process and eliminates the surveys with substantial missing values, only a total of 106 responses were eligible for analysis. The reason of the missing data is assumed mostly due to the technical glitch during the respondent's filling up the online forms. The survey code number determines this issue as the missing data is mostly on the responses that were collected online.

Thus, all of the responses eliminated (altogether fourteen) were where the missing data is within the variables' constructs. The data without demographic factors are still kept for the analysis. The final data inputs were loaded into a statistical package (SPSS 17.0) for doing various statistical analyses.

### 3.4.2 Remedy for missing Data

There were very low percentage of missing data, and were managed by imputation by using replacement values, i.e. where calculation replacement values is using mean substitution (Multivariate Data Analysis, A Global Perspective, 7th edition, pg 53). Although the method were also known to have a downside of it, but since the percentage (%) of the missing value is minimal, this is the most well-known method to perform.

The filling up of data by its Mean value, as below :

| | |
|---|---|
| Questionnaire feedback no. 96 | : ITU2 missing. Mean is 4.01, put value as 4.0 |
| Questionnaire feedback no. 7 | : CP1, CT1, CP2, CP3 – put value as 4.0 |
| | : CT2, CT3 – put value as 3.0 |

## 3.5 RELIABILITY TEST

**Table 3.5-1**

**Reliability Statistics – Overall**

| Cronbach's Alpha | N of Items |
|---|---|
| .932 | 17 |

The Cronbach's Alpha's value for the seventeen (17) constructs were high, i.e. Cronbach's Alpha of .932 which indicates that the constructs are reliable to be tested further.

**Table 3.5-2**

**Inter-Item Correlation Matrix**

| | PU1 | PU2 | PU3 |
|---|---|---|---|
| PU1 | 1.000 | .789 | .699 |
| PU2 | .789 | 1.000 | .790 |
| PU3 | .699 | .790 | 1.000 |

The inter-item correlation matrix result shows that each of the question of the var PU is positively correlated . Meaning – the construct is reliable.

**Legend :**

PU1 : I think, using Cloud Services in my job would enable me to accomplish my tasks faster.

PU2 : I think, using Cloud Services would enhance my effectiveness in my job.

PU3 : I think I would find Cloud Services useful in my work.

### 3.5.1 Perceived Ease of Use

**Table 3.5-3**

**Reliability Statistics PEU**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .867 | .867 | 3 |

Cronbach's Alpha is .867 and near to 1.

Perceived Ease of Use shows a high Cronbach's Alpha value of .867, indicating high reliability. Thus, the variable is fit for further analysis.

**Table 3.5-4**

**Inter-Item Correlation Matrix**

| | PEU1 | PEU 2 | PEU 3 |
|---|---|---|---|
| PEU1 | 1.000 | .681 | .652 |
| PEU 2 | .681 | 1.000 | .724 |
| PEU 3 | .652 | .724 | 1.000 |

**Legend :**

PEU1 : I think I would find it easy to use the features offered by Cloud Services to do what I want to do.

PEU 2 : I think I would find Cloud Services easy to interact with.

PEU 3 : I think would find Cloud Services Easy to Use.

### 3.5.2 Data Type

Data type collected and ready for analysis is **Categorical and Nominal**. Categorical data is data with a limited number of distinct values or categories (for example, gender or marital status). In this study, these qualitative, categorical data have been coded in numeric codes to represent the category.

Nominal data is Categorical data where there is no inherent order to the categories, except for education level.

### 3.5.3 Data Analysis Techniques

Data is examined and analysed to gain a basic understanding of the data set, including information about the relationships among the variables and to ensure that the statistical and theoretical underpinnings of the chosen techniques are upheld.

The analysis is based on Quantitative data analysis based on survey by Questionnaire. Both descriptive and inferential data analysis is done. Descriptive data analysis is performed on the demographic data and inferential is performed on the variables to determine the relationship in accordance to the theoretical framework.

This study follows parametric tests with the assumption that the population is normal. Normality is further proved in the next chapter. Mean and standard deviation is calculated.

Factor analysis tests were not performed due to the reason that the questions used in the construct were already successfully used in the previous researches, i.e. the constructs are really in a group and the questions are design according to the objectives.

Used Multiple regression/predictive modelling because the model is developed to explain behavioral factors towards cloud computing adoption. The model consists of the dependent variable, Intention To Use (ITU) and the set of independent variables

i.e. Perceived Usefulness, Perceived Ease of Use, Compatibility, Triability and Cloud Trust.

This multiple regression will help to explain the intention to use (dependent variable) using the independent variables and shows which independent variable, whether Perceived Usefulness, Perceived Ease of Use, Compatibility, Triability or Cloud Trust matter most. This allows the study to understand behaviours and attitudes better and develop effective strategy to make use and manipulate the behaviours.

The contingency table analysis is used as guide to the analysis :

| | | Outcome variable (Y) | |
|---|---|---|---|
| | | ***continuous*** | ***nominal*** |
| Determinant (X) | ***continuous*** | Fitting a linear relation | Logistic regression analysis |
| | ***nominal*** | One-way analysis of variance | Contingency table analysis |

**Figure 3.5-1: Contingency Table Analysis**

Discriminant analysis is used to know which group have more intention to adopt Cloud Computing. In this case, gender is used as the discriminant.

A) Discriminant analysis is

i) useful for situations where you want to build a predictive model of group membership based on observed characteristics of each case.

ii) appropriate technique when the dependent variable is categorical (nominal or non-numeric) and the independent variables are metric.

B) The procedure generates a discriminant function (or, for more than two groups, a set of discriminant functions) based on linear combinations of the predictor variables which provide the best discrimination between the groups.

Data Analysis is performed using SPSS 17.0 and Microsoft Excel application. The results were downloaded in Excel form, exported from the online Free Survey tool and were further loaded in SPSS 17.0 for further analysis. Microsoft Excel helps in developing the visually-attractive graphs and charts for the report.

## 3.6 CHAPTER SUMMARY

The research framework is explored in this chapter. The research variables and their associated relationships are identified. This theoretical framework will form the basis for empirical examination of the impact of the factors described, on the intention to adopt Cloud Computing among internet users in Malaysia.