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Factor Analysis of Development Identity for Graduates in the Faculty of Forestry, Kasetsart University

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Abstract

This study aims to analyze the identity components of graduates from the Faculty of Forestry at Kasetsart University using exploratory factor analysis and confirmatory factor analysis. Two sample groups were involved: Group 1 (400 individuals) for exploratory factor analysis and Group 2 (710 individuals) for confirmatory factor analysis. Both groups responded to a 5-point Likert scale questionnaire. The exploratory factor analysis results showed a strong Kaiser-Meyer-Olkin measure of .930 and Bartlett's Test of Sphericity with a chi-square value of 10437.275, 1770 degrees of freedom, and a significance level of .0001. Nine identity components were identified through factor rotation using the Varimax method: teamwork, commitment to task completion, application of knowledge, integrity towards oneself and others, adaptability to the environment, humility, willingness to help and share, non-egoism, and perseverance. The confirmatory factor analysis confirmed a good fit of the model to the observed data, indicated by indices such as p = .148, χ^2/df = 1.314, RMSEA = .02, GFI = .991, AGFI = .98, CFI = .998, and RMR = .097. Notably, "teamwork" had the highest standardized weight of .825, followed by "willingness to help and share" (.749) and "commitment to task completion" (.739). The standardized weights ranged from .825 to .636. All variables had statistically significant p-values, and the coefficients of determination (R^2) ranged from .680 to .405 when measured by Square Multiple Correlation.

Keywords: factors analysis, identity, graduate, faculty of forestry

1. Introduction

1.1 Introduce the Problem

The National Scheme of Education of Thailand (Revised Edition B.E. 2552-2559) was prepared with the intention of developing Thai people to be good, smart, and happy people. (Office of the Educational Council, B.E. 2553) A good person is someone who maintains a quality life, morality, and ethics, with a desirable mind and behavior, which can be interpreted as being disciplined, economical, caring, reasonable, having awareness of duty, honesty, and diligence. A smart person is someone who lives effectively and has good academic achievement. Good competence in one area, in any field, or all around, and maybe someone with special abilities. A happy person is someone who is physically and mentally healthy which corresponds to Higher Education Development Project No. 11. (Office of the Higher Education Commission, B.E. 2556) indicating that quality graduates must be produced to meet the needs of society. They must be able to think analytically, be creative, have communication and work skills, and also work well with others. (Thanasak Chanthasin and Wiraporn Chanthasin, 2023) For this reason, universities are important in providing education for the country. Higher education students are also very important because they are the indicators of the success of higher education institutions. Therefore, educational institutions cannot neglect their duties to take care of students, so that they

can become graduates who effectively serve society. Kasetsart University is a state-controlled higher education institution that recognizes the importance of every student studying at this university, as the aspiration of the university stated that Kasetsart University devotes itself to the task of accumulating and developing intellectual knowledge. It thrives for the growth in academic wisdom including ethical and moral excellence. In addition, it has a responsibility to play a leading role in keeping our Thai heritage alive and to ensure that it continues to grow to enrich the civilization of the nation (Kasetsart University, 2020).

Self-identification among students is the ability during adolescence to mold one's inner self with the outside. Identity helps students to set goals for their work and life. (Wipada Kantang, Manas Hattasak and Paweena Onjai-uae, 2018) Each year Kasetsart University has produced several graduates to the society. Therefore, it is necessary to encourage those graduates to be competent in all areas while they are still studying. This is to enable them to have competence in various fields that are suitable for being desirable graduates of the university and be able to serve society effectively. The university recognizes the importance of Therefore, the university's identity (IDKU) has been defined, which can be divided into 4 aspects: 1. Integrity means having a good heart, honesty, morality, and ethics 2. Determination means having determination, patience, persistence, persistence, and effort to achieve results in work and performance.3. Knowledge creation means being a person who loves, likes to seek new knowledge, can create value from knowledge, and creates innovation 4. Unity means cooperation, being able to compromise, working as a team, and being able to integrate and link knowledge in various fields appropriately. (Chanthasin Wiraporn, Chanthasin Thanasak, Supmee Manussthanun, Hatthasak Manassanan, & Boonsathirakul Jittinun, 2019) Identity is an important factor in student development and helps mold the institute's students to comply with the university's philosophy and determination. identity also means Effects for learners or students according to philosophy, vision, mission, and objectives of the establishment of an educational institution according to the intention of the institution. (Royal Institute, 2012) Identity is a unique property indicating the unique characteristics of a person, which is different from other people, from international or from other societies.

1.2 Explore the Importance of the Problem

The university defines the identity of its students. To be consistent with the identity of the university, each faculty has set the identity of the students in their faculty as well, for example, the Faculty of Forestry defines the characteristics of the students of the Faculty of Forestry as "Forestry, Strong, Courageous, Patience and Unity" (Vasan Sudha, 2002). The Faculty of Forestry aims to produce graduates who are equipped with knowledge, skills, morals, and ethics (Vasan Sudha, 2002). They should be able to develop themselves to keep up with changes in science and advances in forest management and forest conservation by applying analytical thinking skills, creativity, problem-solving, and analytical abilities amid the dynamics of changes in social contexts and environments at the national, regional and global levels (Vasan Sudha, 2002). In addition, they must focus on behaving based on morality and ethics to coexist with others and to have a good professional attitude (Vasan Sudha, 2002). Duties in the transmission of knowledge, skills, and work attitudes in life are essential in forestry operations. As can be seen from research in India, forestry personnel agree that learning during the course of study, both in terms of academically and in terms of practice, is very important (Vasan Sudha, 2002). If the teacher or learner does not pay attention, it may lead to problems in future operations. The transfer of knowledge will make graduates more professional. (Vasan Sudha, 2002). When society changes, societal demands naturally evolve accordingly. In the context of individuals completing their studies in Forestry, which is fully integrated within Keysets University? the pioneer in forest management education in Thailand? it is essential to develop graduates who possess academic excellence, ethics, and morality to meet societal expectations. Therefore, this research study aims to retrospectively examine the strengths, weaknesses, and trajectory of developing Forestry graduates from the past to the present. The goal is to acquire valuable insights and knowledge to enhance the curriculum and optimize the efficiency of teaching and learning activities to keep pace with the ever-changing demands of society. Furthermore, this endeavor focuses on nurturing well-rounded graduates who embody academic knowledge and possess the virtues and ethics needed to contribute to building a better and sustainable society. Achieving this objective will undoubtedly contribute to the overall growth and prosperity of society and Thailand. When it comes to identifying elements of the identity of graduates of the Faculty of Forestry, requires psychological and research processes to separate the elements clearly and define behavior for observation by the principles of behavior and the development of a good psychological measure. To obtain a standardized test that can explain the behavior of graduates from the Faculty of Forestry, Keysets University in a wider area.

1.3 State Hypotheses and Their Correspondence to Research Design

The research team saw the importance of cultivating the identity of the students of the Faculty of Forestry, which has a form of diversity through training both in the classroom and outside the classroom both through academics

and activities. As a result, students who have graduated can serve society according to the expectations of the Faculty of Forestry. This research was conducted to obtain the necessary database, related to the development of student identity at the Faculty of Forestry so that the personnel who involves in the operation or organize various activities for students of the Faculty of Forestry can convey a holistic identity that leads the students to meet expectations of the Faculty of Forestry Kasetsart University. Specifically, this study intents to test the following hypotheses:

- The variables used in the study could be classified as survey elements for the identity development of graduates of the Faculty of Forestry.
- The confirmatory factor model for identity development of the Faculty of Forestry graduates was harmonious with the empirical data.

1.4 Purpose of the Study

This research aims to study the components of the identity of the Faculty of Forestry graduates by analyzing the composition by two methods: 1) Exploratory Component Analysis 2) Confirmation Component Analysis

2. Method

2.1 Identify Subsections

The research method is descriptive research, accredited following the International Standards for Human Research Ethical Guidelines; Declaration of Helsinki, The Belmont Report, CIOMS Guideline and International Conference on Harmonization in Good Clinical Practice (ICH-GCP) and 45CFR 46.101(b) from the Research Ethics Committee Kasetsart University, project number KUREC-SS62/134 dated 13 August B.E. 2563. The author has sent the letter to the relevant agencies to request assistance in collecting information. A structural relationship model was used in this research through a 2-step research process: Exploratory Factor Analysis and Confirmatory Factor Analysis, which has the following details

1. Exploratory Factor Analysis: Creating a prototype component by studying related research and interviews and applying it as a conceptual framework for creating questionnaires. The questionnaires were used to collect data from the sample group and the data were analyzed by Exploratory Factor Analysis: EFA
2. Confirmatory Factor Analysis: the survey in item 1 was used as a conceptual framework for creating questionnaires and the questionnaires were used to collect data from samples, which are Graduates of the Faculty of Forestry. The data were analyzed by the Second Order Confirmatory Factor Analysis: 2nd Order: CFA.

2.2 Participant Characteristics

The following group is a sample of participants who are involved in this research project. They are graduates with a bachelor's degree from the Faculty of Science at Kasetsart University. The age range of the participants is between 18 and 60 years old. They possess strong abilities in reading, writing, and comprehending the Thai language, and they are fully committed to participating in the research project.

2.3 Sampling Procedures

In this study, samples were randomly selected for the project using a multi-step randomization process for both sample groups. Participants involved in the exploratory component analysis research project will not be eligible to participate in the confirmatory component analysis research. The sample acquisition process is as follows: 1) Divide graduates from the Faculty of Forestry, Kasetsart University into 80 different graduation periods. 2) Determine an equal quota for the number of samples in each year. 3) Conduct a simple random process by placing the names of graduates from each year into separate containers and randomly selecting the required number of graduates. If any of the randomly selected samples decline to participate in the research project, the research team will continue randomizing new samples until the required number is obtained.

2.3.1 Sample Size, Power, and Precision

This research determined the group size for the analysis of exploratory elements by calculating the parameter value derived from 60 observable variables multiplied by 5, which is the minimum sample value used in the research. Therefore, in composition analysis, a sample of 400 people is used, while affirmative element analysis has 45 observable variables, multiplied by 5. The sample was 225 people, but due to the large number of people interested in participating in the research project. At the time of confirmatory component analysis, a sample of 710 people was taken.

2.3.2 Measures and Covariates

The tools used for collecting research data were two questionnaires created by the research team. The first set was a questionnaire for collecting data in which all of the Exploratory Factors were analyzed, consisting of 60 questions, which have been assessed for IOC by one psychology expert and two educational evaluation specialists. The finding indicated that the full-scale questions have an IOC of 0.66 - 1.00. and Cronbach's alpha coefficient is 0.944. The second set was a questionnaire for collecting data in which all of the Confirmatory Factors were analyzed, consisting of 45 questions and Cronbach's alpha coefficient is 0.945.

The first set of questionnaires consisted of 60 closed-ended questions and the second set had 45 questions. Each question has five levels (Likert Rating Scales) (Albaum, G, 1997; Joshi, A., Kale, S., Chandel, S., & Pal, D. K., 2015). There are 5 levels of the opinion scale as follows: 5 means most true, 4 means very true, 3 means moderately true, 2 means true, less than 1 means least tru

2.3.3 Research Approach

This research is quantitative research to survey the opinions of samples to create a composition model of the Graduate Identity of the Faculty of Forestry, Kasetsart University.

3. Results

The analysis of research data was divided into 2 parts according to research objectives, which include Exploratory Factor Analysis and Confirmatory Factor Analysis as follows:

1. The exploratory factor from the sample was analyzed with the data obtained from the statistical exploratory factor. Elements were extracted from principal component analysis and orthogonal rotation by a varimax method using SPSS for Windows.
2. The confirmatory factor from the sample was analyzed with the data obtained from the second statistical confirmatory factor using the AMOS program.

The analysis was divided into 2 parts as follows:

The Exploratory Factor Analysis (EFA) of the identity development questionnaire of the Graduates from Faculty of Forestry, Kasetsart University revealed that the questionnaire tested by KMO and Barlett's Test has a value of .930. which is greater than the set value of .60. The Chi-Square value is equal to 10437.275 The df value is 1770 and has a significance of .000. This shows that the data is correlated enough to make Further data analysis explains that the variables included in the study showed significant correlation. This indicates that the data is correlated enough to do an analysis. The variables used in the study had a statistically significant relationship. In other words, the data analyzed are suitable for analyzing the factor composition, which is shown in Table 1.

Table 1. Analysis of KMO and Barlett's Test of the Graduate Identity Development Model, Faculty of Forestry, Kasetsart University

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.930
Barlett’s Test of Sphericity	Chi-Square	10437.275
	df	1770
	Significance	.001
	number of samples	400

All variables were extracted to find the composition using Principal Component Analysis (PCA). The Eigenvalue, Percentage of Variance, and Cumulative Percentage of Variance were found. The extraction of composition using the PCA method has the following results: An element with an Eigenvalue of 1.00 or higher has 9 subfactors. The Varimax method used elements with an Eigenvalue greater than 1 to rotate the orthogonal axis. Only valuable questions Element weights of 0.50 and above will be selected as criteria for consideration as shown in the details in Table 2.

Table 2. Eigenvalue, Percentage of Variance, Cumulative Percentage of Variance

Component	Eigenvalue			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	%of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.494	27.490	27.490	16.494	27.490	27.490	4.282	7.136	7.136
2	2.303	3.839	31.329	2.303	3.839	31.329	3.544	5.907	13.043
3	2.123	3.539	34.868	2.123	3.539	34.868	3.470	5.783	18.826
4	2.089	3.481	38.349	2.089	3.481	38.349	3.094	5.157	23.982
5	1.814	3.023	41.372	1.814	3.023	41.372	2.931	4.885	28.868
6	1.744	2.906	44.278	1.744	2.906	44.278	2.928	4.880	33.748
7	1.624	2.707	46.985	1.624	2.707	46.985	2.887	4.812	38.560
8	1.511	2.518	49.503	1.511	2.518	49.503	2.753	4.589	43.149
9	1.220	2.034	53.705	1.220	2.034	53.705	1.980	3.299	50.733

The result of spindle rotation after variable extraction indicated that the factors in the identity development of the Faculty of Forestry graduates from Kasetsart University consist of 9 components. Rotating the perpendicular element axis with the Varimax method reveals elements of identity development factors of the graduates from the Faculty of Forestry, Kasetsart University. Only variables with factor loading values from 0.400 will be selected for analysis. Each component must contain at least 4 observable variables. From Table 2, there are 9 components as follows:

Element 1 contains question numbers No.46 No.47 No.45 No.43 No.48 No.44 and No.57

Element 2 contains question numbers No.30 No.28 No.29 No.27 and No.26

Element 3 contains question numbers No.34 No.35 No.31 No.32 and No.36

Element 4 contains question numbers No.09 No.08 No.07 No.10 No.11 and No.12

Element 5 contains question numbers No.50 No.49 No.54 No.51 and No.52

Element 6 contains question numbers No.39 No.38 No.37 and No.42

Element 7 contains question numbers No.20 No.19 No.14 and No.33

Element 8 contains question numbers No.22 No.17 No.21 No.53 and No.25

Element 9 contains question numbers No.01 No.04 No.05 and No.03

More details are shown in Table 3.

Table 3. The weight of the element when the element's axis is rotated (final analysis)

No.	*Rotated Component Matrix (final analysis)*								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
46	.745								
47	.716								
45	.694								
43	.627								
48	.546								
44	.542								
57	.409								
30		.759							
28		.708							
29		.692							
27		.504							
26		.485							
34			.724						
35			.700						
31			.679						
32			.665						
36			.581						
09				.708					
08				.676					
07				.598					
10				.476					
11				.457					
12				.426					
50					.732				
49					.678				
54					-.648				
51					.530				
52					.526				
39						.746			
38						.698			
37						.592			
42						.568			
20							.653		
19							.600		
14							.553		
33							.533		
22								.657	
17								.549	
21								.519	
53								.489	
25								.412	
01									.743
04									.508
05									.424
03									.404

In conclusion, in Exploratory Factor Analysis, the number of components was determined to describe the variance of each variable. This method is often used to test variables that still need to produce visual evidence. The Exploratory Factor Analysis Model enumerated the identity development of graduates of the Faculty of Forestry, Kasetsart University into 9 elements: 1. teamwork, containing a total of 7 questions 2. commitment to success, containing a total of 5 questions 3. putting knowledge into success, containing a total of 5 questions 4. being virtuous to oneself and others, containing a total of 6 questions 5. readiness to adapt to the environment, containing a total of 5 questions 6. politeness, containing a total of 4 questions 7. readiness to help and share, containing a total of 4 questions 8. not being indifferent, containing a total of 5 questions 9. being a fighter, containing a total of 4 questions

3.1 Results of Confirmatory Factor Analysis

Confirmation factors were analyzed before structural equation analysis. This is to confirm that observable variables and latent variables can measure what needs to be studied. Observable variables in the study of causative factors have been formulated from previous theories and research.

The second confirmatory factor was used to analyze the identity of the Graduate School of Forestry, Kasetsart University. These six sub-components were analyzed in the form of a second corroborative factor measurement model as shown in Figure 1.

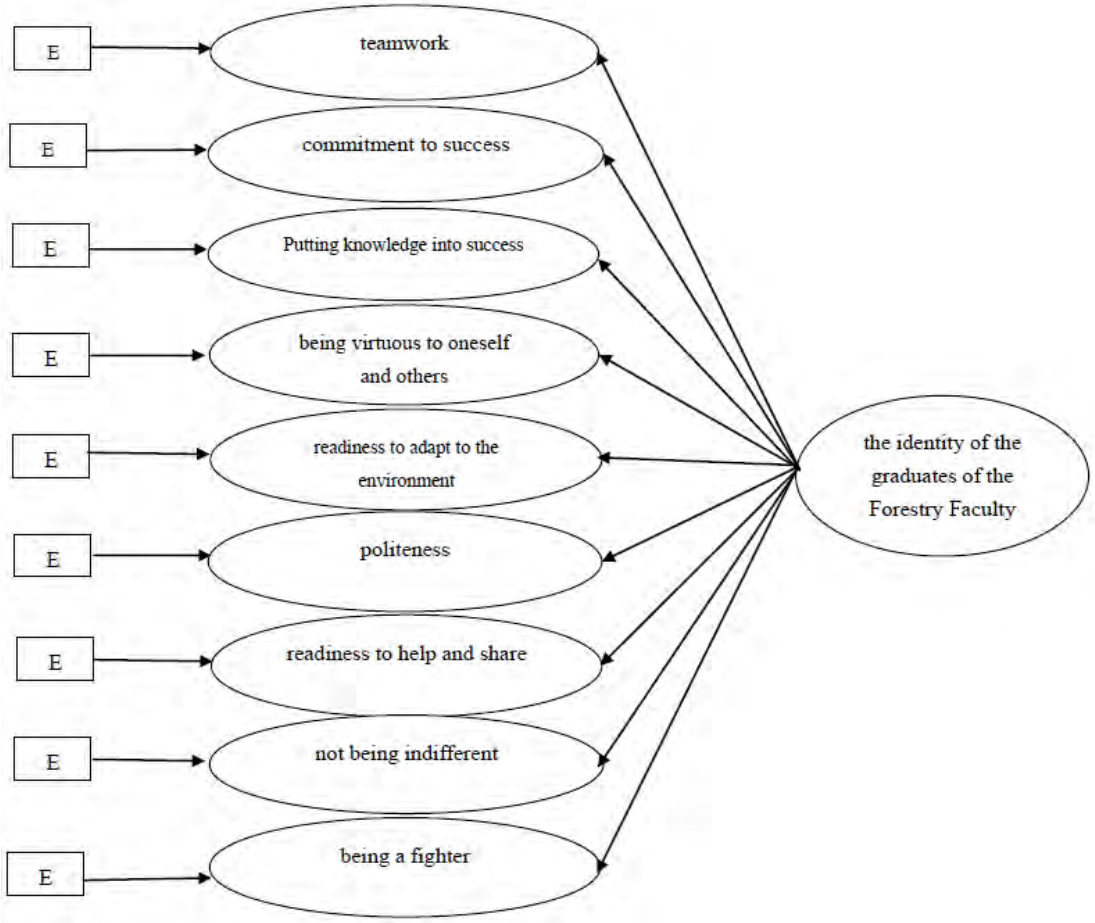

Figure 1. The second diagram demonstrates the identity of the graduates of the Forestry Faculty, at Kasetsart University

The second component of confirmatory factor analysis revealed that all questions of the graduate identity development model in the Faculty of Forestry Kasetsart University are accurate because the model is favorably consistent with the empirical data. The 8 Harmony Index passed the criteria at a good level and does not meet the criteria for 1 character. These are p-values which are not statically significant, where p=48, 2 /df = 1.314, RMSEA = .021, GFI = .991, AGFI = .981, CFI = .998 and RMR = .097. When the obtained results were compared with the data in Table 4, it was found as followings:

Table 4. Shows the comparison of the model's conformity with the empirical data considering the criteria

index of suitability	**index value**	**criteria**	**indication**
$\chi 2$	28.90	no statistical significant	appropriate
Statistical significance (p)	>.148	<0.05	appropriate
$\chi 2$ /df	>1.314	<2.00	appropriate
Root Mean Square Error of Approximation (RMSEA)	>.021	< .05	appropriate
Goodness of Fit Index (GFI)	>.991	<.90	appropriate
Adjusted Goodness of Fit Index (AGFI)	>.981	<.90	appropriate
Comparative Fit Index (CFI)	>.998	<.90	appropriate
Root Mean Square Residual (RMR)	>.097	<.05	inappropriate

As for confirmatory factor analysis of the second variable of graduate identity, Faculty of Forestry, Kasetsart

University by considering the regression weight of all 9 variables, it was found that ‘teamwork’ had the highest standard weighted factor of .825, followed by latent variables 'readiness to help and share' which has a standard factor weight of .749. The latent variable ‘commitment to success’ had a standard factor weight of .739. The standard component weights are between .825 - .636. In addition, p-values were statistically significant for all variables. In addition, p-values were statistically significant for all variables. The reliability coefficient of all indicators, measured by Square Multiple Correlation or R2, ranged from .680 - .405.

Table 5. The confirmatory factor analysis result of the second variable of graduate identity, Faculty of Forestry, Kasetsart University

Variable	Coefficient	Standard Error	C.R.>1.96	Standardized Factor Loading	p	R2
F9	Identity	1.000	-	-		.680
F8	Identity	1.482	.086	17.203	***	.546
F7	Identity	1.142	.070	16.374	***	.413
F6	Identity	1.244	.083	15.058	***	.541
F5	Identity	1.095	.075	14.525	***	.406
F4	Identity	1.688	.096	17.523	***	.444
F3	Identity	1.679	.117	14.381	***	.562
F2	Identity	1.463	.077	19.074	***	.522
F1	Identity	2.311	.131	17.638	***	.405

4. Discussion

From research hypothesis 1, it was discovered that by exploratory factor analysis, the Eigenvalue, Percentage of Variance, Percentage of Variance, and Percentage of Variance were obtained. The results of factor extraction by the PCA method showed that the elements with an Eigenvalue of 1.00 or higher had 9 subfactors. The elements with an Eigenvalue greater than 1 were then used in the orthogonal rotation by the Varimax method. Only questions with an element weight of 0.50 or higher are selected (Hair, et al., 2006). The 9 elements are described as follows: 1. Teamwork, containing a total of 7 questions 2. Commitment to success, containing a total of 5 questions 3. Putting knowledge into success, containing a total of 5 questions 4. Being virtuous to oneself and others, containing a total of 6 questions 5. Readiness to adapt to the environment, containing a total of 5 questions 6. Politeness, containing a total of 4 questions 7. Readiness to help and share, containing a total of 4 questions 8. Not being indifferent, containing a total of 5 questions 9. Being a fighter contains a total of 4 questions. This section is carried out for further inquiry and analysis as part of the confirmatory factor analysis. The results are in part consistent with the findings of Vasan, S. (2002) studying ethnography of the forest guard: contrasting discourses, conflicting roles, and policy implementation, which found that forest rangers in India have two distinct characteristics: 1. They rely on Forest rangers in India have two distinct characteristics: 1. They rely on villagers to accomplish their official duties. Indicates that teamwork is a key factor in getting the job done successfully. 2. Rangers are responsible for all offenses related to forest areas within the provinces they oversee. A single person can’t track all the activities that occur within such a vast geography, especially in the hilly areas that lack amenities and are difficult to access, and cannot be easily contacted by communication devices. These factors indicate that the worker must have patience both physically and mentally, have a commitment to work, and have the spirit of a fighter. These qualifications are consistent with the identity of the Faculty of Forestry graduates. Kasetsart University. It is a result of social interactions between individuals such as teachers, seniors, classmates, and juniors. All of this is partly due to the process of life during university studies, learning styles, courses, teachings, and activities both within the university and outside the university (Lairio Marjatta, Puukari Sauli, & Kouvo Anne, 2013).

From research hypothesis 2, it was discovered that the identity of the Faculty of Forestry at Kasetsart University is a result of social interactions between individuals such as teachers, seniors, classmates, and juniors. All of this is partly due to the process of life during university studies. which consists of Organizing learning styles, courses, teachings, and activities both within the university and outside the university. From the results of confirmatory factor analysis, it was found that ‘teamwork’ had the highest standard weighted factor of .825, followed by latent variables 'readiness to help and share' which has a standard factor weight of .749. The latent variable ‘commitment to success’ had a standard factor weight of .739. This explains how the classroom and extracurricular activities of the Faculty of Forestry instill in students an awareness of shared responsibility and teamwork. These long-standing intensive activities are all that encourage teamwork. This result was consistent with two other latent variables that were followed by scores: readiness to help and share and commitment to success. It can be seen that success in teamwork requires help and commitment to success. This latent variable corresponds to the identity of Kasetsart University which focuses on goodwill, determination, creativity, and

unity. (Achariya Lekpetch, Chatsiri Piyapimolsit, Pikul Aekwarangkul, 2016), in other words, that means working as a team. The latent variable 'fighter' has a standard weight of .636 (the lowest of the bunch). The reason why the fighter's latent variable received a low standard score was probably because there weren't many competitions in the field of forestry nowadays. This corresponds to the interviews with senior alumni of the faculty, who have expressed the same opinion that many of the younger generations are less fighters compared to their predecessors. The affirmative analysis of the 9 components of the Faculty of Forestry graduates was thoroughly examined by both theoretical concepts and exploratory factor analysis. All 9 components were analyzed according to the principles of Supamas Angsuchot, Somthawin Wichitwanna, & Ratchaneekul Pinyopanuwat (2008), and Kanlaya Vanichbuncha (2014), which explains that the model is consistent with the empirical data when there are statistical measures of conformity as follows: The Chi-square Probability must be statistically insignificant, i.e., greater than 0.05. The model is consistent with the empirical data (Relative Chi-square), i.e., less than 3. The model will be consistent with the empirical data. The 9-confirmatory factor analysis is the study of how each factor can be measured by which observable variables to create a factor model. The probability of a chi-square value must be statistically insignificant. In other words, there must be a calculated value greater than 0.05. Then, the consistency of the data is measured by the degree of Goodness of Fit, which must be greater than 0.900 and the model error in terms of Root Mean Square Error of Approximation must be less than 0.08. All 9 elements of the Faculty of Forestry's graduate identity at Kasetsart University comply with the above criteria. This indicates that the model and the empirical data are consistent. In conclusion, the identity of the Faculty of Forestry, Kasetsart University can be used as a measure of the components of the graduate development of the Faculty of Forestry in the future.

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