A Projection Model of IT and Computer Personnel Requirements in Thailand

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Abstract

The introduction of technologies to process and transport data and information has proceeded at exceptional rates for many decades in the globalization and information technology era. This trend relates to the rapid diffusion of IT and computerization in Thailand. The research findings in this study revealed that the problem associated with a shortage of IT and computer professionals would probably occur in the year 2010. Hence, the increasing trend of IT and computerization should concern the proper planning of related human resource requirements.

Keywords: Projection model, IT and computer personnel, information technology, applications of information technology and computerization

1. INTRODUCTION

It is generally agreed that technological innovation is necessary for both developed and developing countries. Trends like globalization and technological innovation are changing the way firms are managed. Organizations today must grapple with revolutionary trends: accelerating product and technological change, globalized competition, deregulation, demographic change, and trends toward a service society and new era of information technologies. These trends have far reaching implications and have pervasively affected IT and computer human resource requirements. Technological change will continue to shift employment from some occupations to others while contributing to a rise in productivity. For example, telecommunications have already made it relatively easy for many to work at home. Information technologies, computer-aided design, and computer-aided manufacturing systems plus robotics are also increasing. These changes mandate more highly skilled job requirements. Similar changes are taking place in office automation, where personal computers, word processing, and management information systems continue to change the nature of office work. As a result, IT and computer human resource requirements must be properly planned. IT and computerization in Thailand in 1992 was growing much faster than in the last two decades. The number of computers in Thailand was only 36 in 1972, 120 in 1977, 2400 in 1982, 70,000 in 1987, and increased dramatically to 400,000 units in 1992. The alarming increases of IT and computerization in the past have caused concern in both the public and private sectors. A shortage of IT and computer human resource requirements has been felt everywhere in both private companies and government organizations. In 1992, the Ministry of University Affairs (MUA) established the MUA Subcommittee on Computer Human Resource Planning to advice the government. The widespread use of IT and computerization today in Thailand holds

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promising potential to spread economic activity, democratic principle, wealth distribution, and social benefits across every region of the country. In the meantime, Thailand's Master Plan for Industrial Development articulated its vision for 2012 as: Thai industries being able to maintain competitiveness in the future with new comparative advantage. Some of the industrial promotion action plan covers the development of modern management practices with emphasis on efficiency and information support and promotion of the application of information technology. The far-reaching use of IT in the information society will alter significantly the way one lives, works, learns, and entertains. In sum, IT and computerization can play a pivotal role in particular to support many of the policies of Thailand's government for better distribution of wealth and opportunity to rural inhabitants for equal services; for solving the chronic traffic gridlock and worsening pollution; for conservation of the nation's natural resources and environment; in addition to that of making the country a regional hub for finance, manufacturing and trade, transportation and tourism. However, the most interesting point that should be considered is the rapid diffusion of IT and computerization in Thailand that has made it necessary to study IT and computer human resource requirements, because without proper planning, the problem associated with either a shortage or oversupply of IT and computer professionals will probably occur.

2. RESEARCH OBJECTIVES

In this study, researchers aim to achieve the following research objectives: 1) to investigate and predict the applications of IT and computerization in Thailand from the year 2001 to 2010, 2) to find out and predict total volume of IT and computer spending in Thailand from the year 2001 to 2010, 3) to find out and predict the number of university graduates with IT and computer-related majors in Thailand from the years 2001 to 2010, and 4) to find out and predict the number of IT and computer personnel requirements in Thailand from the year 2001 to 2010.

3. RESEARCH METHODS

This paper is based on the nationwide survey basis. It's on the applications of information technology, IT and computer personnel requirements in Thailand, also, it's on the secondary data of government organizations, private organizations, and Ministry of University Affairs (MUA) concerning the number of university graduates with IT and computer-related majors in Thailand. The sample size of this study is 400 organizations and 1,756 IT and computer university graduates. The stratified sampling was applied as the sample selection. The data collection method was self-administered interview during August-December, 2000. Some statistics were applied for the data analysis, including frequency, percentage, tabulations, and regression with time-series analysis. Additionally, multiple-regression analysis was used and SPSS/FW was used for data processing.

4. GENERAL DATA OF SAMPLE

From the survey research of the industries in Thailand, the findings revealed that 45.0% out of the total sample were production and trading sectors, 25.0% were IT and computer sector, 25.0% were service sector, and only 5.0% were education/R&D sector. More than one of three, or 36.8% out of the total sample had between 1–25 computers while 25.3% had more than 100 computers. Many samples, or 39.0%, had the value of permanent assets (excluding land) more than $5 million (US), 35.6% had not more than $1.25 million (US), 16.9% had a value of permanent assets between 1.26–2.5 million US dollars, and the remaining 8.5% had a value of permanent assets between 2.6–5 million US dollars.

5. APPLICATIONS OF INFORMATION TECHNOLOGY AND COMPUTERIZATION IN THAILAND

From the survey research of 400 organizations (including production and trading, IT and computer, services, educational institutions, and research and development), the research findings illustrate that most of the total sample (75.7%) use computers, 69.1% use the Internet, 67.6% use email, 54.5% use shared databases, 53.2% have their own Web site, 44.5% use an intranet, 28.6% have web servers, 27.5% have online catalogs, 22.3% use EDI, 18.5% use E-commerce, and 9.9% apply digital cash for their businesses.

6. ESTIMATION

To make predictions according to the research objectives, estimation was applied for finding out the number of each characteristic in the study, such as computer hardware, computer software, university graduates with IT and computer-related majors, and IT personnel requirements. The estimation for the number of all studied characteristics consists of 3 steps as the below:

Step 1: Estimation for the total number of each characteristic in the study.

$$Y'_{hs} = \frac{N_{hs}}{n_{hs}} \left(\sum_{k=1}^{k} Y_{hsk} \right) \qquad (1)$$

This equation (1) is for the estimated total number of the sample survey for each studied characteristic of Y for companies/organizations/ institutes in each size(s) and business sectors at (h).

$$H'_{hs} = \frac{N_{hs}}{n_{hs}} (n'_{hs}) \qquad (2)$$

This equation (2) is for the estimated total number in the sample survey of all companies/organizations/institutes in each size (s) and business sectors at (h).

$$Y''_{hs} = \frac{Y'_{hs}}{H'_{hs}} (H''_{hs}) \qquad (3)$$

This equation (3) is for the estimated total number of the sample survey for adjusted studied characteristics of Y for companies/organizations/institutes in each size (s) and business sectors at (h).

Step 2: Estimation for adjusting the total number of the studied characteristics of Y for companies/organizations and institutes in each business sector (h).

$$Y'_h = \sum_{s=1}^{3} Y''_{hs} \qquad (4)$$

; when s1 = large size of industries
s2 = medium size
s3 = small size

Step 3: Estimation for adjusting the total number of the studied characteristics of Y for all companies/organizations and institutes in Thailand

$$Y' = \sum_{h=1}^{4} Y'_h \qquad (5)$$

; when h1 = production and trading
h2 = IT and computer
h3 = service
h4 = education / R&D

In the estimated results for the computer hardware installed in Thailand from 1994 to 2000, it was estimated that the number of mainframe computers was 44, 49, 55, 59, 61, 65, and 70 sets. The estimated numbers of minicomputers were 690, 730, 790, 820, 850, 890, and 934 sets. The number of supercomputers was found in 1997 up to 2000 only one set (the Meteorological Department). However, the estimated number of microcomputers was 634,634 in 1994, which increased dramatically to 1,666,722 in 2000. In the meantime, the estimated results of total IT and computer spending in Thailand from 1994 was about 648.52 million US dollars, but it was about 820.75 million US dollars in the year 2000.

7. UNIVERSITY GRADUATES WITH IT AND COMPUTER-RELATED MAJORS

These increasing trends of IT and computerization in the country have caused concern in both the public and private sectors, because the estimated number of university graduates with IT and computer-related majors was about 2,377 in 1994 and this number increased slightly to 4,951 in the year 2000.

Table 1. The number of university graduates with IT and computer-related majors in Thailand from 1994 to 2000.

Years	Number of University Graduates with IT and Computer-Related Majors
1994	2,377
1995	2,592
1996	3,148
1997	3,516
1998	4,454
1999	4,294
2000	4,951

Source: Ministry of University Affairs (MUA)

Table 2. Estimated number of IT and computer requirements in Thailand from 1994 to 2000.

Years	Estimated Number of IT and Computer Requirements
1994	14,630
1995	16,070
1996	19,410
1997	21,910
1998	24,140
1999	30,900
2000	31,983

The shortage of IT and computer personnel occurred over the past many years due to the large difference between the number of university graduates with IT and computer-related majors and the requirements of IT and computer personnel from 1994 (2,377 IT and computer graduates: 14,630 IT and computer personnel requirements) up to the year 2000 (4,951 IT and computer graduates: 31,983 IT and computer personnel requirements).

8. REGRESSION MODEL SUMMARY OF IT AND COMPUTER PERSONNEL REQUIREMENT IN THAILAND

According to the purpose statement, research objectives, scope, assumptions, and hypotheses of this study, and prediction requirements of IT and computer personnel in Thailand's industries, Multiple Regression Analysis was used by determining the following variables:

-The requirements of IT and computer personnel in Thailand's industries is the dependent variable (REQUIRE).

-The applications of IT and computerization in the industries is an independent variable (APPLY).

-The volume of IT and computer spending is an independent variable (SPEND).

-The number of university graduates with IT and computer-related majors is an independent variable (GRADUATE).

From these independent variables, the stepwise of multiple-regression was used for selecting them into the

model by testing the strength of significant relationships with the dependent variable. After selecting the significant independent variables in the model, the prediction of independent variables from the year 2001 to the year 2010 was processed. Finally, the comparison between the number of university graduates with IT and computer-related majors in Thailand's industries and the requirements of IT and computer personnel in the industries was considered whether the shortage or oversupply of IT and computer personnel occurred in each year from the year 2001 to the year 2010.

The results of testing are shown in the following:

1) Testing coefficient correlation between the applications of computer (APPLY) and the requirements of IT and computer personnel (REQUIRE).
The statistical significance of testing hypotheses in this case:

H_0: $\rho_{APPLY,REQUIRE} = 0$
H_1: $\rho_{APPLY,REQUIRE} \neq 0$

The result of significant level in this testing is $0.005<0.05$, so H_0 is rejected. Therefore, the relationship between the applications of computer and the requirements of IT and computer personnel is significant at $\alpha = 0.05$.

2) Testing coefficient correlation between the university graduates with IT and computer-related majors (GRADUATE) and the requirements of IT and computer personnel (REQUIRE).
The statistical significance of testing hypotheses in this case:

H_0: $\rho_{GRADUATE,REQUIRE} = 0$
H_1: $\rho_{GRADUATE,REQUIRE} \neq 0$

The result of significant level in this testing is $0.012<0.05$, so H_0 is rejected. Therefore, the relationship between university graduates with iT and computer-related majors and the requirements of IT and computer personnel is significant at $\alpha = 0.05$.

3) Testing coefficient correlation between the IT and computer spending (SPEND) and the requirements of IT and computer personnel (REQUIRE).
The statistical significance of testing hypotheses in this case:

H_0: $\rho_{SPEND,REQUIRE} = 0$
H_1: $\rho_{SPEND,REQUIRE} \neq 0$

The result of significant level in this testing is $0.101>0.05$, so H_0 is accepted. Therefore, the relationship between IT and computer spending and the requirements of IT and computer personnel is not significant at $\alpha = 0.05$.

4) Testing coefficient correlation between the applications of computer (APPLY) and IT and computer spending (SPEND).
The statistical significance of testing hypotheses in this case:

H_0: $\rho_{APPLY,SPEND} = 0$
H_1: $\rho_{APPLY,SPEND} \neq 0$

The result of significant level in this testing is $0.305>0.05$, so H_0 is accepted. Therefore, the relationship between the applications of computer and IT and computer spending is not significant at $\alpha = 0.05$.

5) Testing coefficient correlation between the applications of computer (APPLY) and the university graduates with IT and computer-related majors (GRADUATE).
The statistical significance of testing hypotheses in this case:

H_0: $\rho_{APPLY,GRADUATE} = 0$
H_1: $\rho_{APPLY,GRADUATE} \neq 0$

The result of significant level in this testing is $0.001<0.05$, so H_0 is rejected. Therefore, the relationship between the applications of computer and IT and the university graduates with IT and computer-related majors is significant at $\alpha = 0.05$.

6) Testing coefficient correlation between IT and computer spending (SPEND) and the university graduates with IT and computer-related majors (GRADUATE).

The statistical significance of testing hypotheses in this case:

H_0: $\rho_{SPEND,GRADUATE} = 0$
H_1: $\rho_{SPEND,GRADUATE} \neq 0$

The result of significant level in this testing is $0.447>0.05$, so H_0 is accepted. Therefore, the relationship between IT and computer spending and the university graduates with IT and computer-related majors is not significant at $\alpha = 0.05$.

From the testing coefficient relation among variables, the results illustrate the multicollinearity between independent variables (the applications of computer and the university graduates with IT and computer-related majors). Therefore, in building the multiple regression model for predicting the requirements of IT and computer personnel, the applications of computer should be deleted from the model.

For building the multiple regression model in predicting the requirements of IT and computer personnel, the purpose of stepwise regression is to select. In this procedure, the predictor variables enter or are removed from the regression equation one at a time including the university graduates with IT and computer-related majors (GRADUATE) and IT and computer spending (SPEND).

From the results in this figure (Probability-of-F-to-enter ≤ 0.05 and Probability-of-F-to-remove ≥ 0.10), the predicting regression models consist of:

Model 1: Enter the independent variable (GRADUATE) into the equation of model

$$REQUIRE = \beta_0 + \beta_1 \ GRADUATE + \varepsilon$$

Model 2: Enter the independent variable (SPEND) into the equation of model 1

$$REQUIRE = \beta_0 + \beta_1 \ GRADUATE + \beta_2 \ SPEND + \varepsilon$$

When the multiple regression Model 2 is optimal.

The value of multiple R shows the coefficient relation at 0.996. The R^2 obtained in multiple regression of model 2 is very high too (.993). Therefore, both the university graduates with IT and computer-related majors (GRADUATE) and IT and computer spending (SPEND) are important in explaining the requirements of IT and computer personnel.

The analysis of variance with multiple regression Model 2 has two independent variables, including the university graduates with IT and computer-related majors (GRADUATE) and IT and computer spending (SPEND)

The statistical significance of testing hypotheses in this case:

H_0: $\beta_1 = \beta_2 = 0$
H_1: $\beta_i \neq 0$ at least one variable ; i = 1, 2, 3

The result of F test is 204.730 and the significant level in this testing is $0.001 < 0.05$, so H_0 is rejected. Therefore, there is a significant relationship between the requirements of IT and computer personnel and at least one independent variable from the university graduates with IT and computer-related majors (GRADUATE) and IT and computer spending (SPEND). It is a summary of the analysis of multiple regression regarding the requirements of IT and computer personnel. The optimal equation of multiple regression Model 2 is shown as the below:

$$REQUIRE = \beta_0 + \beta_1 \ GRADUATE + \beta_2 \ SPEND + \varepsilon$$
$$\text{or } REQUIRE^{\wedge} = b_0 + b_1 \ GRADUATE + b_2 \ SPEND$$

Interpretation of the model:

B = Regression coefficient (b_0 = -13486.475, b_1 = 5.104, b_2 = 0.969)
Std.Error = Standard Error ; when SE (b_0) = 2002.875
SE (b_1) = 0.369 SE (b_2) = 0.117

Beta = Standardized regression coefficient; the beta weights in the standardized version of the equation reveal that the university graduates with IT and computer-related majors or GRADUATE (beta=0.739) is significantly more important than IT and computer spending or SPEND (beta=0.441).

Therefore, the prediction model of multiple regression in this testing for the requirements of IT and computer personnel is illustrated the below:

$$REQUIRE^{\wedge} = -13486.475 + 5.104 \ GRADUATE + 0.969 \ SPEND$$

9. PROJECTION MODEL

In testing the multiple regression model, we found that the number of university graduates with IT and computer-related majors are significantly important to the requirements of IT and computer personnel more than other independent variables. However, in building the projection model of IT and computerization in Thailand for the next 10 years, or in the year 2010, many statistical techniques allow this study to build complex predictive models using secondary data and primary data. At this point of the study, the Regression with time-series method was applied.

The results include the applications of IT and computerization, total volume of IT and computer spending, university graduates with IT and computer-related majors, and IT and computer personnel requirements in Thailand from the years 2001 to 2010. The model illustrates that in the year 2010 the number of mainframe will be 111 sets, the number of minicomputer will be 1,331 sets, the number of workstations will be 10,960 sets, and the number of microcomputers will be 3,347,337 sets. This model also reveals that in the year 2001 the total volume of IT and computer spending will be $867.71 million (US) and will sharply increase to $4278.38 million (US) in the year 2010. The most important point is the large difference between the number of university graduates with IT and computer-related majors and the requirements of IT and computer personnel, because the results of the projection model illustrate that the requirements of IT and computer personnel will be about 62,857 in the year 2010 but the number of university graduates with IT and computer-related majors will be approximately only 9,390. (See Table 3)

In considering these research findings, it is generally agreed that IT and computerization is necessary for both developed and developing countries. This is especially true in Thailand where IT and computerization are growing much faster than the last 10 years. This study presents the increasingly heavy applications of IT and computer in Thailand, computer hardware and software situations, university graduates with IT and computer-

related majors, job positions of IT and computer graduates, and the projection model of IT and computer personnel requirements for the years 2001 up to 2010. Therefore, it is most important to implement these research findings for all sectors of industry, including production and trading, IT and computer, service, educational institutions, and research and development institutions, because the findings of this research clearly demonstrate that all business sectors of industries in Thailand will sharply increase their IT and computer applications and require IT and computer personnel.

Table 3: Comparison between the prediction of university graduates with IT and computer-related majors and IT-computer personnel requirements in Thailand from 2001 to 2010.

Years	Prediction of IT and Computer Requirements	Prediction of University Graduates with IT and Computer- Related Majors
2001	35,070	5,395
2002	38,158	5,839
2003	41,245	6,283
2004	44,332	6,727
2005	47,420	7,171
2006	50,507	7,615
2007	53,595	8,059
2008	56,682	8,503
2009	59,770	8,946
2010	62,857	9,390

The results of testing the assumption of this research state that some factors including the IT and computer spending in the industries and the university graduates with IT and computer-related majors affect on the requirements of IT and computer human resources. This supports the recommendation on the findings in this study with the significance levels at 0.001 for the university graduates with IT and computer-related majors and 0.004 for IT and computer spending.

It's also important to consider the results of analysis on the current job positions of IT and computer personnel. The findings reveal that about 1 of 3 out of total university graduates with IT and computer-related majors are dropping out from their jobs and some of them are further studying. This event may cause some shortage of IT and computer personnel demand in both public and private sectors. Therefore, both private and government universities have to continuously produce graduates with IT and computer-related majors from the year 2000 up to 2010. However, the most important point is that both private and government universities should monitor the quality of their own graduates. This means that both private and government universities should not try to complete the number of IT and computer personnel need with low quality of graduates. To prepare for a future workforce in this information age and to ensure an adequate IT and computer human resource base the country will need, all school children must learn to use IT and computers. Teachers and university professors must provide role models in the use of IT and computer. The training of educators in acquiring at least an adequate basic IT and computer skills is very important; so is the need to instill in children the ability to seek out only what is good and reject the undesirable among information on the future information highway. From the research findings, both private and government universities should achieve the following specific goals: a) to significantly raise the production of IT and computer personnel, which is grossly insufficient now, b) to upgrade curriculum and facilities in IT and computer courses at the university level and take drastic measures to recruit and to retain faculty staff in areas of critical shortage, including the employment of expatriate instructors from overseas as a stop-gap measure. Immigration regulations and laws are to be amended to allow the issuance of work permit covering the entire duration of employment contracts, and c) to promote aggressively private sector participation in the provision of secondary and tertiary education, especially in IT and computer-related education and training. Therefore, without proper planning, the undesirable problems associated with the shortage of qualified and IT and computer personnel would seriously and continuously occur from the year 2001 up to 2010.

10. CONCLUDING REMARKS

The expected benefits of this study are to provide the usable information for planning the IT and computer human resource management in Thailand to both private and government organizations and also to be the useful information for any individual who is interested in the study of related more details. The results of this research will be submitted to the CEM committee of Assumption University and to the committee on computer curriculum of MUA for use in approving and follow up of all IT and computer curricula in Thailand. Other developing countries may apply the significant projection model in this study for some purpose in their own countries. All the parameters in this model may be adjusted to suit their own situations. The model also can be modified to reflect local conditions and enhance the continuous, more rigorous study of IT and computer personnel requirements in the future.

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