The Strategic Development for Research Excellence in Thailand 4.0 of Postgraduate students Under Council of the Graduate Studies Administrations of Thailand (CGAT)

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Abstract. This paper aimed to investigate the exploratory factor analysis of research excellence in Thailand 4.0 and to develop the research strategy towards research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand. The mixed method research design was applied in this study. The quantitative was initiated with exploratory factor analysis, and qualitative was used by focus group to develop the research strategy towards research excellence in Thailand 4.0. The Sample size in this study were 530 students. This paper followed factor analysis methods to set the sample. Sample size data was subject to item ratio1:10, 35 items that mean the sample were 530. Furthermore, the sample of qualitative research were 25 students. Besides, a questionnaire with five points rating scale was used to collect the data needed. For qualitative Focus Group the SWOT Analysis, Position Matrix, and TOWS matrix were used. Additionally, frequencies and exploratory factor analysis were used in the study. The data was analyzed using program R version 3.6.2. The finding found that the factor analysis for this measure yielded a seven factors solution with eigenvalues greater than 1.0. These factors were named as 1) research skill, 2) innovative thinking skill, 3) learning style skill, 4) communication skill, 5) digital skill, 6) academic writing skill, and 7) social and life skill. Furthermore, the SWOT analysis has been assessed through an analysis of strengths, weaknesses, opportunities and threats. All data will be analyzed in a matrix relationship using a table called TOWS Matrix. The TOWS Matrix is an analytical table that takes the data obtained from the analysis of SWOT to be analyzed to determine. Come out into the following types of strategies.

Keyword: Strategic Development, Research Excellence, Administrations

1. Introduction

Nowadays, the waves are changing the world society that caused changes in the social economy and politics is fast. Tieocharoen and Rimkeeratikul (2019) due to the advancement in science and technology, people of each country can quickly get information of another country through various
media such as television, radio, newspaper, especially via the Internet. Therefore, Napacha Singveeratham (2019) the people of the countries of the world need to be able to adapt to keep up with the changing trends. Up all the time and the people of the country must be prepared to face these changes in any situation. Moreover, people have to prepare that has an impact on the education management system of many countries. Raob, Al-Oshaibat, and Ong (2012) despite being called a country that has progressed beyond other countries in the provision of education. Nevertheless, still needs to be continuously developed and changed.

According to various impact factors occurring around in the past decade, many countries have reformed education. Nuansomsri and Jantavongso (2020) by focusing on the main issues consisting of quality development and equality in education, school reform, teaching and learning process, promotion of quality assurance systems, the promotion of lifelong learning, as well as promoting the participation of society and people in the provision of many forms of education, as well as in the Asian region, Singapore, South Korea, Malaysia and Japan have focused on focus on improving the quality of education by improving the curriculum (Embalzado & Sajampun, 2020). Likewise, teaching and learning to develop teachers is important to develop knowledge in science and technology in order to increase competitiveness at the international level.

Higher education institutions have a main mission apart from teaching and learning to produce graduates, academic service to society preserving art and culture, it also has a research mission. This is an important mission because it is a method of building a knowledge base for teaching or disseminating science (Raob, 2012). The present society is the age of knowledge management and process of creating knowledge, therefore research is the essential fundamental factor in knowledge generation (Jindapitak, 2019).

Research also plays a role in building knowledge to support other core missions of the institution such as teaching and learning Lei & Sinjindawong, 2019). Furthermore, graduate production and academic dissemination as well Higher education institutions are required to conduct research, which is the primary duty that must be taken seriously. In order to have the answer in solving problems and creating society. Additionally, Ramingwong, Manopinwes, and Jangkrajarng (2019) it should be a leader of research results and applied knowledge in teaching and learning. Especially in the era of educational reform, which emphasizes the learner as a center for teaching and learning that promotes the application of research results in teaching and learning, will help train good critical thinking process skills.

Along with the national development strategy of Thailand 4.0, the university plays a very important role in promoting research and development for the economic and social progress of the country in science, medicine, biotechnology, and health sciences to drive Thailand (Potjanajaruwit, 2019). In accordance with the Thailand 4.0 policy, universities should pay more attention to building quality researchers. Including investments in structures that meet international quality standards, therefore It can be a vital force to create innovation (Krachangmek & Meuandej,2019). A commitment to the building and development of human resources to meet the needs of the public, private and civil society sectors. Sriboonlue (2019) by reforming teaching and learning. Emphasis on providing 21st century skills and entrepreneurial skills to promote the readiness of students and staff to be able to keep up with the globalization.

Nevertheless, there are still some graduate students who are unable to graduate by the time specified in the program due to lack of research skills and dissertation, that resulting in late completion. Because of academic skills that will help foster research excellence there must be a strategy to drive for the greatest effectiveness and efficiency (Thongsri, Shen, & Bao, 2019, Wisetsat & Nuangchalerm, 2019).

Objective
a) To investigate the exploratory factor analysis of research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand.
b) To develop the research strategy towards research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand.

2. Methodology

The mixed method research design was applied in this study to investigate and develop of the exploratory factor analysis of research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand. The quantitative was initiated with exploratory factor analysis and qualitative used by focus group to develop the research strategy towards research excellence in Thailand 4.0. The Sample size in this study were 530 students from postgraduate students under council of the graduate studies administrations in southernmost Thailand. The random sampling selected by stratified random sampling procedure. This paper analyzed factor analysis methods to investigate number of latent constructs measured for standardizing our sample size data was subject to item ratio 1:10, 35 items that mean the sample were 530. Furthermore, the sample of qualitative research were 25 students including of 15 Fatoni University students, five Prince of Songkhla University students, and five Yala Rajabhat University students. Besides, a questionnaire with five points rating scale was used to collect the data needed. For qualitative Focus Group the SWOT Analysis, Position Matrix, and TOWS matrix were used. Additionally, frequencies and exploratory factor analysis were used in the study. Exploratory factor analysis indicated there were seven factors. The KMO result indicated that the sampling was quite adequate. The KMO was 0.926 Bartlett’s test was significant. The Varimax rotation was used. The scree plot and eigenvalues revealed that there were two factors over 1. The seven factors explained 28.953 % of the total variance. Cronbach Alpha reliabilities for overall factors were 0.872. The data was analyzed using program R version 3.6.2.

3. Result and Discussion

The separate factor analyses with varimax rotation was done to validate whether the respondents perceived the independent, mediating and dependent variables were distinct constructs. This paper used the same criterion that was suggested by Igbaria et al. (1995) to identify and interpret factors which were: each item should load 0.50 or greater on one factor and 0.35 or lower on the other factor.

Factor Analysis of Research Excellence in Thailand 4.0 of Postgraduate Students under Council of the Graduate Studies Administrations in Southernmost Thailand

The results for the factor analysis for this measure yielded a seven factors solution with eigenvalues greater than 1.0 and the total variance explained was 28.953% of the total variance. KMO measure of sampling adequacy was 0.926 indicating sufficient intercorrelations. These factors were named as 1) research skill, 2) innovative thinking skill, 3) learning style skill, 4) communication skill, 5) digital skill, 6) academic writing skill, and 7) social and life skill.

| Item | Variables                                | Loading |
|------|------------------------------------------|---------|
| I1   | Students able to identify thesis title   | .692    |
| I2   | Students able to identify research problem| .723    |
| I3   | Students able to identify research objective| .512    |
| I4   | Students able to identify research question| .686    |
| I5   | Students able to identify literature reviews| .815    |
| I6   | Students able to identify research design| .785    |
| I7   | Students able to identify population and sample| .846    |
| I8   | Students able to identify stakeholders | .771    |
| I9   | Students able to identify research instruments| .720    |
| I10  | Students able to identify data analysis | .628    |
From Table 1 presented the results factor loadings that factor is consisted item I1 to I10 totally ten variables. This study employed the loadings .512–.846 instead. Eigen value was 28.953. This factor is called academic research skill factor.

Table 2. Factor loading results of innovative thinking skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I12  | Students able to communicate good well                                    | .530    |
| I13  | Students able to observe a friend in the class                            | .591    |
| I14  | Students always have a question when they don't understand               | .604    |
| I15  | Students love experimenting and learning new things                       | .510    |
| I16  | Students have many close friends from different faculties and universities| .739    |
| I17  | Students have the skills to link the content they have learned and they are studying | .776 |
| I18  | Students love the discussion of the work of friends                       | .646    |
| I19  | Students have skills to synthesize various content and lessons           | .746    |
| I20  | Students able to apply the content of the study to the thesis             | .588    |
| I21  | Students have techniques to create works that are not like their classmates | .642 |

Eigen Value 36.713

From Table 2 showed that factor loadings that factor is involved item I11 to I21. This study employed the loadings .510-.776 instead. Eigen value was 36.713. This factor is called innovative thinking skill factor.

Table 3. Factor loading results of learning style skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I22  | Students prefer presentations that use diagrams, plans, or graphs         | .772    |
| I23  | Students love to listen to others and answer questions, discuss groups   | .723    |
| I24  | Students like to read other people's thesis and take notes of important points | .760 |
| I25  | Students are interested in an application that can play games and animation | .756 |
| I26  | Students read the manual and can learn computer programs                 | .739    |
| I27  | Students love to post and share pictures in private Facebook invasion    | .784    |
| I28  | Students like to pronounce and spell when learning new words             | .676    |
| I29  | Students like teachers who teach using the Active Learning               | .531    |

Eigen Value 43.707

From Table 3 offered the results factor loadings that factor is consisted item I22 to I29 totally eight variables. This study employed the loadings .531-.784 instead. Eigen value was 43.707. This factor is called learning style skill factor.

Table 4. Factor loading results of communication skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I30  | Students use Thai language to communicate correctly                       | .757    |
| I31  | Students can communicate in foreign languages such as English, Arabic, and Malay | .624 |
| I32  | Students able search articles and search in foreign languages            | .789    |
| I33  | Students can present academic papers fluently                            | .730    |
| I34  | Students can make slides presentations with Microsoft PowerPoint         | .681    |
| I35  | Students can use nonverbal communication as well                         | .774    |
From Table 4 obtainable the results factor loadings that factor is consisted item I30 to I35 totally six variables. This study employed the loadings .624-.789 instead. Eigen value was 48.902. This factor is called commination skill factor.

Table 5. Factor loading results of digital skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I36  | Students able use basic computers                                        | .701    |
| I37  | Students able use the internet with fluency                              | .709    |
| I38  | Students able use IT equipment and communicate on the Internet            | .716    |
| I39  | Students are aware of the virtues Ethics in the use of digital technology | .545    |
| I40  | Students able Microsoft excel and calculation programs                    | .589    |
| I41  | Students able use the program to create digital media                     | .505    |
| I42  | Students able use Big Data for analysis                                  | .649    |

Eigen Value 48.902

From Table 5 presented the results factor loadings that factor is consisted item I36 to I42 totally seven variables. This study employed the loadings .624-.789 instead. Eigen value was 53.387. This factor is called digital skill factor.

Table 6. Factor loading results of academic writing skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I43  | Students able write their thesis concisely                                | .526    |
| I44  | Students able use language to be consistent                               | .712    |
| I45  | Students able use the correct order of presentation correctly             | .860    |
| I46  | Students able write content synthesis                                     | .870    |
| I47  | Students know how to use standards reference                              | .897    |
| I48  | Students able check plagiarism                                            | .617    |

Eigen Value 53.387

From Table 6 showed the results factor loadings that factor is consisted item I43 to I48 totally six variables. This study employed the loadings .526-.897 instead. Eigen value was 56.680. This factor is called academic writing skill factor.

Table 7. Factor loading results of social and life skill factor

| Item | Variables                                                                 | Loading |
|------|---------------------------------------------------------------------------|---------|
| I49  | Students able build a relationship between their peers and supervisor     | .632    |
| I50  | Students have self-awareness                                              | .716    |
| I51  | Students understand friends and supervisor                                 | .505    |
| I52  | Students able manage and control their emotions                           | .504    |
| I53  | Students have the skills to manage their strain                           | .804    |
| I54  | Students have emotional and social intelligence                           | .775    |

Eigen Value 59.873
From Table 7 presented the results factor loadings that factor is consisted item I49 to I54 totally six variables. This study employed the loadings .504-.804 instead. Eigen value was 59.873. This factor is called social and life skill factor.

*Development the Research Strategy towards Research Excellence in Thailand 4.0 of Postgraduate Students under Council of the Graduate Studies Administrations in Southernmost Thailand*

This study found that development the research strategy towards research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand. According to the SWOT analysis process using the Card Technique to analyze the problem condition, various issues were found as follows;

| Table 8. SWOT Analysis |
|------------------------|
| **Internal Factors** | **External Factors** |
| **Strength** | **Opportunities** |
| S1 learning style skill | O1 Thailand 4.0 Policy |
| S2 digital skill | O2 Gen-Z |
| S3 social and life skill | O3 New Normal |
| **Weakness** | **Threats** |
| W1 academic writing skill | T1 VUCA world |
| W2 commination skill | T2 Differences of opinion in society |
| W3 innovative thinking skill | |
| W4 research skill | |

From Table 8 that showed SWOT analysis on the internal factors (Strengths & Weaknesses) and analyzing the external factors (Opportunities & Threats). In addition, considering the key points to be used in the matrix, the evaluation of internal factors, external factors and the preparation of the position matrix, the following table is summarized Table 9 and 10.

| Table 9. Position Matrix of internal factor |
|-------------------------------------------|
| **Critical success internal factors** | **Weight** | **Rating** | **Weighted score** |
| S1 learning style skill | 0.10 | 3 | 0.30 |
| S2 digital skill | 0.20 | 4 | 0.80 |
| S3 social and life skill | 0.10 | 3 | 0.30 |
| **Total** | **1.40** | | |
| W1 academic writing skill | 0.20 | 1 | 0.20 |
| W2 commination skill | 0.10 | 2 | 0.20 |
| W3 innovative thinking skill | 0.10 | 2 | 0.20 |
| W4 research skill | 0.20 | 1 | 0.20 |
| **Total** | **0.80** | | |

| Table 10. Position Matrix of external factor |
|---------------------------------------------|
| **Critical success internal factors** | **Weight** | **Rating** | **Weighted score** |
| O1 Thailand 4.0 Policy | 0.30 | 4 | 1.20 |
| O2 Gen-Z | 0.20 | 4 | 0.80 |
| O3 New Normal | 0.20 | 4 | 0.80 |
| **Total** | **2.80** | | |
| T1 VUCA world | 0.20 | 1 | 0.20 |
| T2 Differences of opinion in society | 0.10 | 2 | 0.20 |
| **Total** | **0.40** | | |
From Table 9 and 10 found that the internal factors of SWOT analysis were 3 strengths and four weaknesses, which were calculated in the Position Matrix by weighting and assessing the total weight. Where the position matrix of strength is 1.40 and weaknesses point is 0.8. Moreover, that result showed that there are 3 opportunities and 2 threats that using the same principle to calculate the position matrix of the opportunities is 2.80 and the threats is 0.40, which will be took the results of the calculation to determine the strategy for further development.

From Table 9 and 10 found that the internal factors of SWOT analysis were 3 strengths and four weaknesses, which were calculated in the Position Matrix by weighting and assessing the total weight. Where the position matrix of strength is 1.40 and weaknesses point is 0.8. Moreover, that result showed that there are 3 opportunities and 2 threats that using the same principle to calculate the position matrix of the opportunities is 2.80 and the threats is 0.40, which will be took the results of the calculation to determine the strategy for further development.

From Figure 1 found that the results from the calculation of the position matrix were used to show the strategy for towards research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand. Study found that a proactive strategy should be established as the first priority. Since the curve has the skewness of the line in the most proactive SO, WO, ST, and WT respectively, as follows:

| Internal Factors | STRENGTHS – S | WEKNESSES – W |
|------------------|---------------|---------------|
|                  | S1 learning style skill | W1 academic writing skill |
|                  | S2 digital skill | W2 communion skill |
|                  | S3 social and life skill | W3 innovative thinking skill |

| External Factors | OPPORTUNITIES – O | WEKNESSES – W |
|------------------|--------------------|---------------|
|                  | SO: Strategy | WO: Strategy |
|                  | Creating an ecosystem that supports learning towards Thailand 4.0 | Developing capacity for soft skills integrated with hard skills according to the changing world |

| External Factors | THREATS – T | WEKNESSES – W |
|------------------|-------------|---------------|
|                  | ST: Strategy | WT: Strategy |
|                  | Build the strength of the graduates to be mentally resilient | Create paradigms for research and innovation |

**Figure 1. Strategy Matrix**

From Figure 1 found that the results from the calculation of the position matrix were used to show the strategy for towards research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand. Study found that a proactive strategy should be established as the first priority. Since the curve has the skewness of the line in the most proactive SO, WO, ST, and WT respectively, as follows:

**Table 11. TOWS Matrix Analysis**
From Table 11, after the SWOT analysis has been assessed, then all data will be analyzed in a matrix relationship using a table called TOWS Matrix. The TOWS Matrix is an analytical table that takes the data obtained from the analysis of strengths, weaknesses, opportunities and threats to be analyzed to determine. Come out into the following types of strategies:

SO: Strategy; Creating an ecosystem that supports learning towards Thailand 4.0.

WO: Strategy; Developing capacity for Soft Skills integrated with Hard Skills according to the changing world.

ST: Strategy; Build the strength of the graduates to be mentally resilient.

WT: Strategy; Create paradigms for research and innovation.

4. Conclusion

The exploratory factor analysis of research excellence in Thailand 4.0 of postgraduate students under council of the graduate studies administrations in southernmost Thailand, overall, the mean was 3.44, the standard deviation of 0.49, when considered individually, it was found that the mean was between 2.31-3.85 and the standard deviation between 0.76-1.31 with Eigen Value, which was the result that combined the squares of the coefficient of elements in each element greater than 1, there were 7 elements, that able to explain the cumulative variance 59.873% of the total variance.

1) research skill refers to the capability to search for, locate, extract, unify, evaluate and use or present evidence that is relevant to a particular topic. Graduate study is an advanced study that aim to build professional academics. The researcher with a high professional academic competency is an academic leader and thought leaders have the ability to seek and generate knowledge through research processes. 2) innovative thinking stands for skill the ability to look at things inversely, and find new ways of resolving problems. Which in the present age is very necessary for students to develop thinking skills to be able to bring knowledge to the top and can add value which innovation or new things. Likewise, many things have happened not caused by planning or specifying that it has to be done this year or this month, but it is caused by preparing skilled personnel. The ability to cope with the changes and technologies that occur in a world of constant uncertainty Horth and Buchner (2009) address innovative thinking skills such as paying attention, personalizing, imaging, serious play), collaborative inquiry, and rafting. 3) educational style skill is a student's consistent way of responding to and using stimuli in the context of learning. Students have a need to learn in a variety of ways depending on the learning style individually. Alkhasawneh (2013) showed that the most of students every year, 55 percent of them prefer a blended approach, preferring hands-on approach with viewing or reading and writing. Consequently, students have different styles of study, and teachers should adjust their teaching methods to respond to their preferred learning style that blend will be flexible to acquire new knowledge. But it is worth noting that students who enjoy blended learning will need a variety of teaching methods. 4) commination skill is another essential skill for dissertation writing and presentations on the exam, outline and thesis defense exam Including communication between peers and mentors, consistent. Additionally, language is the heart of communication activity. Because in communication the messenger uses language as a means of transporting the message to the receiver. Zhang and Yu (2019), Badaruddin & Rashid (2019) communication is an important factor in life that humans need to be in constant communication with each other. Especially in university student life, meet with many people such as students and educational personnel, so communication skills are the first step of learning. 5) digital skill is definite as a range of capabilities to use digital devices, communication applications, and networks to access and manage data. Ministry of Education is committed to driving the development. the country's educational institutions to create personnel or workers in the future to have digital skills that are in line with the rapidly changing technology or disruptive technology. It is a major transformation of education reform of the country that the Ministry of Education has announced the certification of certification.
Universal computer capability (International Computer Driving License: ICDL) to all official courses. Which, if students have high digital skills, they will be able to research and able to quickly learn to write a thesis. 6) academic writing skill is a core skill that students must have because it must be used in writing a thesis and writing academic articles Altınımakas, & Bayyurt, 2019). Academic writing Refers to writing for the benefit academic in any area with either theory or principle supporting have a systematic source of information, references, and research methods. and 7) social and life skill are secured to a personality's interpersonal skills with peers, private and the community. Higher education is of great importance to the development of the country. Especially in-depth development at the graduates of the master's degree and the doctorate must bring the knowledge gained from education to apply to benefit to the country. Besides, educational management must therefore be of quality education and with world-class standards knowledge that is the product of postgraduate education. This study is not for the benefit of immediate practice. But a quest knowledge for its own sake is knowledge known as "wisdom" that will lead society and the nation to continue to progress. Siburian, Corebima, & Saptasari, 2019).

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