An Analysis of Factors Affecting the IT Officers' Competence By Factor Analysis and Multiple Regression Analysis

Montean Rattanasiriwongwut
Department of Information Technology Management
Faculty of Information Technology
King Mongkut's University of Technology North Bangkok

Abstract

This research is to An Analysis of Factors Affecting the IT Officers' Competence By Factor Analysis and Multiple Regression Analysis. It involves the structure relationship of impact factors. Factor analysis is used to analyze this research.

The data collection tool is a questionnaire that divided in to two parts: general information survey and impact factor of IT competence survey. This questionnaire uses a 5 rating scale. SPSS is used for analyzing the collected data in terms of average score and the Standard deviation. On the other hand, The Exploratory Factor Analysis *by SPSS for Windows and The* Confirmatory Factor Analysis *by LISREL Programs.*

Keyword: Factor Analysis, Competency

1. Introduction

In the modern age, information technology has a strong influence on the way/means things are taught and studied, and even on the way of life as a whole. This is especially so since there has been an integration of computers and telecommunication. This has led to the birth of automatic electronic commerce as well as online education, among many other examples.

In addition, many businesses have shifted their focus onto their customers' satisfaction in order to survive in the ever-increasing competitive environment. Whether it be increasing their efficiency or improving their products and services, many businesses have devoted much in order to assure their own survival. However, these changes alone will not assure their advantage over their competitors. This is why many businesses turn to developing the human potential of their employees – the intellectual asset of every company lies in the skillsets of their employees. The human capital of every company and business can be either a part of that business's success or its failure. It is because of this that every good employer needs to increase the efficiency of his/her employees. The capacity and competency of the organisation must therefore coincide with the vision and mission of the organisation. As for the computer analysts, their capacity lies in applying their skills in information technology [1].

In this paper, the researcher will explore the factors that affect the IT specialists by means of Factor Analysis and Multiple Regression Analysis in order to single out the capacities of IT specialists for further research in the capacities' development/improvement.

2. Relevant Theories

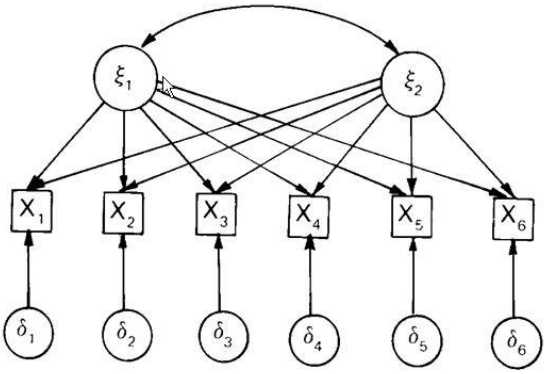
2.1 Factor Analysis

Factor Analysis is a data reduction technique that can group together data that share a common variable. Factors within the same grouping or share the same variable are highly interrelated [2].

2.2 Purpose of the Factor Analysis

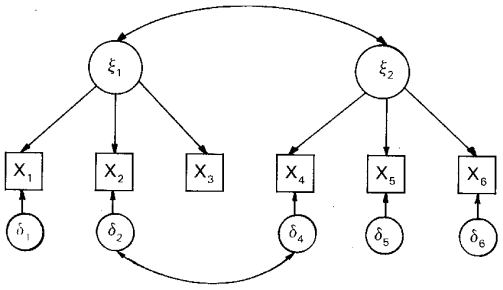
2.2.1 To find underlying variables that may not be visible at first, called Exploratory Factor Analysis or EFA. [3]

Picture 1: *Exploratory Factor Analysis*



2.2.2 To prove or support the existing theory, called Confirmatory Factor Analysis or CFA [3]

Picture 2: *Confirmatory Factor Analysis*



2.3 Model Test

The model test will be done by computer. In regards to the completeness of the analysis, the results must present statistics that can test the compatibility of the model or explain the fluctuation of the variables in the form of "fit statistics". The said statistics will be calculated all at once. These statistics will be used to shed light on the compatibility of the model with the observed data by describing the relationship between the observed and the underlying variables [3].

2.3.1 Fit Stastistics

Testing the Fit Statistics that will be used in testing the model include: Chi Square, GFI (The goodness of fit index), AGFI (Adjusted Goodness of fit Index), and RMR (Root mean squared Residual). Details as follows:

2.3.1.1 Chi-square

If the model is correct and the sample is large enough to measure χ^2, it will be used in the statistical test for testing the model, with a degree of freedom of χ^2 being:

$$df = \tfrac{1}{2}(p+q)(p+q+1)\ t \qquad (1)$$

where $p + q$ are the amount of observed variables being analysed and t is the parameter that is set. The *p-value* is the probability, which is calculated by the program; the *p-value* is probability that χ^2 value is big enough so that it is not statistically significant. This would mean that the model is compatible with the data, which is determined by the value of χ^2 as either a bad fit or a good fit. The *df* value is used as a standard for determining the value of χ^2. The value of χ^2 is therefore affected by sample group and very much susceptible to a variables when there are multiple observable variables. The bigger the size of the sample group and more the number of observed variables, the larger the value of χ^2 will be. The reason behind choosing χ^2 as the unit of comparison to the data is because if the value of χ^2 is large enough to be statistically significant, it may be used in conducting a compatibility test and evaluate the model by using a standard margin and indices for adjusting the model so that the model's parameter is higher. Usually, the adjust model will have a smaller χ^2 value.

2.3.1.2 Goodness-of-fit indices

$$GFI = 1 - \frac{(s-\hat{\sigma})'\ W^{-1}(s-\hat{\sigma})}{s'W^{-1}s} \qquad (2)$$

AGFI is the adjustment index for GFI with the following equation

$$AGFI = 1 - \frac{(p-q)(p+q+1)}{2d}(1-GFI) \qquad (3)$$

When the model's *d-value* or degree of freedom of both equations is within the range 0-1, even though in theory is it possible to have a negative *d-value*, if the indices GFI and AGFI are bigger than 0.9, it means that the model is compatible with the data, where GFI is not influenced by the sample size.

2.3.1.3 Root Mean Squared Residual (RMR)

$$RMR = \left[2 \sum_{i=1}^{p+q} \sum_{j=1}^{i} (Sij - \hat{\sigma})^2 / (p+q)(p+q=1) \right]^{\frac{1}{2}} \qquad (4)$$

RMR has a value in the range 0-1. If the value is lower than 0.05, it means that the model is compatible with the data. The Comparative Fit index is used to compare the baseline to the model according to the theory or the assumption. The baseline will be "null" or "independent", meaning it is a model that is free from the influence of the variables (no correlation to the variables or the variable matrix has a value of 0).

2.3.1.4 Comparative Fit Index (CFI)

The index is of noncentral χ^2 distribution. The index takes a value between 0 and 1. If the value is higher than 0.9, it means that the assumed model is compatible with the data.

$$CFI = 1 - \left[\frac{\chi^2 null - \chi^2 mod\ el}{\chi^2 null - df\ mod\ el} \right] \qquad (5)$$

Similarly, the Parsimonious Goodness-Fit Index (PGFI) is derived from the GFI, with the following equation:

$$PGFI = 1 - \left(\frac{P}{N} \right) x\ GFI \qquad (6)$$

Where P is the parameter approximated within the model and where N is the amount of data sets.

Both PNFI and PGFI have values within the range 0-1, where the higher the value, the more is economised. The term "high value" here does not have an exact definition, but generally 0.9 is assumed to be "high" and points to the economisation of the model.

2.4 LISREL Model – LInear Structure RELationship

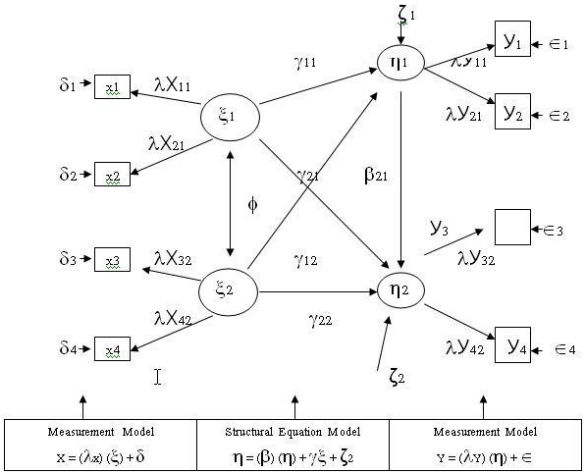
The model is used for presenting the relationship between all the variables. It is also called the Linear Structure Equation Model and the Covariance Structure Model. The program was developed by K.G. Joreskog and D. Sorbom between 1967 and 1979. It is the first program to be developed for the purpose analyzing of the LISREL Model [4].

The LISREL Model comprises 2 models:

a) Measurement Model – used for showing the relationships between the observed variables and the underlying variables;
b) Structural Equation Model – used for showing the relationships between all the variables themselves

Figure 3. *Measurement Model and Structural Equation Model*

The Measurement Model has 2 observable variables, which can be used to measure the 2 underlying variables.



2.5 Multiple Regression Analysis

Is a technique to approximate the variable form the estimated data [5] with the following equation:

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + e \quad (7)$$

$\hat{y} =$ Estimated variable (independent)
$x_1 \ldots x_n =$ Indices' values (independent variable)
$\beta_0 =$ Constant (value of y when $x = 0$)
$\beta_1 \ldots \beta_n =$ Regression coefficient
$e =$ Error value

2.6 Evaluation Criterion

Using a variety of methods for a Model Best Fit for testing with the actual data. The predicted data will be used to calculate the Magnitude of Relative Error

$$MRE_i = \frac{|Actual_i - Predicted_i|}{Actual_i} \quad (8)$$

3. Research Methodology

The research is conducted by the analysis of data relevant to the capacities, including making and conducting surveys, analysing the results as well as making confirmations, with the details as follows:

3.1 Data Research

3.1.1 Data collection as well as study of relevant research that has been done before and analyses on the capacities that are important aspects of the work of an IT specialist.

3.1.2 Multiple Regression Analysis

3.1.3 Accuracy Evaluation of Analaysis

3.1.4 Creating a suitable questionnaire

The researcher has studied various data and created a questionnaire with the aim of answering questions that the prior studies have not addressed. The questionnaire has been approved by the advisor. The draft was able to capture information on 5 aspects. It was then sent for evaluation by experts and used to calculate IOC. All the data gathered were useful, so a final draft was created and used for this research report.

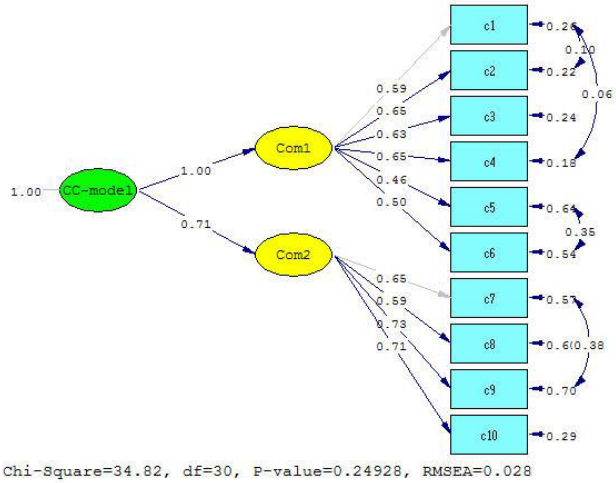
4. Results

The results of the research is used to analyse the factors that affect the capacity of IT specialists by analysing from the 5 different aspects.

4.1 Aspect 1: Computer Skills

Categorised into 2 groups: proficiency in usage of computers and; competency in writing programs. The data was then used to make a model to measure the compatibility of the model (proficiency in usage of computers), with these results: chi-square=34.82, df=30, P-value=0.249, RMSEA=0.028

Picture 4. Proficiency in usage of computers

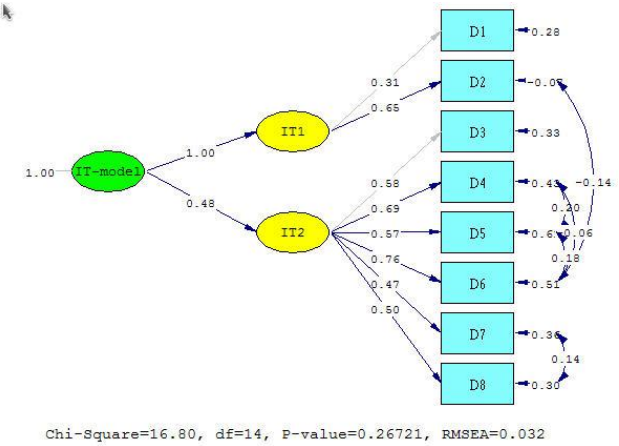


4.2 Information Technology Ability Aspect

Again, this is categorised into 2 groups: aptness in using the Internet and; aptness in using the computer

for IT purposes. The data was then used to make a model to measure the compatibility of the model (IT ability), with these results: chi-square=16.80, df=14, P-value=0.267, RMSEA=0.

Picture 5. Ability in IT

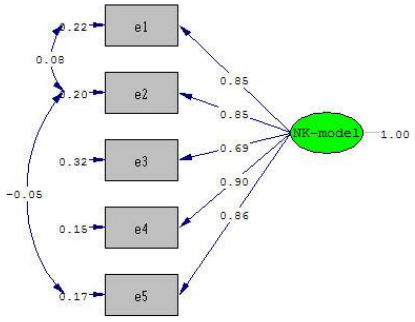


Chi-Square=16.80, df=14, P-value=0.26721, RMSEA=0.032

4.3 Knowledge of Network Systems

The results of the research support the hypothesis that all the variables are interrelated. The data was then used to make a model with these results: chi-square=2.62, df=3, P-value=0.45, RMSEA=0.000

Picture 6. Knowledge of network systems

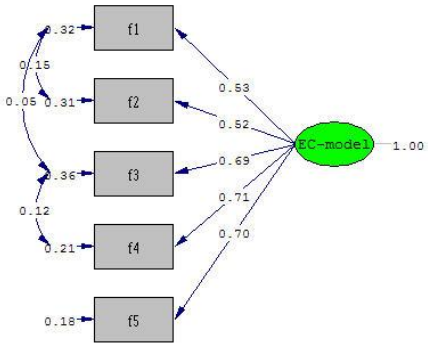


Chi-Square=2.62, df=3, P-value=0.45457, RMSEA=0.000

4.4 Proficiency in the English Language

The results of the research suggest that all variables are interrelated. The data was then used to make a model to measure the compatibility of the model (knowledge of the Engish language), with these results: chi-square=1.34, df=2, P-value=0.511, RMSEA=0.000

Picture 7. Proficiency in the English language

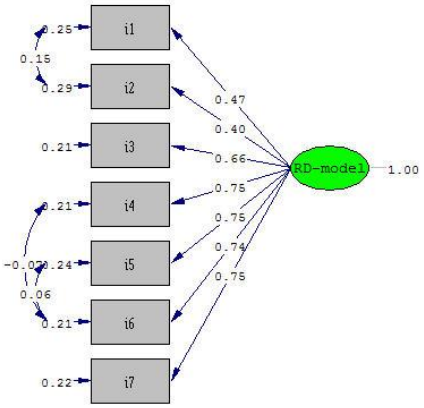


Chi-Square=1.34, df=2, P-value=0.51109, RMSEA=0.000

4.5 Research and Development

Categorised into 2: Knowledge and understanding of the research process and; presentation techniques. The data was then used to make a model to measure the compatibility of the model (research and devleopment), with these results:
chi-square=17.29, df=11, P-value=0.099, RMSEA=0.054

Picture 8. Research and Development



Chi-Square=17.29, df=11, P-value=0.09970, RMSEA=0.054

5. Conclusion

From the results of the research, is it possible to make the following conclusions from each of the 5 aspects:

Usage of computers aspect: the resulting data was grouped into 2 categories: knowledge of computers and; abilitiy to write programs.

Ability in IT aspect: the resulting data was grouped into 2 categories: aptness in using the Internet and; aptness in using the computer for IT purposes.

Knowledge of network systems aspect: the resulting data supports the hypothesis that all variables are interrelated.

Proficiency in the English language: the resulting data supports the hypothesis that all variables are interrelated.

Research and Development aspect: the resulting data supports the hypothesis that all variables are interrelated.

6. References

[1] Sharon S.Dawes and Natalie Helbig. Building government IT workforce capacity a

[2] competency framework. Center for Technology in Government, 2007.

[3] Bollen, K. A. 1989. Structural Equation with Latent Variables. New York: John Wiley and Sons.