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The Use of Discriminant Analysis to Predict the Work Status of Science Graduates of Srinakharinwirot University

Sukanya Intarapak and Rawewan Ngamsuntikul

Department of Mathematics, Faculty of Science, Srinakharinwirot University

Correspondence author E-mail: sukanyain@g.swu.ac.th

Abstract: The propose of this study was to predict the work status of science graduates of Srinakharinwirot University. The sample of this study consisted of 394 students who graduated from the Faculty of Science of Srinakharinwirot University in academic year of 2013. The samples were classified into four groups: work, work and continue study, not work, and continue study groups. By the discriminant analysis, the result showed that six variables: major of study, GPA, family burden, pension and welfare, public and private company job, and scholarship and technology had an influence on the science graduates in working their statuses. For the model built by using the original validation data set, 61.4% correctly classified for predicting in the work status.

Keywords: continue study, discriminant analysis, factor analysis, work status

INTRODUCTION

In 2013-2014, Srinakharinwirot University ranked 13th of all universities in Thailand in the University Ranking by Academic Performance (URAP, 2016). Presently, Srinakharinwirot University is popular and located in downtown Bangkok. Graduates from Srinakharinwirot University are able to *find jobs* easily after *the graduation*. About 67% of *science graduates* of Srinakharinwirot University in academic year of 2011 were employed within six months after *the graduation*. Fernquest (2015) presented that Thailand's official unemployment rate was 0.56% by the end of 2014 whereas India's unemployment rate was 9.4% and Philippine's unemployment rate was 6%. Thailand's unemployment rate was among the lowest in the world.

According to Newman (2012), most of the graduates get a job easily after the graduation. However, some of the graduates become an entrepreneur and own their own business. This trend is rapidly increasing. Owning a business or entrepreneurship will be more important than ever in 2020. Forecasters expect strong growth in traditional businesses such as used-car dealers, hair and nail salons, pet grooming, and office services. This means that anybody who is able to come up with better and cheaper ways to serve

customers will reap a windfall. Technology startups will keep changing the way consumers work and live. Nobody really knows what the next iPad, Twitter, or Pinterest will be—except, perhaps, some entrepreneurs who are dreaming about it right now. He or she may have a bigger impact on life in 2020 than anything the forecasters see it coming.

In addition, increasing in basic education will lead to a need to expand the supply of higher education in the future. With the advance in communication technology and increasing longevity, the new generation of students who look for higher education will vary in ages, needs, and places of study (Nitungkorn, 2001). In Thai society, we value and prestige people with high level of education. This results in the increasing number of people attending the graduate and post graduate program each year.

LITERATURE REVIEW

Kallio (1995) examined the relative influence of factors that affect the college choice decisions of graduate students. Factor analysis of ratings of importance of 31 college characteristics yielded dimensions upon which student decisions are based. These results were used to build five scales of importance and preference, which were then tested with other variables in a regression model in which the dependent variable was the decision to enroll or not to enroll at the surveying institution. The following were found to influence decisions: residency status, quality and other academic environment characteristics, work-related considerations, spouse considerations, financial aid, and campus social environment.

Waisriseang (2009) studied and found factors affecting decision making of undergraduate students from public and private university in Bangkok. The results found that students selected private company or private enterprise in the first rank and followed by private practice or freelance, government service, state enterprise, international organization and other occupation such as service sector. Factors affecting decision making of undergraduate students of both public and private university in Bangkok were faculty, domicile and expectation on student's occupation from their parents.

Teowkul, Seributra, Sangkaworn, Jivasantikarn, Denvilai and Mujtaba (2009) explained why individuals decide to pursue higher education, especially master and doctoral degrees which are often considered to be the top two levels that one can achieve academically. The sample consists of 89 graduate students at a state-run, open University in Thailand, who are enrolled in the Master and Doctoral degree programs¹. The findings show that doctoral students expect to gain more respect than master degree students. Master degree students expect to gain more compensation, to easily change jobs, and to smoothly transition into new careers. This study also demonstrates that doctoral students are satisfied with their existing jobs and careers.

Saithanu and Mekparyup (2011) found the influential variables or factors of decision in continuing study for Master's degree of the fourth year students (224 persons), faculty of Science, Burapha University, by the use of factor analysis. The model to predict decision in continuing study for Master's degree is then later modeled by discriminant analysis. The result of this research shows eight influential variables: GPA, number of persons in family who finished Master's degree, status of family, progress in career, cost of continuing study for Master's degree, acceptance of social, knowledge and skill of faculty and competence.

Sarwar and Azmat (2013) highlighted the factors that have an impact on the career decision of business graduates in Pakistan. The factors were divided into five broad categories: family, socializers, environmental

influence, personality, and career preferences. All the variables were measured with the help of survey of universities in Pakistan. From the findings of this survey, a model was proposed which showed two results. The first result showed the trend of graduates preferring management oriented jobs over other career options and the second result showed the preference of business over other career options. This allowed us to measure the interrelationship of the variables.

Numkham and Raungdessuwon (2014) studied the factors that influenced the choice of job for bachelor graduates, Far Eastern university. In addition, they also studied the relationship between personal factors and external factors that influenced the choice of job of Bachelor Graduates. The research sample consisted of 218 fourth year students in The Far Eastern university who graduates in the academic year 2011. The factors that influenced the choice of job were 1) the need to earn enough for the living cost 2) size of organization that is large size organization (more than 500 employees) 3) opportunity of work process factor that had the chance to be accepted as full time staff 4) job description factor that is the need of work stability 5) the job environment factor that was the need for safety 6) the organization stability factor that was the need of credibility 7) distance for journey factor that was the need for ease of journey and 8) reputable organization factor's. Moreover, the testing of relationship between personal factors and external factors affecting in the choice of work found that 1) gender factor had positive correlation with need of obvious work sequence process 2) age factor had positive correlation with decision to work in small size organization (less than 50 employees) 3) work experience factor had positive correlation with choice of the work that must be equitable and had the justified rules for promoting 4) gender factor had positive correlation with organization stability and 5) work experience had correlation with the standardized work place.

Recently, Intarapak and Ngamsuntikul (2016) found the influential variables about decision making in choosing a career of science graduates (308 persons) through practical data. The result of this research shows that five variables: major of study, GPA, family burden, retirement pension and private company job have influenced the science graduates in choosing their careers. That is not considered science graduates who are continue study or not work.

In this research, we will use the discriminant analysis to find the influential variables of prediction the work status of science graduates of Srinakharinwirot University in Thailand.

METHODOLOGY

Sample and Instruments

The sample of this study consisted of 394 students who graduated from the Faculty of Science of Srinakharinwirot University in academic year of 2013. The sample was surveyed by the questionnaire approximately 6 months after graduation. The totals of 394 science graduates were from 14 different undergraduate majors offered by Srinakharinwirot University in academic year of 2013. The total samples reported the mean age of 23.47 years (range = 21-29, SD = 0.76) and the mean GPA of 2.92 (range = 2.00-3.81, SD = 0.42). Most of the samples were female (71.3%) and had family burden (51.8%).

The questionnaire of this study consisted of 3 parts: (1) General data of science graduates such as sex, age, GPA, major, family burden and current working status (2) Getting Job items were composed of 35 questions and (3) Getting Continue Study items were composed of 57 questions. Each item of Getting

a Job or Continue Study is a five-point Likert scale questionnaire that ranged from 1-strongly disagree to 5-strongly agree. The Cronbach's alpha reliability coefficient of the Getting Job items and the Getting Continue Study items were 0.94 and 0.98, respectively, before computing the factor analysis.

Statistical Analysis

The data were analyzed by using factor analysis and discriminant analysis from R software. Exploratory factor analysis using principal component analysis with varimax rotation was performed to validate the Getting Job items and Getting Continue Study items (Tabachnick, & Fidell, 2013). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was exceeded 0.70 which indicated that the sample data were suitable for the undergoing of factor analysis. Factors were formed by using eigenvalues greater than 1 as the criterion, with a cutoff point for the loadings at 0.4. (Kaiser, 1958).

Discriminant analysis provides information that contributes to an increased understanding of the nature, extent, and dimensionality of group differences, as well as to the prediction of group membership for purposes of selection, placement, and intervention, and for testing stage and taxonomic theories (Betz, 1987). Discriminant analysis is used for two purposes: (1) describing major differences among the groups, and (2) classifying subjects into groups on the basis of a battery of measurements (Stevens, 2002). Discriminant function analysis produces functions that help define the groups; the maximum number of functions that can be defined is one less than the number of groups. The functions first seek to distinguish the first group from the others, then the second group from the rest, and so on. These are identified by the Eigenvalues on the output. The eigenvalues also show what percentage of variance is accounted for with each function. In addition, Wilks lambda tests the significance of each function.

RESULTS

In Table 1, most of science graduates in this study are science graduates from Biology major of Srinakharinwirot University in academic year of 2013. Most of science graduates about 55.6% are employed within six months after graduation and about 51.8% have family burden.

The results of the principal component analysis with a varimax rotation of Getting Job items showed that the KMO was 0.907. The extracted seven factors explained 69.80% of the variance and Cronbach's alpha coefficients of all factors were exceeded 0.70. Factor 1 had an eigenvalue of 12.16, accounting for 34.75% of the variance; Factor 2 had an eigenvalue of 3.89, accounting for another 11.11% of the variance. While factors 3, 4, 5 and 6 had the eigenvalues of 2.57, 2.11, 1.42, 1.27, 1.00 and accounting for 7.33%, 6.04%, 4.06%, 3.64%, 2.87%, respectively (see Table 2). Finally, the seven factor-composite variables were named: Factor 1-Pension and welfare, Factor 2-Boss and colleague, Factor 3-Public and private company job Factor 4-Workplace location, Factor 5-Job objective and values, Factor 6-Major of study and Factor 7-Government job.

This analysis resulted in seven factors accounting for 66.80% of variance in the solution. The concluding eigenvalues were 26.73, 3.79, 2.07, 1.56, 1.53, 1.22 and 1.18 and the accounting variances were 46.90%, 6.64%, 3.63%, 2.74%, 2.68%, 2.13% and 2.07% for Factors 1, 2, 3, 4, 5, 6 and 7, respectively. Moreover, Cronbach's alpha coefficients of all factors were exceeded 0.70. The seven factors were named as follows: Factor 1-Field of study, Factor 2-Agencies or friend, Factor 3-Well-known, Factor 4-Scholarship and

Table 1
Characteristics of science graduates

	<i>Characteristic</i>	<i>Frequency (%)</i>
Current work status	Work	219 (55.6)
	Work and continue study	86 (21.8)
	Not work	19 (4.8)
	Continue study	70 (17.8)
Family Burden	Yes	204 (51.8)
	No	190 (48.2)
Major	Bachelor of Science in Mathematics	10 (2.5)
	Bachelor of Science in Statistics	25 (6.3)
	Bachelor of Science in Computer Science	40 (10.2)
	Bachelor of Science in Home Economics	25 (6.3)
	Bachelor of Science in Chemistry	37 (9.4)
	Bachelor of Science in Physics	39 (9.9)
	Bachelor of Science in Biology	41 (10.4)
	Bachelor of Science in Microbiology	26 (6.6)
	Bachelor of Science in Gems and Jewelry	31 (7.9)
	Bachelor of Education in Mathematics	27 (6.9)
	Bachelor of Education in Chemistry	20 (5.1)
	Bachelor of Education in Physics	27 (6.9)
	Bachelor of Education in Biology	22 (5.9)
	Bachelor of Education in General Science	24 (6.1)

Table 2
Factor loadings of the Getting Job items for seven factors with a varimax rotation

	<i>Items</i>	<i>Loading</i>	<i>Eigenvalue</i>	<i>Variance Explained (%)</i>
Factor 1	Retirement payment	0.848	12.16	34.75
	Pension	0.847		
	Post-employment remuneration	0.826		
	Welfare	0.748		
	Bonus	0.677		
	Salaries	0.673		
	Job progression	0.653		
	Job security	0.611		
Factor 2	Boss	0.778	3.89	11.11
	Colleague	0.769		
	Life style	0.765		
	Subordinate	0.701		
	Family	0.517		
	Fit your personality	0.506		
	Working system	0.5		

contd. table 2

	<i>Items</i>	<i>Loading</i>	<i>Eigenvalue</i>	<i>Variance Explained (%)</i>
Factor 3	Public company job	0.908	2.57	7.33
	Private company job	0.893		
	International organizations	0.86		
	State enterprises job	0.802		
Factor 4	Workplace located in Bangkok metropolitan	0.763	2.11	6.04
	Workplace located in big city	0.742		
	People are encouraged to get the job done	0.669		
	Working with guarantors	0.666		
	Working with guarantee funds	0.649		
	Can make a part time	0.404		
	Job objective	0.653		
Working environment	0.645			
Values	0.636			
Working with many amenities	0.575			
Factor 6	According to my major	0.918	1.27	3.64
	Applying my knowledge	0.899		
	Job satisfaction	0.452		
Factor 7	Government job	0.643	1	2.87
	Family's reputation	0.599		
	Test and interview	0.531		

technology, Factor 5-Parents, Factor 6-Special course and Factor 7-Values. The factor loadings for the seven factors are presented in Table 3.

Table 3
Factor loadings of the Getting Continue Study items for seven factors with a varimax rotation

	<i>Items</i>	<i>Loading</i>	<i>Eigenvalue</i>	<i>Variance Explained (%)</i>
Factor 1	Field of study can be applied to real work	0.725	26.73	46.9
	Abilities and aptitudes	0.716		
	Field of study will be advancement in the work	0.676		
	Courses are reliable and attractive	0.615		
	Major of master's degree is correspond to bachelor's degree	0.611		
	Determined to continue study in the master's degree	0.609		
	The course has a good standard of teaching	0.566		
	To gain more knowledge in the fields of interest	0.560		
	Choosing the major that market is in need	0.537		
	To pass on the new knowledge to others	0.524		
	Study to gain useful knowledge and experience	0.515		
	The graduate is higher than other institutions	0.504		
	Value the important of education	0.494		

contd table 3

	<i>Items</i>	<i>Loading</i>	<i>Eigenvalue</i>	<i>Variance Explained (%)</i>			
Factor 2	Field of study make a good income	0.487	3.79	6.64			
	To make a job progression	0.476					
	To increase capacity of work	0.44					
	Following to the policies of agencies	0.683					
	Introduce from a friend or alumni	0.672					
	Received information from various media	0.653					
	The cost of living in a community around university is appropriate	0.647					
	Family members provide support	0.632					
	Advice from the university's counseling center	0.624					
	Accommodation near university	0.574					
	Teachers who teach undergraduate suggest to continue study	0.573					
	Teaching in English	0.546					
Factor 3	Major is in need in the labor market	0.464	2.07	3.63			
	Field of study are famous	0.433					
	University play a role in social development	0.749					
	Faith in the history of the university	0.736					
	Faculty is highly quailed in their fields	0.695					
	Faculty is friendly	0.691					
	Faculty has many academic work that benefit in teaching	0.667					
	Well-known of institution	0.607					
	Faculty has skill in the subjects	0.578					
	Factor 4	The university offers many scholarship			0.722	1.56	2.74
		The university has a modern technology			0.715		
		The university is equipped to education			0.695		
The university has several facilities		0.679					
The university has a learning atmosphere		0.532					
University location		0.512					
Factor 5	Parents have higher education levels	0.799	1.53	2.68			
	Relatives have higher education levels	0.776					
	Get scholarship for continue study	0.64					
	To be published international paper	0.538					
	The demands of father / mother or parent	0.535					
	To continue study in the doctor's degree	0.524					
Factor 6	The work require postgraduate qualification	0.484	1.22	2.13			
	A special course, they can work and study	0.636					
	To change to new professional	0.589					
	The appropriate of cost per course	0.57					
	The appropriated time period of the courses	0.50					
	To use my free time wisely	0.423					
Factor 7	Appropriate admission process	0.423	1.18	2.07			
	The values of the society to highly educated	0.617					
	To improve may researching skills	0.537					
	To make yourselves as socially acceptable	0.527					
	Familiar with the university	0.412					

Table 4
Eigenvalues for discriminant functions

Function	Eigenvalue	Canonical Correlation	Wilks' Lambda	Chi-square	df	P-value
1	0.476	0.568	0.608	193.094	18	0.000
2	0.082	0.276	0.898	41.928	10	0.000
3	0.030	0.169	0.971	11.290	4	0.023

a. First 3 canonical discriminant functions were used in the analysis.

There were three functions with a P-value less than .05 (see Table 4). This means that there was a variate used to classify groups of the work status, statistically significant was at .05. In Table 5, the discriminant analysis is applied to the data set to distinguish four difference groups (work/ work and continue study/ not work/ continue study).

Fisher's linear discriminant function for the work group is

$$\hat{Y}_1 = -26.828 - 0.302 \text{ Major} + 18.087 \text{ GPA} + 1.943 \text{ Burden} - 0.268 \text{ Pension} + 0.806 \text{ Job} - 0.695 \text{ Scholarship}$$

Fisher's linear discriminant function for the work and continue study group is

$$\hat{Y}_2 = -29.192 - 0.049 \text{ Major} + 18.076 \text{ GPA} + 2.253 \text{ Burden} - 0.427 \text{ Pension} + 0.630 \text{ Job} - 0.953 \text{ Scholarship}$$

Fisher's linear discriminant function for the not work group is

$$\hat{Y}_3 = -25.867 - 0.392 \text{ Major} + 18.082 \text{ GPA} + 0.505 \text{ Burden} + 0.512 \text{ Pension} + 1.255 \text{ Job} - 1.116 \text{ Scholarship}$$

Fisher's linear discriminant function for the continue study group is

$$\hat{Y}_4 = -30.468 - 0.470 \text{ Major} + 19.786 \text{ GPA} + 0.172 \text{ Burden} + 0.754 \text{ Pension} + 1.457 \text{ Job} - 0.276 \text{ Scholarship}$$

Furthermore, the percentage correctly classified of this study is 61.4% and the 80.4 percentage correctly classified of the work group is the highest (see Table 6).

Table 5
Classification Function Coefficients

	Current status			
	Work	Work and continue study	Not work	Continue study
Major	-0.302	-0.049	-0.392	-0.470
GPA	18.087	18.076	18.082	19.786
Family burden	1.943	2.253	0.505	0.172
Pension and welfare	-0.268	-0.427	0.512	0.754
Public and private company job	0.806	0.630	1.255	1.457
Scholarship and technology	-0.695	-0.953	-1.116	-0.279
(Constant)	-26.828	-29.192	-25.867	-30.468

Table 6
Classification Results

Original	Current work status	Predicted Group Membership				Total
		Work	Work and continue study	Not work	Continue study	
Count	Work	176	25	1	17	219
	Work and continue study	54	30	0	2	86
	Not work	16	0	0	3	19
	Continue study	32	1	1	36	70
%	Work	80.4	11.4	0.5	7.8	100.0
	Work and continue study	62.8	34.9	0.0	2.3	100.0
	Not work	84.2	0.0	0.0	15.8	100.0
	Continue study	45.7	1.4	1.4	51.4	100.0

a. 61.4% of original grouped cases correctly classified.

CONCLUSION

According to the result of discriminant analysis, it can be concluded that there are six significant factors that can indicate work, work and continue study, not work or continue study statuses: major of study, GPA, family burden, Pension and welfare, Public and private company job and Scholarship and technology. The ability of discriminant analysis to develop a predictive model based on the practical data produced the 61.4 percentage correctly classified for deciding in work status of Science Graduates of Srinakharinwirot University in Thailand. GPA is the factor which has the highest influence in all discriminant models corresponding to Intarapak and Ngamsuntikul (2016). Next, family burden is the second factor which has the influence for the discriminant model of the work group and the work and continue study group, whereas public and private company job is the second factor which has the influence for the discriminant model of the not work group and the continue study group.

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