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**The Road Map to Close the Skill Gap in Taiwan and ASEAN Countries – A  
Perspective of Education Benchmarking**

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## Introduction

This research tries to construct a benchmark road map as the skill and technology diffusion road map for skilled labor migration in Taiwan and ASEAN countries through data compare and analysis of unemployment rate data, economic performance data, data of education population, data of the population rate with academic skills, data of the population rate with generic/life skills, data of the population rate with skills for future, and data of the population rate with technical skills by industry for exploring the possible resolution of closing the skill gap from the perspective of education.

## Research Background

The “skill gap” between the labor supply and demand is one of the most important problems we should face today. In the new era based on “knowledge-economy”, the key for the successful economic growth would be the high-quality human capital.

However, the shortage of the supply of market-driven qualified employees from the demands of higher-level academic and technical skill training system is an emerging problem in East Asia nowadays, and it reduces the human productivities and national competitiveness dramatically<sup>1</sup>.

Take China for example, according to 2013 McKinsey & Company report, the cost of China for the widening gap of high-skilled labor would be up to USD 250 billion, and it also means the loose of 2.3% of Chinese GDP in 2020<sup>2</sup>.

Besides, according to the World Bank Skill Report (2010), there is a huge skill gap (skill mismatch) between the employers and the employee in ASEAN membership countries, especially focus on both the soft skills of English., creativity, behavior skills, and technical skills such computing, and many other specific skills the industries required (World Bank, 2010).

Moreover, one kind of negative impacts of “skill gap” is the problem of the youth unemployment rate. Although the youth unemployment rate in ASEAN countries has been improving gradually from 19.2% to 19% during the years of 2012-2017<sup>3</sup>; however, it is still a serious problem in some of the ASEAN countries like Indonesia since Indonesia still remains the highest youth unemployment rate in the Southeast Asia from 1995-2007 (20%-25.1%)(Martinez-Fernandez, Powell, 2009: 31)<sup>4</sup>.

Another impact resulted from the “skill gap” is the unstable workforce market. According to the Employer Skill Survey (2008) in the World Bank Skill Report (World Bank, 2010: 23-24), the high rate of new hires and discharges in the specific industry would cause the unstable workforce market with impacts on economic performance and labour productivities based on

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<sup>1</sup> The World Bank (2012). *Putting Higher Education to Work: Skills and Research for Growth in East Asia*. World Bank East Asia and Pacific Regional Report.

<sup>2</sup> Li-Kai Chen, Mona Mourshed, and Andrew Grant (2013). *The USD 250 Billion Question: Can China Close the Skill Gap?* McKinsey & Company.

<sup>3</sup> Source from the Statista website: <https://www.statista.com/statistics/812110/youth-unemployment-rate-in-indonesia/>. Visited on 2018/05/18.

<sup>4</sup> Cristina Martinez-Fernandez and Marcus Powell (2009). *Employment and Skills Strategies in Southeast Asia: Setting the Scene*. OECD Local Economic and Employment Development Programme, LEED Programme: France.

the data compare of the “education of new hires”, “education of discharges”, including the data compare between the “education of new hires in manufacturing” and the “education of discharges in manufacturing”, and the data compare between the “education of new hires in services” and the “education of discharges in services”.

Take Indonesia for example, the most serious gaps between the “education of new hires in manufacturing and services” and the “education of discharges in manufacturing and services” fall on two education groups of “primary education level” and “junior high school education level”, and the least unstable gaps between the “education of new hires in manufacturing and services” and the “education of discharges in manufacturing and services” fall on the “diploma education level” and the “postgraduate education level”. There is development trend based on this data compare that the more unstable workforce market might be caused by the lower levels of education.

In short, it is the time to stop the economic lost by closing the skill gap. Therefore, this research aims to find the possible way to reduce the unemployment rate for closing the skill gap from the perspective of education in Taiwan and ASEAN countries.

Table1. Unemployment Rate Over Time In East Asia

Country	Earlier Year	Latest Year	Change (%)
Vietnam (1998, 2006)			
- All	0.64	0.41	-35.9
- University Graduates	0.96	1.22	27.1
- Youth unemployment (All)		2.80	
- Youth unemployment (University)		9.88	
Cambodia			
- All (1999, 2007)	0.81	0.75	-7.4
- University Graduates	5.38	2.11	-60.8
- Youth unemployment (All)		1.43	
- Youth unemployment (University)		1.59**	
Thailand (1996, 2006)			
- All	0.73	1.64	124.6
- University Graduates	2.77	2.11	-23.8
- Youth unemployment (All)		7.62	
- Youth unemployment (University)		2.69	
Indonesia (1998, 2007)			
- All	4.08	3.27	3.2
- University Graduates	12.71	6.84	-32.7
- Youth unemployment (All)		16.92	
- Youth unemployment (University)		30.84	
Mongolia (1998, 2007)			
- All	10.61	8.17	-23.0
- University Graduates	10.68	6.71	-37.2
- Youth unemployment (All)		15.46	
- Youth unemployment (University)		5.95	
Philippines (2000, 2006)			
- All	6.24	5.85	-6.2
- University Graduates	8.92	11.55	29.5
- Youth unemployment (All)		16.44	
- Youth unemployment (University)		11.55	
China (2005)			
- All		9.13	
- University Graduates		5.22	
- Youth unemployment (All)		15.32	
- Youth unemployment (University)		5.94	

\*\* Less than 5 obs.

Source from: Sakellariou (2010: 5-6)<sup>5</sup>

## Purpose Statement

Based on the research goal of finding the possible way to reduce the unemployment rate for

<sup>5</sup> Chris Sakellariou (2010). *Labor Market Outcomes of Higher Education in East Asia*. OECD draft document for discussion.

closing the skill gap from the perspective of education in Taiwan and ASEAN countries, there are several in-depth problems which will be explored, identified, and partially answered in this research as following.

1. What are the current situations of unemployment rate by country, industry, and sector in Taiwan and ASEAN countries?
2. What are the current situations of education background by country, industry employment population, and industry unemployment population in Taiwan and ASEAN countries?
3. What are the current situations of economic performance or trade exporting performance by country and industry in Taiwan and ASEAN countries?
4. What kind of relationship among the domains of education background, industry employment rate, industry unemployment rate, and economic performance or trade exporting performance through the test of second-hand data in Taiwan and ASEAN countries?
5. What are the results and which country is the benchmark after compare all of the indicators of the domains of education background, industry employment rate, industry unemployment rate, and economic performance or trade exporting performance through the compare of second-hand data in Taiwan and ASEAN countries?
6. What is the road map to close the skill gap in Taiwan and ASEAN countries from the perspective of education benchmarking?

### **Importance of the Research**

This research touches two kinds of research fields, including the “human capital theory” and “closing the skill gap”. There are a lot of former researches related to the topic of the relationship between the education and the economic performance (human capital theory) or economic returns as well as a lot of statistical data for the skill gap around the world.

However, few literature offer the holistic blue print of the data combinations of human capital theory literature and the literature of “closing the skill gap”, and it is also short of the clues based on the former research to construct a road map as the facilitation to close the skill gap.

Therefore, the main contributions of this research are as following.

1. To offer the holistic blue print of the data combinations of human capital theory literature and the literature of “closing the skill gap”
2. To construct a road map as the facilitation to close the skill gap.
3. To describe the current situations of unemployment rate by country, industry, and sector in Taiwan and ASEAN countries.
4. To describe the current situations of education background by country, industry employment population, and industry unemployment population in Taiwan and ASEAN countries.
5. To describe the current situations of economic performance or trade exporting performance by country and industry in Taiwan and ASEAN countries.
6. To integrate the indicators which can be assessed and explained the domains of education background, industry employment rate, industry unemployment rate, and economic performance or trade exporting performance based on the former research.
7. To describe the relationship among the domains of education background, industry employment rate, industry unemployment rate, and economic performance or trade exporting performance through the test of second-hand data in Taiwan and ASEAN countries.
8. To explore the results and find benchmark country after compare all of the indicators of the

domains of education background, industry employment rate, industry unemployment rate, and economic performance or trade exporting performance through the compare of second-hand data in Taiwan and ASEAN countries.

## Definition of Terms

According to the definition of ASTD, “skill gap” is the gap between the skill-need from the organizations and the skill-demand of job-seekers. When the capabilities, knowledge, and skills of job-seekers do not satisfy the requirements of the job vacancies, the job-seekers are less competitive and the gap between the skill supply and skill demand is emerging.<sup>6</sup>

According to the report of ADB, there are two parts of the definition of “skill”, including the formal academic education qualification, and the skills which are actually needed and applied in the workplace. For the second part of the definition of “skill”, it also means that the competencies required by the employers ( Ra, Chin, Liu, 2015: 2 )<sup>7</sup>. However, the data of the “skill” required by the employers in the workplace is usually more difficult collected than the data of the “skill” defined as the academic education qualification ( OECD, 2012 )<sup>8</sup>.

For the “skill” required by the employers in the workplace According to European Commission ( 2015 ) , the definition of “skill” is “the ability to apply knowledge and use know-how to complete tasks and solve problems” ( Ra, Chin, Liu, 2015: 2 ) , and there are two kinds of skills, including “hard skills” and “soft skills”. The definition of “hard skill” is the competencies to complete certain operation processes or tasks, and it also named as “technical skill” ( Ra, Chin, Liu, 2015: 2 ) . The definition of “soft skill” is composed by two kinds of soft skills, including “cognitive skill”(such as the basic knowledge of math, literacy or English required in the workplace) and “noncognitive skill”(also named as “personality traits” such as the personality of leadership, team-working ability, or disciplines)<sup>9</sup> ( Ra, Chin, Liu, 2015: 2 ) .

According to the skills report from the Human Development Department East Asia and Pacific Region, World Bank, there are three kinds of employees’ skills required to be assessed by the employers for the estimations of the company’s competitiveness and the human resource productivity, including academic skills (the basic knowledge such as math, literacy or English), generic skills (also named as life skills such as the creating ability, problem solving ability, communication ability, teamwork ability, or leadership skills), and technical skills (the skills or abilities associated with the individual’s profession) (World Bank, 2010: vii).

The definition of “skill mismatch” is that “the imbalances between the supply of skills and the

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<sup>6</sup> ASTD (2012). *Bridging the Skill Gap – Help wanted, Skill lacking: Why the Mismatch in Today’s Economy?* The American Society for Training & Development.

<sup>7</sup> Sungup Ra, Brian Chin, Amy Liu ( 2015 ) . *Challenges and Opportunities for Skills Development in Asia: Changing Supply, Demand, and Mismatch*. Asian Development Bank.

<sup>8</sup> Organization for Economic Co-operation and Development (OECD)(2012). *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies*.

<https://skills.oecd.org/documents/OECDSkillStrategyFINALENG.pdf>.

<sup>9</sup> E. A. Hanushek, G. Schwerdt, S. Wiederhold, and L. Woessmann (2015). “Returns to Skills around the World: Evidences from PIAAC.” *European Economic Review*. 73©. Pp.103-130.

International Labor Organization(ILO)(2015). *World Employment and Social Outlook-Trend 2015*. Geneva. World Bank(WB)(2010). *Stepping Up Skills for More Jobs and Higher Productivity*. Source from WB website: <http://documents.worldbank.org/curated/en/538131468154167664/Stepping-up-skills-for-more-jobs-and-higher-productivity>.

demand for skills for the work.”<sup>10</sup> (Ra, Chin, Liu, 2015: 2)

## Review of Literature

### Human Capital Theory

This research is going to analyze the data and current situation from the perspective of “human capital theory”. Based on the dual relationship analysis of education and economics, the main hypothesis of human capital theory is that the high quality education and skill training will bring the high quantity of economic performance<sup>11</sup>.

According to the research results of Mincer (1958), the continuing learning for further training and advanced skills would affect the personal income, and the determinations of the growth of personal income include formal education (the year of schooling)<sup>12</sup>, work experience, and the number of working weeks (Mihm-herold, 2010: 57).

Furthermore, Schultz (1974)<sup>13</sup> found more determinations can increase the economic returns, including the investments on health facilitation and services, on the job training, studies of adults, and the migration of individuals and families (Mihm-herold, 2010: 57).

Therefore, this research will focus on the determinations related to “formal education”, “migration of individuals and families”, and “economic returns” to construct a road map for closing the skill gap in Taiwan and ASEAN countries.

### Closing the Skill Gaps

There are two kinds of literature to explore the possible ways to close the skill gap, including the research of increasing the education population and education quality, and the research of catching up of the rapid development of technologies.

For the first kind of resolution option of closing skill gap, many models were proposed and utilized such as to increase the education investment for increasing the education population, to expand the secondary and tertiary education through public policies (Ferranti, Perry, Gill, Guasch, Maloney, Sanchez-Paramo, Schady, 2003: 12)<sup>14</sup>, and to set up the academic study programs like STEM, or national exams like TIMSS, PISA, and TOIEC (World Bank, 2010:

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<sup>10</sup> International Labor Organization (ILO)(2011). *Formulating a National Policy on Skills Development. Skills for Employment, Policy Brief*. Geneva.

P. H. Cappelli (2015). “Skill Gaps, Skill Shortages, and Skill Mismatches: Evidence and Arguments for the United States.” *ILR Review*. 68(2). Pp. 251-290.

<sup>11</sup> Wendy Ann Mihm-herold (2010). *Considering Human Capital Theory in Assessment and Training: Mapping the Gap between Current Skills and the Needs of a Knowledge-Based Economy in Northeast Iowa*. Graduate Theses and Dissertations. 11913. The Graduate College at Iowa State University.

S. Sweetland (1996). Human Capital Theory: Foundations of a Field of Inquiry. *Review of Educational Research*, 66(3), 341-360.

<sup>12</sup> Daron Acemoglu and David Author. Lectures in Labor Economics. Source from the website: <https://economics.mit.edu/files/4689>. Visited on 2018/02/28.

<sup>13</sup> T. W. Schultz (1974). Economics of the Family: Marriage, Children and Human Capital. A Conference Report . National Bureau of Economic Research, Population Council.

<sup>14</sup> David de Ferranti, Guillermo E. Perry, Indermit Gill, J. Luis Guasch, William F. Maloney, Carolina Sanchez-Paramo and Norbert Schady (2003). *Closing The Gap in Education and Technology*. World Bank: Washington D.C.

xiii-xxii)<sup>15</sup>.

For the second kind of resolution option of closing skill gap, lots of approaches were used to reduce the skill gap, including the technologically transferring (Almendarez, 2013: 21)<sup>16</sup>, technology innovation (Messinis, Ahmed, 2012: 565-566)<sup>17</sup>, increasing the investment of research and development, application of ICT, and the skill or technology diffusion through the labor migration (Iara, 2008: 1)<sup>18</sup>.

Furthermore, there are several indicators of skills for future which can be also the option to construct the possible way to close the skill gap. Six indicators are identified as the index to educate for the future, including “interdisciplinary skills”, “creative and analytical skills”, “entrepreneurial skills”, “leadership skills”, “digital and technical skills”, and “global awareness and civic education” (The Economist, 2017: 8)<sup>19</sup>.

## Methodology

This research uses the benchmark-searching approach through the compare of document and second-hand data analysis to construct the road map for possible resolution option of closing the skill gap in Taiwan and ASEAN countries.

### Data Collection

There are seven parts of data collected for this research, including the unemployment rate data (unemployment rate by country, industry, and sector in Taiwan and ASEAN countries), economic performance data (economic performance or trade exporting performance by country and industry in Taiwan and ASEAN countries), and five kinds of education data (data of education population, data of the population rate with academic skills[such as math skill, literacy skill, English skill, TIMSS, TOIEC], data of the population rate with generic/life skills [such as team-working skill, leadership skill, and management skill], data of the population rate with skills for future (include interdisciplinary skills, creative and analytical skills, entrepreneurial skills, leadership skills, digital and technical skills, and global awareness and civic education), and data of the population rate with technical skills by industry.

### Data Analysis Framework

Observing the problems of “skill gap” in industries around the world, including Taiwan and the Southeast Asian countries; this research is trying to explore an improvement road-map from the perspective of education benchmarking for better economic performance based on the former literature of human capital theory and the researches on the issue of “closing the skill gaps”.

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<sup>15</sup> World Bank (2010). *Indonesia Skills Report: Trends in Skills Demand, Gaps, and Supply in Indonesia*. Human Development Department East Asia and Pacific Region: World Bank.

<sup>16</sup> Leroy Almendarez(2013). “Human Capital Theory: Implications for Educational Development in Belize and the Caribbean” *Caribbean Quarterly*, 59(3-4), 21-33.

<sup>17</sup> George Messinis, Abdullahi Ahmed (2012). “Cognitive Skills, Innovation and Technology Diffusion” *Economic Modelling*, 30: 565-578.

<sup>18</sup> Anna Iara (2008). *Skill Diffusion by Temporary Migration? Returns to Western European Work Experience in Central and East European Countries*. Wiener Institute für International Wirtschaftsvergleiche, The Vienna Institute for International Economic Studies.

<sup>19</sup> The Economist (2017). *Worldwide Education for The Future Index: A Benchmark for the Skills of Tomorrow*. The Economist Intelligence Unit Limited.

Therefore, there are three parts of variables observed and compared in this research based on the demands of the research structure of “skill gap problem”, “education”, and “economic performance” to identify the education benchmarking cases for specific industries. Three parts of the variables are divided into “background domain” for observing the current situations of the “skill gap problem”, “education domain” for observing the current development of “education” system, and “economic outcome domain” for observing the industry performance and national economic performance.

### Background Domain

For observing the “skill gap problems” of each nation, there are 12 variables, as the independent variables, observed in this research to understand how worst of the skill gap problems in each nation. All of the data of the 12 variables are collected from several international data bases, including the Global Competitiveness Report 2017-2018, the ASEAN Statistical Yearbook 2016/2017, the Global Human Capital Report 2017, and the ILOSTAT.

According to the Global Competitiveness Report 2017-2018 (Schwab ed., 2017)<sup>20</sup>, there are two factors assessed to explore the problematic factors for doing business, including the factor of “inadequately educated workforce”, and the factor of “poor work ethic in national labor force”. These two variables can be identified as the critical elements with the impacts on the environment of doing business in one way, and also as the indexes to observe the obstacles of the workforce development such as the problem of “skill gap”.

IV01: inadequately educated workforce (definition of this variable - This chart summarizes those factors seen by business executives as the most problematic for doing business in their economy. The information is drawn from the World Economic Forum’s Executive Opinion Survey (the Survey). From a list of 16 factors, respondents were asked to select the five most problematic and rank them from 1 (most problematic) to 5. The results were then tabulated and weighted according to the ranking assigned by respondents. Unit: percent.)<sup>21</sup>

IV02: poor work ethic in national labor force (definition of this variable - This chart summarizes those factors seen by business executives as the most problematic for doing business in their economy. The information is drawn from the World Economic Forum’s Executive Opinion Survey (the Survey). From a list of 16 factors, respondents were asked to select the five most problematic and rank them from 1 (most problematic) to 5. The results were then tabulated and weighted according to the ranking assigned by respondents. Unit: percent.)

According to the Global Human Capital Report 2017, there are one variables assessed to explore the deployment of the human capital of a nation (“labour force participation rate”), and one variable assessed to explore the “youth not in employment, education or training rate” (World Economic Forum, 2017). Based on the data of the two variables, the problems of the development of human capital are observed and assessed which might be resulted from the factor of “skill gap” of a nation.

IV03: labour force participation rate ( definition of this variable – Percentage of the country’s

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<sup>20</sup> Klaus Schwab ed. (2017). *The Global Competitiveness Report 2017-2018*. Geneva: World Economic Forum.

<sup>21</sup> According to the Global Competitiveness Report 2017-2018, the percentage of each problematic factor is the responding percentage based on the survey results. The respondents to the World Economic Forum’s Executive Opinion Survey were asked to select the five most problematic factors for doing business in their country to rank between 1 (the most problematic) to 5.



working age population who are either looking for work or working.<sup>22</sup>) (World Economic Forum, 2017: 55).

IV04: youth not in employment, education or training rate ( definition of this variable – Among people aged 15–24 ‘the youth’ the proportion who are not in employment and not in education or training.<sup>23</sup>) (World Economic Forum, 2017: 54).

According to the ASEAN Statistical Yearbook 2016/2017, there are two variables assessed to explore the development of the national employment rate by industry or occupation 2007-2016 (“percentage of employment by major industry group 2007-2016”, and “percentage of employment by occupation 2007-2016”) ( ASEAN, 2016/2017: 27-37) . These two variables can help us to observe the increasing or decreasing curves of the employment rate by industry, occupation, or education level of a nation 2007-2016 for the identifications of the impacts of “skill gap” .

IV05: percentage of employment by major industry group 2007-2016 (definition of this variable - Employment rates are defined as a measure of the extent to which available labour resources (people available to work) are being used. They are calculated as the ratio of the employed population by the major industry group.)( ASEAN, 2016/2017: 36)

IV06: percentage of employment by occupation 2007-2016 (definition of this variable - Employment rates are defined as a measure of the extent to which available labour resources (people available to work) are being used. They are calculated as the ratio of the employed population by different occupations.)( ASEAN, 2016/2017: 37)

### Education Domain

For observing the “education” system of each nation, there are 10 variables, as the control variables, observed in this research to figure out the picture of the government input in the field of education, and the educated population percentage in different education levels. All of the data are collected from several international data bases, including the Global Competitiveness Report 2017-2018.

According to the Global Competitiveness Report 2017-2018 (Schwab ed., 2017), there are two variables assessed to explore the current development of the “primary education” of a nation (“quality of primary education” and “primary education enrollment rate”), and eight variables assessed to explore the latest development of the “higher education and training” of a nation (“secondary education enrollment rate”, “tertiary education enrollment rate”, “quality of the education system”, “quality of math and science education”, “quality of management schools”, “internet access in schools”, “local availability of specialized training services”, and “extent of staff training”) (Schwab ed., 2017: 345-346)<sup>24</sup>. These ten variables can be identified as the education quality, which is assumed to promote the workforce quality of the nation as well as one kind of approach to close the skill gap of the national human capital.

CV01: quality of primary education ( definition of this variable – the survey questionnaire: “In

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<sup>22</sup> Source: ILOSTAT.

<sup>23</sup> Source: ILOSTAT.

<sup>24</sup> Source from World Economic Forum, Executive Opinion Survey.

your country, how do you assess the quality of primary education?” [1 = extremely poor—among the worst in the world; 7 = excellent—among the best in the world] | 2016–17 weighted average. ) (Schwab ed., 2017: 345)

CV02: primary education enrollment rate ( definition of this variable – Net primary education enrollment rate | 2015 or most recent year available.<sup>25</sup> ) (Schwab, 2017: 345)

CV03: secondary education enrollment rate ( definition of this variable – Gross secondary education enrollment rate | 2015 or most recent year available.<sup>26</sup> ) (Schwab ed., 2017: 345)

CV04: tertiary education enrollment rate ( definition of this variable – Gross tertiary education enrollment rate | 2015 or most recent year available.<sup>27</sup> ) (Schwab ed., 2017: 345)

CV05: quality of the education system ( definition of this variable – the survey questionnaire: “In your country, how well does the education system meet the needs of a competitive economy?” [1 = not well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 345)

CV06: quality of math and science education ( definition of this variable – the survey questionnaire: “In your country, how do you assess the quality of math and science education?” [1 = not well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 345)

CV07: quality of management schools ( definition of this variable – the survey questionnaire: “In your country, how do you assess the quality of business schools?” [1 = not well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 346)

CV08: internet access in schools ( definition of this variable – the survey questionnaire: “In your country, to what extent is the Internet used in schools for learning purposes?” [1 = not well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 346)

CV09: local availability of specialized training services ( definition of this variable – the survey questionnaire: “In your country, how available are high-quality, professional training services?” [1 = not well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 346)

CV10: extent of staff training ( definition of this variable – the survey questionnaire: “In your country, to what extent do companies invest in training and employee development?” [1 = not

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<sup>25</sup> The reported value corresponds to the ratio of children of official primary school age (as defined by the national education system) who are enrolled in primary school. Primary education (ISCED level 1) provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music. Sources: UNESCO Institute for Statistics, *Data Centre* (accessed June 8, 2017); Organization for Economic Co-operation and Development (OECD), *Education at a Glance 2016*; UNICEF; national sources.

<sup>26</sup> The reported value corresponds to the ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to the secondary education level. Secondary education (ISCED levels 2 and 3) completes the provision of basic education that began at the primary level, and aims to lay the foundations for lifelong learning and human development by offering more subject- or skills-oriented instruction using more specialized teachers. Sources: UNESCO Institute for Statistics, *Data Centre* (accessed June 8, 2017); national sources

<sup>27</sup> The reported value corresponds to the ratio of total tertiary enrollment, regardless of age, to the population of the age group that officially corresponds to the tertiary education level. Tertiary education (ISCED levels 5 and 6), whether or not leading to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level. Sources: UNESCO Institute for Statistics, *Data Centre* (accessed June 8, 2017); national sources

well at all; 7 = extremely well] | 2016–17 weighted average. ) (Schwab ed., 2017: 346)

### Economic Outcome Domain

For observing the “economic performance” situations of each nation, there are 6 variables, as the dependent variable, observed in this research as the outcome test of the results and performance of the “education” system based on the GDP data or the trading data by industry. All of the data of the variables are collected from the ASEAN Statistical Yearbook 2016/2017.

According to the ASEAN Statistical Yearbook 2016/2017, there are six variables assessed to explore the economic outcome by industry, sector, and the export or import trade performance of a nation 2007-2016 (“GDP share of major group of economic sectors 2013-2016”, “ASEAN total trade in goods 2007-2016”, “Intra-ASEAN trade in goods 2007-2016”, “ASEAN exports of services by country 2007-2016”, “ASEAN imports of services by country 2007-2016”, and “rate of GDP growth”) ( ASEAN, 2016/2017: 47-137 ) . These six variables can be identified as parts of the education outcome which is assumed to be the mechanism to improve the problem of “skill gap” .

DV01: GDP share of major group of economic sectors 2013-2016 (definition of this variable – the nominal GDP of the major group of economic sector composition ratios.) (ASEAN, 2016/2017: 47)

DV02: ASEAN total trade in goods 2007-2016 (definition of this variable – Trade in goods and services is defined as change in ownership of material resources and services between one economy and another. The indicator comprises sales of goods and services as well as barter transactions or goods exchanged as part of gifts or grants between residents and non-residents. It is measured in million USD and percentage of GDP for net trade and also annual growth for exports and imports.<sup>28</sup>) (ASEAN, 2016/2017: 59).

DV03: Intra-ASEAN trade in goods 2007-2016 (definition of this variable – Trade in goods and services is defined as change in ownership of material resources and services between ASEAN countries. It is measured in million USD.<sup>29</sup>) (ASEAN, 2016/2017: 59).

DV04: ASEAN exports of services by country 2007-2016 (definition of this variable – merchandise trade comprised services leaving the ASEAN countries.<sup>30</sup>) (ASEAN, 2016/2017: 125).

DV05: ASEAN imports of services by country 2007-2016 (definition of this variable – Imports of services (merchandise trade) are goods which add to the stock of material resources of a country by entering its economic territory (ASEAN countries).<sup>31</sup>) (ASEAN, 2016/2017: 125).

DV06: rate of GDP growth 2007-2016 (definition of this variable – Annual percentage growth

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<sup>28</sup> Source: OECD Data website <https://data.oecd.org/trade/trade-in-goods-and-services.htm>.

<sup>29</sup> Source: OECD Data website <https://data.oecd.org/trade/trade-in-goods-and-services.htm>.

<sup>30</sup> Source: OECD Data website <https://stats.oecd.org/glossary/detail.asp?ID=919>.

International Merchandise Trade Statistics – Concepts and Definitions, United Nations, 1998, Series F, No. 52, Rev. 2, para. 111- 130.

<sup>31</sup> Source: OECD Data website <https://stats.oecd.org/glossary/detail.asp?ID=1300>.

International Merchandise Trade Statistics – Concepts and Definitions, United Nations, 1998, Series F, No. 52, Rev. 2, paras. 14 and 115-116.

rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.<sup>32</sup>) (ASEAN, 2016/2017: 43).

### Hypothesis

Based on the main hypothesis of human capital theory, the high quality education and skill training will cause the high quantity of economic outcome, there are two hypotheses in this research among the independent variables, control variables, and dependent variables.

Hypothesis 01: The low-quality independent variables (such as the relative high unemployment rate and the relative low labour participation rate; further details are as following, high score of *IV01 inadequately educated workforce*, high score of *IV02 poor work ethic in national labor force*, low *IV03 labour force participation rate*, high *IV04 youth not in employment, education or training rate*, low *IV05 percentage of employment by major industry group 2007-2016*, low *IV06 percentage of employment by occupation 2007-2016*) will cause the low performance of control variables (such as the relative low quality of primary education or the relative low tertiary education enrollment rate; further details are as following, low *CV01 quality of primary education*, low *CV02 primary education enrollment rate*, low *CV03 secondary education enrollment rate*, low *CV04 tertiary education enrollment rate*, low *CV05 quality of the education system*, low *CV06 quality of math and science education*, low *CV07 quality of management schools*, low *CV08 internet access in schools*, low *CV09 local availability of specialized training services*, low *CV10 extent of staff training*).

Hypothesis 02: The low quality of control variables (such as the relative low quality of primary education or the relative low tertiary education enrollment rate; further details are as following, low *CV01 quality of primary education*, low *CV02 primary education enrollment rate*, low *CV03 secondary education enrollment rate*, low *CV04 tertiary education enrollment rate*, low *CV05 quality of the education system*, low *CV06 quality of math and science education*, low *CV07 quality of management schools*, low *CV08 internet access in schools*, low *CV09 local availability of specialized training services*, low *CV10 extent of staff training*) will lead the results of relative low quality and quantity of dependent variables (such as the relative low value of GDP or the relative low US\$ of PPP of mean monthly earnings; further details are as following, low *DV01 GDP share of major group of economic sectors 2013-2016*, low *DV02 ASEAN total trade in goods 2007-2016*, low *DV03 Intra-ASEAN trade in goods 2007-2016*, low *DV04 ASEAN exports of services by country 2007-2016*, low *DV05 ASEAN imports of services by country 2007-2016*, and low *DV06 rate of GDP growth 2007-2016*).

### Education Benchmark Road Map Construction

This research identifies the education benchmark road map as the skill and technology diffusion road map. And the road map is constructed based on the data comparison and the two hypothesis test, which means that the road map is shaped by the skill and technology diffusion flow from the nations with the relative high quality of education system (based on the test and the observing of the control variables) to the nations with the relative low quality of education

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<sup>32</sup> Source: World Bank national accounts data, and OECD National Accounts data files. <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>.

system (based on the test and the observing of the control variables), and the skill and technology diffusion flow from the nations with the relative high quality and quantity of economic outcome (based on the test and the observing of the dependent variables) to the nations with the relative low quality and quantity of economic outcome (based on the test and the observing of the dependent variables).

## Case Analysis

According to the analysis framework, this research observes all of the independent, control, and dependent variables of Taiwan and the ASEAN member countries through the multi-national data comparative analysis for the test of the two hypothesis of this research.

### Background Domain

#### Analysis of IV01

Based on the data observing of IV01 in 2017, the score of inadequately educated workforce, the data of individual nation include Indonesia (8.8%, problem serious rank 13/16), Vietnam (10.4%, problem serious rank 2/16), Malaysia (7%, problem serious rank 7/16), Thailand (9.7%, problem serious rank 6/16), Philippines (2.1%, problem serious rank 12/16), Singapore (9.2%, problem serious rank 4/16), Cambodia (10.9%, problem serious rank 2/16), Lao PDR (14.1%, problem serious rank 1/16), Brunei Darussalam (7.3%, problem serious rank 7/16), Taiwan ROC (2.9%, problem serious rank 8/16). According to the data, there are four countries assess the variable of “inadequately educated workforce” as the more serious factor among the 16 factors, including Lao PDR (identifies it as the most problematic factor), Cambodia and Vietnam (identify it as the second problematic factor), and Singapore (identifies it as the fourth problematic factor).

#### Analysis of IV02

In accordance with the data observing of IV02 in 2017, the score of poor work ethic in national labor force, the data of individual nation include Indonesia (5.8%, problem serious rank 8/16), Vietnam (9.5%, problem serious rank 4/16), Malaysia (6.1%, problem serious rank 9/16), Thailand (4.1%, problem serious rank 10/16), Philippines (2.6%, problem serious rank 10/16), Singapore (5.8%, problem serious rank 5/16), Cambodia (5%, problem serious rank 11/16), Lao PDR (6.8%, problem serious rank 7/16), Brunei Darussalam (14.4%, problem serious rank 3/16), Taiwan ROC (2.1%, problem serious rank 11/16). According to the data, there are three countries assess the variable of “poor work ethic in national labor force” as the more serious factor among the 16 factors, including Brunei Darussalam (identifies it as the third problematic factor), Vietnam (identify it as the fourth problematic factor), and Singapore (identifies it as the fifth problematic factor).

#### Analysis of IV03

For the data compare of IV03 in 2017, labour force participation rate, the data of individual nation include Indonesia (67.2%), Vietnam (77.4%), Malaysia (67.7%), Thailand (69%), Philippines (63.5%), Singapore (68.3%), Cambodia (82.6%), Lao PDR (78.2%), Brunei Darussalam (65.6%), and Taiwan (58.83%<sup>33</sup>). According to the compare of this data, three top-

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<sup>33</sup> Source from National Statistics, R.O.C. (Taiwan):

rate countries are Cambodia (82.6%), Lao PDR (78.2%), and Vietnam (77.4%).

#### Analysis of IV04

Besides, observing the data of IV04 in 2017, youth not in employment, education or training rate, the data of individual nation include Indonesia (24.8%), Vietnam (11.3%), Malaysia (1.2%), Thailand (13.8%), Philippines (22.7%), Singapore (11.4%), Cambodia (12.7%), Lao PDR (5.1%), Brunei Darussalam (17.2%), and Taiwan (6.27<sup>34</sup>). According to the compare of this data, three top-rate countries are Indonesia (24.8%), Philippines (22.7%), and Brunei Darussalam (17.2%).

Meanwhile, according to the data of IV05 2014-2016, the percentage of employment by major industry group, the data of individual nation is as following. Observing the data of Indonesia, the employment population in the industry of “agriculture, fishery & forestry” is increasing from 24% to 31.9%, the employment population in the industry of “manufacturing” is decreasing from 13.3% to 13.1%, the employment population in the industry of “construction” is increasing from 6.4% to 6.7%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is increasing from 21.7% to 22.5%, the employment population in the industry of “transportation, storage, communication” is increasing a little from 4.5% to 4.7%, the employment population in the industry of “finance, insurance, real estate and business services” is increasing from 2.6% to 3%, the employment population in the industry of “public services” is increasing from 16.1% to 16.4%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” remains the same value of 1.5%.

Observing the data of Vietnam, the employment population in the industry of “agriculture, fishery & forestry” is decreasing from 47.9% to 41.9%, the employment population in the industry of “manufacturing” is increasing from 14.9% to 16.6%, the employment population in the industry of “construction” is increasing from 6.2% to 7.1%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” remains at the same value of 17.3%, the employment population in the industry of “transportation, storage, communication” is increasing a little from 3.6% to 3.7%, the employment population in the industry of “finance, insurance, real estate and business services” remains at the same value of 2%, the employment population in the industry of “public services” is increasing from 6.7% to 10%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” remains the same value of 1.4%.

Observing the data of Malaysia, the employment population in the industry of “agriculture, fishery & forestry” is decreasing from 12.2% to 11.4%, the employment population in the industry of “manufacturing” is decreasing from 17.1% to 16.9%, the employment population in the industry of “construction” is decreasing from 9.2% to 8.8%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is decreasing from 25.1% to 25%, the employment population in the industry of “transportation, storage, communication” remains at the same value of 5.9%, the employment population in the industry of “finance, insurance, real estate and business services” remains at the same value of 3%, the employment population in the industry of “public services” is decreasing from 5.4% to 5.3%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water,

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<https://www.stat.gov.tw/ct.asp?xItem=37135&ctNode=517&mp=4>.

<sup>34</sup> Source from National Statistics, R.O.C. (Taiwan):

<https://www.stat.gov.tw/ct.asp?xItem=37135&ctNode=517&mp=4>.

unknown)” is increasing from 22.2% to 22.6%.

Observing the data of Thailand, the employment population in the industry of “agriculture, fishery & forestry” is decreasing from 32.4% to 30.2%, the employment population in the industry of “manufacturing” is decreasing from 16.3% to 16.2%, the employment population in the industry of “construction” is increasing from 5.8% to 6%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is increasing from 22.3% to 23.3%, the employment population in the industry of “transportation, storage, communication” remains at the same value of 3.7%, the employment population in the industry of “finance, insurance, real estate and business services” is increasing from 2.6% to 2.8%, the employment population in the industry of “public services” is increasing from 1.3% to 1.5%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” is increasing from 15.7% to 16.3%.

Observing the data of Philippines, the employment population in the industry of “agriculture, fishery & forestry” is decreasing from 30.8% to 28.3%, the employment population in the industry of “manufacturing” remains at the same value of 8.1%, the employment population in the industry of “construction” is increasing from 6.6% to 8.1%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is increasing from 23.4% to 23.6%, the employment population in the industry of “transportation, storage, communication” is increasing a little from 7.9% to 8.1%, the employment population in the industry of “finance, insurance, real estate and business services” is increasing from 5.1% to 5.7%, the employment population in the industry of “public services” is decreasing from 10.6% to 10.4%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” is increasing from 7.5% to 7.6%.

Observing the data of Singapore, the employment population in the industry of “manufacturing” is decreasing from 11.9% to 10.5%, the employment population in the industry of “construction” remains at the same value of 4.7%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is increasing from 23% to 23.2%, the employment population in the industry of “transportation, storage, communication” is increasing a little from 13.1% to 12.6%, the employment population in the industry of “finance, insurance, real estate and business services” is increasing from 22.7% to 24.3%, the employment population in the industry of “public services” is increasing from 23.5% to 23.8%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” is decreasing from 1.2% to 0.9%.

Observing the data of Cambodia, the employment population in the industry of “agriculture, fishery & forestry” is decreasing from 64.8% to 54.9%, the employment population in the industry of “manufacturing” is increasing from 9.1% to 13.1%, the employment population in the industry of “construction” is increasing from 2.1% to 5%, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is increasing from 12.8% to 17%, the employment population in the industry of “transportation, storage, communication” is increasing a little from 2.7% to 4.5%, the employment population in the industry of “finance, insurance, real estate and business services” is increasing from 0.3% to 0.4%, the employment population in the industry of “public services” is decreasing from 7.8% to 3.3%, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” is increasing from 1.3% to 1.9%.

Observing the data of Taiwan (R.O.C.), the employment population in the industry of

“agriculture, fishery & forestry” is 5% in 2017, the employment population in the industry of “manufacturing” is 75% in 2017, the employment population in the industry of “construction” is 22.2% in 2017, the employment population in the industry of “wholesales & retail trade, restaurants & hotel” is 12.3% in 2017, the employment population in the industry of “transportation, storage, communication” is 7% in 2017, the employment population in the industry of “finance, insurance, real estate and business services” is 6.3% in 2017, the employment population in the industry of “public services” is 6% in 2017, and the employment population in the industry of “others (mining, quarrying, electricity, gas & water, unknown)” is 0.09% in 2017<sup>35</sup>.

#### Analysis of IV05

According to the data of the variable of “percentage of employment by occupation” of Indonesia, the value of the variable of “professionals, technical and related workers” is 7%, “administrative, executive and managerial workers” is 1.2%, “clerical and related workers” is 6.8%, “sales workers and services workers” is 23%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 31.3%, “production and related workers, transport equipment operators and labours” is 29%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 1.7% ( ASEAN, 2017: 37 ) .

According to the data of the variable of “percentage of employment by occupation” of Vietnam, the value of the variable of “professionals, technical and related workers” is 9.9%, “administrative, executive and managerial workers” is 1%, “clerical and related workers” is 1.9%, “sales workers and services workers” is 16.6%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 10.3%, “production and related workers, transport equipment operators and labours” is 22%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 36.2% ( ASEAN, 2017: 37 ) .

According to the data of the variable of “percentage of employment by occupation” of Malaysia, the value of the variable of “professionals, technical and related workers” is 22.7%, “administrative, executive and managerial workers” is 4.6%, “clerical and related workers” is 8.2%, “sales workers and services workers” is 22.4%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 6.2%, “production and related workers, transport equipment operators and labours” is 22.9%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 13% ( ASEAN, 2017: 37 ) .

According to the data of the variable of “percentage of employment by occupation” of Thailand, the value of the variable of “professionals, technical and related workers” is 8.7%, “administrative, executive and managerial workers” is 3.8%, “clerical and related workers” is 4%, “sales workers and services workers” is 19.6%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 27.6%, “production and related workers, transport equipment operators and labours” is 21%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 15.3% ( ASEAN, 2017: 37 ) .

According to the data of the variable of “percentage of employment by occupation” of Philippines, the value of the variable of “professionals, technical and related workers” is 7.5%, “administrative, executive and managerial workers” is 15.8%, “clerical and related workers” is

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<sup>35</sup> Source from National Statistics, R.O.C. (Taiwan):  
<https://www.stat.gov.tw/ct.asp?xItem=37135&ctNode=517&mp=4>.



6.2%, “sales workers and services workers” is 19.3%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 13.6%, “production and related workers, transport equipment operators and labourers” is 37.1%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 0.5% ( ASEAN, 2017: 37) .

According to the data of the variable of “percentage of employment by occupation” of Singapore, the value of the variable of “professionals, technical and related workers” is 40.1%, “administrative, executive and managerial workers” is 15%, “clerical and related workers” is 11.1%, “sales workers and services workers” is 12.4%, “production and related workers, transport equipment operators and labourers” is 10.7%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 10.7% ( ASEAN, 2017: 37) .

According to the data of the variable of “percentage of employment by occupation” of Cambodia, the value of the variable of “professionals, technical and related workers” is 3.7%, “administrative, executive and managerial workers” is 0.8%, “clerical and related workers” is 3.9%, “sales workers and services workers” is 15.3%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 58.1%, “production and related workers, transport equipment operators and labourers” is 17.3%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 0.9% ( ASEAN, 2017: 37) .

According to the data of the variable of “percentage of employment by occupation” of Brunei, the value of the variable of “professionals, technical and related workers” is 33.2%, “administrative, executive and managerial workers” is 7.6%, “clerical and related workers” is 1.4%, “sales workers and services workers” is 19.5%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 1.4%, “production and related workers, transport equipment operators and labourers” is 13%, and “others(mining, quarrying, electricity, gas & water, unknown)” is 13.9% ( ASEAN, 2017: 37) .

According to the data of the variable of “percentage of employment by occupation” of Taiwan, the value of the variable of “professionals, technical and related workers” is 12.4%, “administrative, executive and managerial workers” is 3.3%, “sales workers and services workers” is 20%, “agricultural, animal husbandry and forestry workers; fishermen and hunters” is 4.4%, “production and related workers, transport equipment operators and labours” is 31% ( ASEAN, 2017: 37) .

## Education Domain

### Analysis of CV01

Observing the score rank of the control variable of “quality of primary education”, the score rank of Indonesia is 47/137, Vietnam is 93/137, Malaysia is 23/137, Thailand is 89/137, Philippines is 66/137, Singapore is 3/137, Cambodia is 112/137, Lao PDR is 88/137, Brunei is 27/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Brunei was ranked as the third among the ASEAN countries in this variable.

### Analysis of CV02

For the score rank of the variable of “primary education enrollment rate”, the score rank of Indonesia is 106/137, Vietnam is 36/137, Malaysia is 32/137, Thailand is 100/137, Philippines

is 66/137, Singapore is 1/137, Cambodia is 73/137, Lao PDR is 93/137, Brunei is 46/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Vietnam was ranked as the third one among the ASEAN countries in this variable. And the primary education enrollment rate of Taiwan is 97.23% in 2017.

#### Analysis of CV03

Observing the score rank of the control variable of “secondary education enrollment rate”, the score rank of Indonesia is 85/137, Vietnam is 68/137, Malaysia is 92/137, Thailand is 8/137, Philippines is 80/137, Singapore is 25/137, Cambodia is 117/137, Lao PDR is 106/137, Brunei is 59/137. Thailand was ranked as the top, Singapore was ranked as the second, and Brunei was ranked as the third one among the ASEAN countries in this variable. And the secondary education enrollment rate of Taiwan is 95.78% in 2017.

#### Analysis of CV04

Based on the data of the score rank of the variable of “tertiary education enrollment rate”, the score rank of Indonesia is 91/137, Vietnam is 84/137, Malaysia is 89/137, Thailand is 59/137, Philippines is 77/137, Singapore is 4/137, Cambodia is 108/137, Lao PDR is 101/137, Brunei is 80/137. Singapore was ranked as the top, Thailand was ranked as the second, and Brunei was ranked as the third one among the ASEAN countries in this variable. And the tertiary education enrollment rate of Taiwan is 71.13% in 2017.

#### Analysis of CV05

Observing the score rank of the control variable of “the quality of the education system”, the score rank of Indonesia is 33/137, Vietnam is 71/137, Malaysia is 14/137, Thailand is 65/137, Philippines is 46/137, Singapore is 2/137, Cambodia is 79/137, Lao PDR is 53/137, Brunei is 34/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Indonesia was ranked as the third one among the ASEAN countries in this variable.

#### Analysis of CV06

Based on the data of the score rank of the variable of “the quality of math and science education”, the score rank of Indonesia is 40/137, Vietnam is 85/137, Malaysia is 16/137, Thailand is 83/137, Philippines is 76/137, Singapore is 1/137, Cambodia is 111/137, Lao PDR is 88/137, Brunei is 34/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Brunei was ranked as the third one among the ASEAN countries in this variable.

#### Analysis of CV07

Observing the score rank of the control variable of “the quality of management schools”, the score rank of Indonesia is 42/137, Vietnam is 120/137, Malaysia is 25/137, Thailand is 78/137, Philippines is 38/137, Singapore is 4/137, Cambodia is 123/137, Lao PDR is 80/137, Brunei is 64/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Philippines was ranked as the third one among the ASEAN countries in this variable.

#### Analysis of CV08

Based on the data of the score rank of the variable of “the internet access in schools”, the score

rank of Indonesia is 45/137, Vietnam is 77/137, Malaysia is 27/137, Thailand is 48/137, Philippines is 62/137, Singapore is 1/137, Cambodia is 101/137, Lao PDR is 96/137, Brunei is 40/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Brunei was ranked as the third one among the ASEAN countries in this variable.

#### Analysis of CV09

Observing the score rank of the control variable of “local availability of specialized training services”, the score rank of Indonesia is 45/137, Vietnam is 108/137, Malaysia is 18/137, Thailand is 90/137, Philippines is 43/137, Singapore is 4/137, Cambodia is 117/137, Lao PDR is 95/137, Brunei is 98/137. Thailand was ranked as the top, Malaysia was ranked as the second, and Philippines was ranked as the third one among the ASEAN countries in this variable.

#### Analysis of CV010

Based on the data of the score rank of the variable of “extent of staff training”, the score rank of Indonesia is 30/137, Vietnam is 71/137, Malaysia is 9/137, Thailand is 47/137, Philippines is 38/137, Singapore is 5/137, Cambodia is 84/137, Lao PDR is 74/137, Brunei is 55/137. Singapore was ranked as the top, Malaysia was ranked as the second, and Indonesia was ranked as the third one among the ASEAN countries in this variable.

### Economic Outcome Domain

#### Analysis of DV01

Observing the variable of “GDP share of major group of economic sectors 2013-2016”, the top three countries in the industry sector in 2013 are Brunei (63.2%), Indonesia (42.1%), and Malaysia (39.3%); and top four countries in the services sector in 2013 are Singapore (72.4%), Taiwan (64.85%), Philippines (56.7%), and Malaysia (51.1%).

The top three countries in the industry sector in 2014 are Brunei (62%, decreased from 2013), Indonesia (41.8%, decreased from 2013), and Malaysia (39.3%); and top four countries in the services sector in 2014 are Singapore (72.6%, increased from 2013), Taiwan (63.41%), Philippines (56.6%, decreased from 2013), and Thailand (56.1%).

The top three countries in the industry sector in 2015 are Brunei (62.2%, increased from 2014), Indonesia (41%, decreased from 2014), and Malaysia (39.4%, increased from 2014); and top four countries in the services sector in 2015 are Singapore (74%, increased from 2014), Taiwan (63.17%), Philippines (57.1%, increased from 2014), and Thailand (57%, increased from 2014).

The top three countries in the industry sector in 2016 are Indonesia (40.6%, decreased from 2015), Vietnam (39.1%), and Malaysia (38.9%, decreased from 2015); and top four countries in the services sector in 2016 are Singapore (73.7%, decreased from 2015), Thailand (57.6%, increased from 2015), Taiwan (63.13%), and Philippines (57.5%, increased from 2015).

Observing the value development of “GDP share of major group of economic sectors 2013-2016” in Taiwan, the share rate in agriculture is increasing little 2013-2016 from 1.69% to 1.82%; the share rate in industry is increasing stably 2013-2016 from 33.46% to 35.06%; and the share rate in services is decreasing a little 2013-2016 from 64.85% to 63.13%.

#### Analysis of DV02

The development trend of the variable of “ASEAN total trade in goods 2007-2016” is followed a regular model which is divided into three groups of countries, including high Value (US\$ million) group of Singapore (with top value in 2013 and now is decreasing lower than the values of 2010-2015), Thailand (with top value in 2012 and now is decreasing lower than the values of 2011-2015), and Malaysia (with top value in 2014 and now is decreasing lower than the values of 2010-2013); middle Value (US\$ million) group of Indonesia (with stable increasing values year by year), Philippines (with stable increasing values year by year), and Vietnam (with stable increasing values year by year); and low Value (US\$ million) group of Brunei (with top value in 2012 and now is decreasing lower than the value of 2007), Cambodia (with stable increasing values year by year), Lao PDR (with stable increasing values year by year), and Myanmar (with stable increasing values year by year).

#### Analysis of DV03

The development trend of the variable of “Intra-ASEAN trade in goods 2007-2016” is followed a regular model which is divided into three groups of countries, including high Value (US\$ million) group of Singapore (with top value in 2013 and now is decreasing and close to the value of 2007), Malaysia (with stable increasing values year by year), and Indonesia (with stable increasing values year by year); middle Value (US\$ million) group of Thailand (with top value in 2013 and now is decreasing lower than the value of 2012-2015), Vietnam (with stable increasing values year by year), and Philippines (with stable increasing values year by year); and low Value (US\$ million) group of Myanmar (with stable increasing development gradually), Brunei (with top value in 2013 and now is decreasing lower than the value of 2007), Cambodia (with stable and slow increasing values year by year), and Lao PDR (with stable increasing values and now is higher than the value of Brunei in 2016). And the values of the “exports of services” in Taiwan 2013-2016 are US\$ million 36461, US\$ million 41491, US\$ million 40986, US\$ million 41360.

#### Analysis of DV04

The development trend of the variable of “ASEAN exports of services by country 2007-2016” is followed a regular model which is divided into three groups of countries, including high Value (US\$ million) group of Singapore (with top value in 2013 and now is decreasing lower than the values of 2010-2015), Malaysia (with top value in 2013 and now is decreasing lower than the values of 2011-2015), and Thailand (with top value in 2013 and now is decreasing lower than the values of 2012-2015); middle Value (US\$ million) group of Indonesia (competitive value comparing with the high value group in 2007, 2010, 2011 and 2012, but decreased fast 2013-2016), Vietnam (with stable increasing values year by year), and Philippines (with stable increasing values year by year); and low Value (US\$ million) group of Brunei (with stable decreasing development gradually), Cambodia (with stable increasing values year by year), Lao PDR (with stable and slow increasing values year by year), and Myanmar (with stable and dramatic increasing values year by year). And the values of the “imports of services” in Taiwan 2013-2016 are US\$ million 51663, US\$ million 52907, US\$ million 51669, US\$ million 51699.

#### Analysis of DV05

The development trend of the variable of “ASEAN imports of services by country 2007-2016”

is followed a regular model which is divided into three groups of countries, including high Value (US\$ million) group of Singapore (with stable increasing values, and the value of 2016 is double of the value of 2007), Thailand (with top value in 2013 and now is decreasing lower than the values of 2011-2014), and Malaysia (with top value in 2013 and now is decreasing lower than the values of 2012-2015); middle Value (US\$ million) group of Philippines (with stable and dramatic increasing values year by year), Vietnam (with stable and dramatic increasing values, and the value of 2016 is more than the double value of 2007), and Indonesia (with top value in 2013 and now is decreasing lower than the values of 2011-2014); and low Value (US\$ million) group of Brunei (with top value in 2013 and now is decreasing lower than the values of 2011-2015), Cambodia (with stable increasing values year by year), Myanmar (with dramatic and fast increasing values and the value of 2016 is more than the fourth times of the value of 2007), and Lao PDR (with stable and slow increasing values year by year).

#### Analysis of DV06

Observing the development of the variable of “rate of GDP growth 2007-2016”, top three countries with the high rate of GDP growth 2007-2016 are Lao PDR, Cambodia, and Myanmar. Moreover, the development of the rate of GDP growth 2007-2016 is different from country to country. Top one with the highest positive rate of GDP growth is Lao PDR, whose rate of GDP growth is increasing from 6% to 7% (increase 1%). Then, the following countries are Philippines, whose rate of GDP growth is increasing from 6.6% to 6.9% (increase 0.3%); Vietnam, whose rate of GDP growth is decreasing from 7.1% to 6.2% (decrease 0.9%); Indonesia, whose rate of GDP growth is decreasing from 6.3% to 5% (decrease 1.3%); Malaysia and Thailand, whose rates of GDP growth are 4.2% and 3.2% in 2016 (decrease 2.1%); Brunei, whose rate of GDP growth is decreasing from 0.6% to -2.5% (decrease 3.1%); Cambodia, whose rate of GDP growth is decreasing from 10.2% to 6.9% (decrease 3.3%); Myanmar, whose rate of GDP growth is decreasing from 12% to 5.7% (decrease 6.3%); Singapore, whose rate of GDP growth is decreasing from 9.1% to 2% (decrease 7.1%). And the rates of GDP growth in Taiwan 2007-2016 are 6.52% in 2007, 0.7% in 2008, -1.57% in 2009, 10.63% in 2010, 3.8% in 2011, 2.06% in 2012, 2.2% in 2013, 4.02% in 2014, 0.81% in 2015, and 1.4% in 2016.

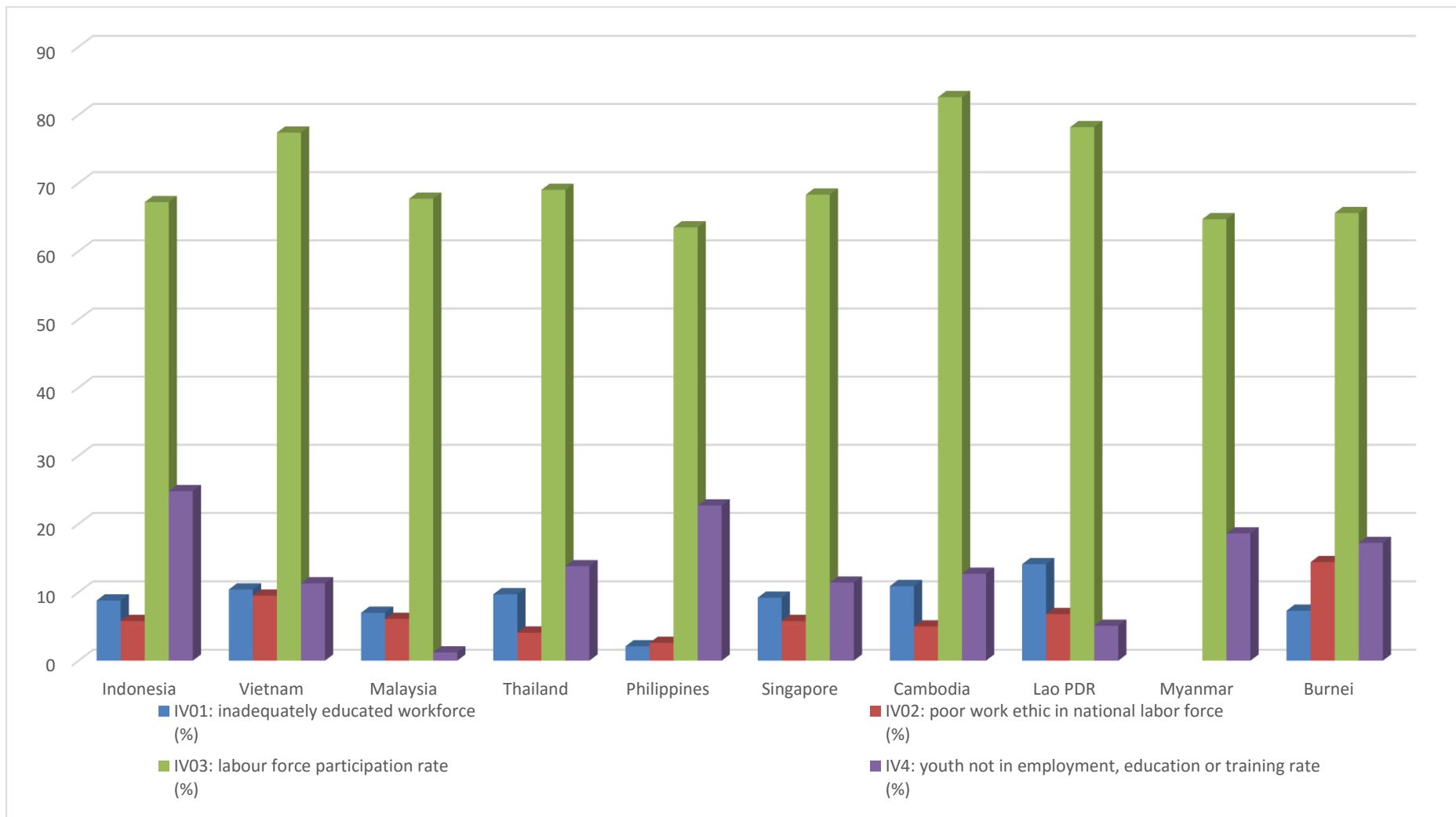


Figure 1 The Statistical Chart of IV01-IV04

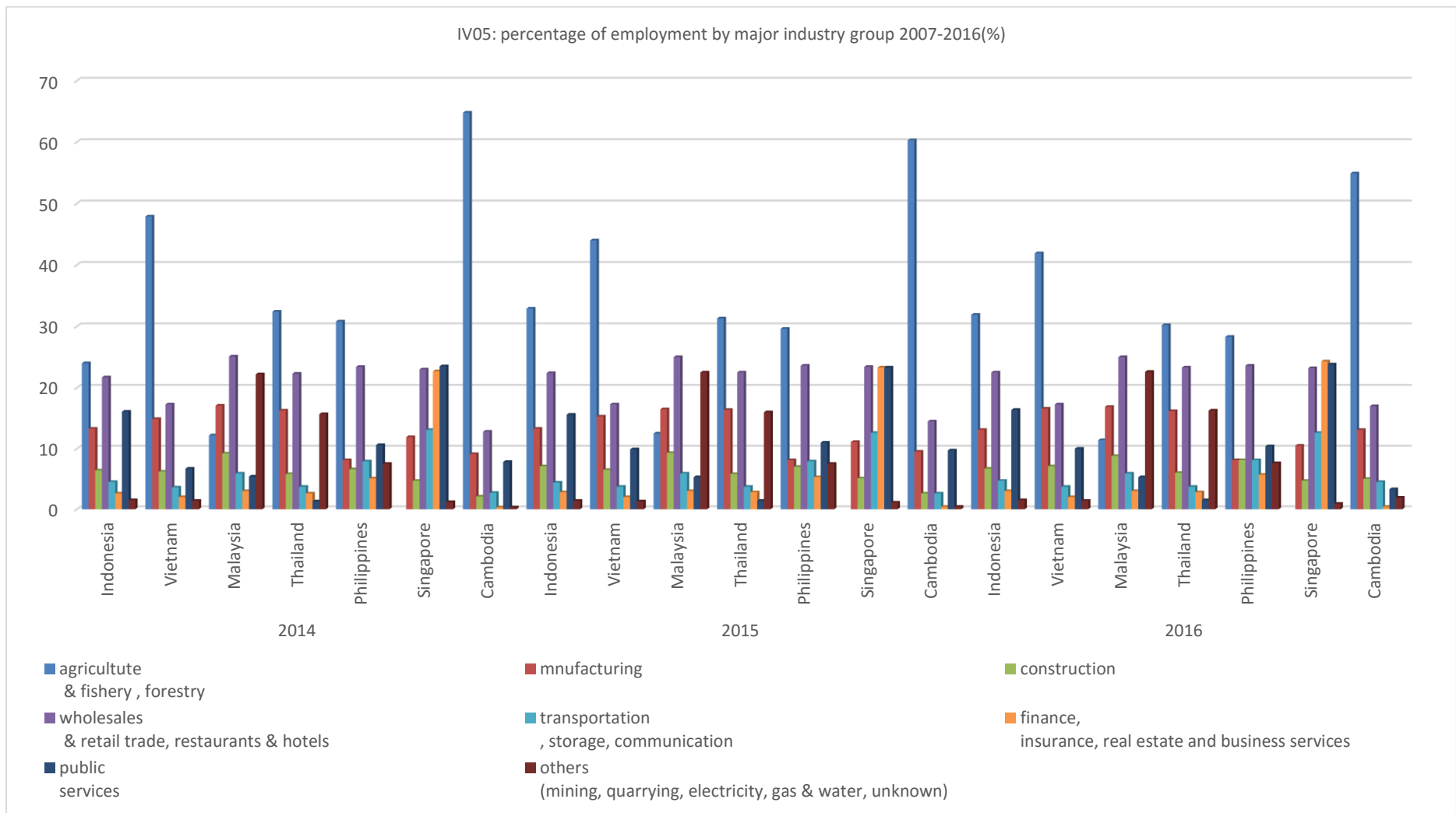


Figure 2 The Statistical Chart of IV05

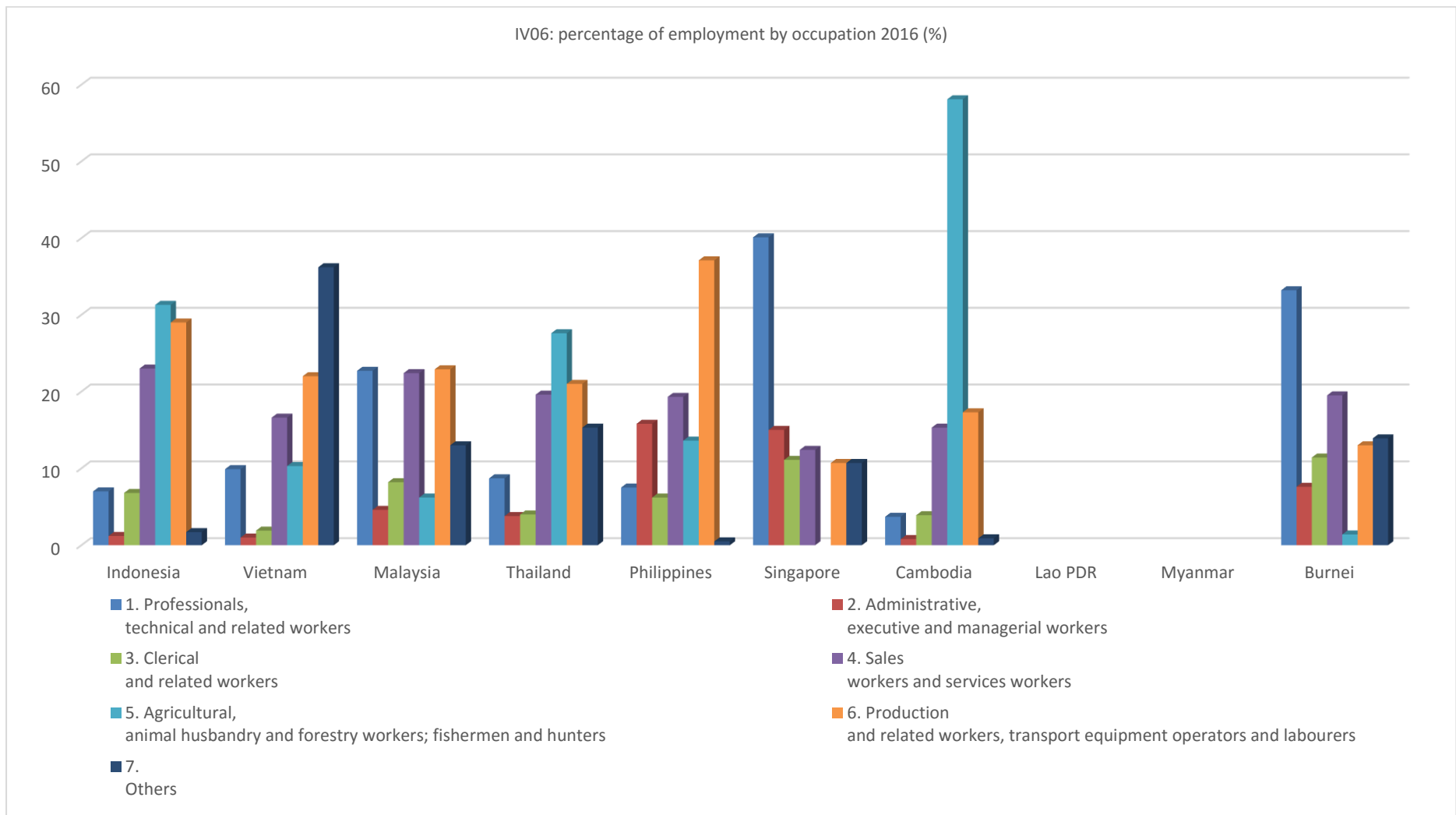


Figure 3 The Statistical Chart of IV06



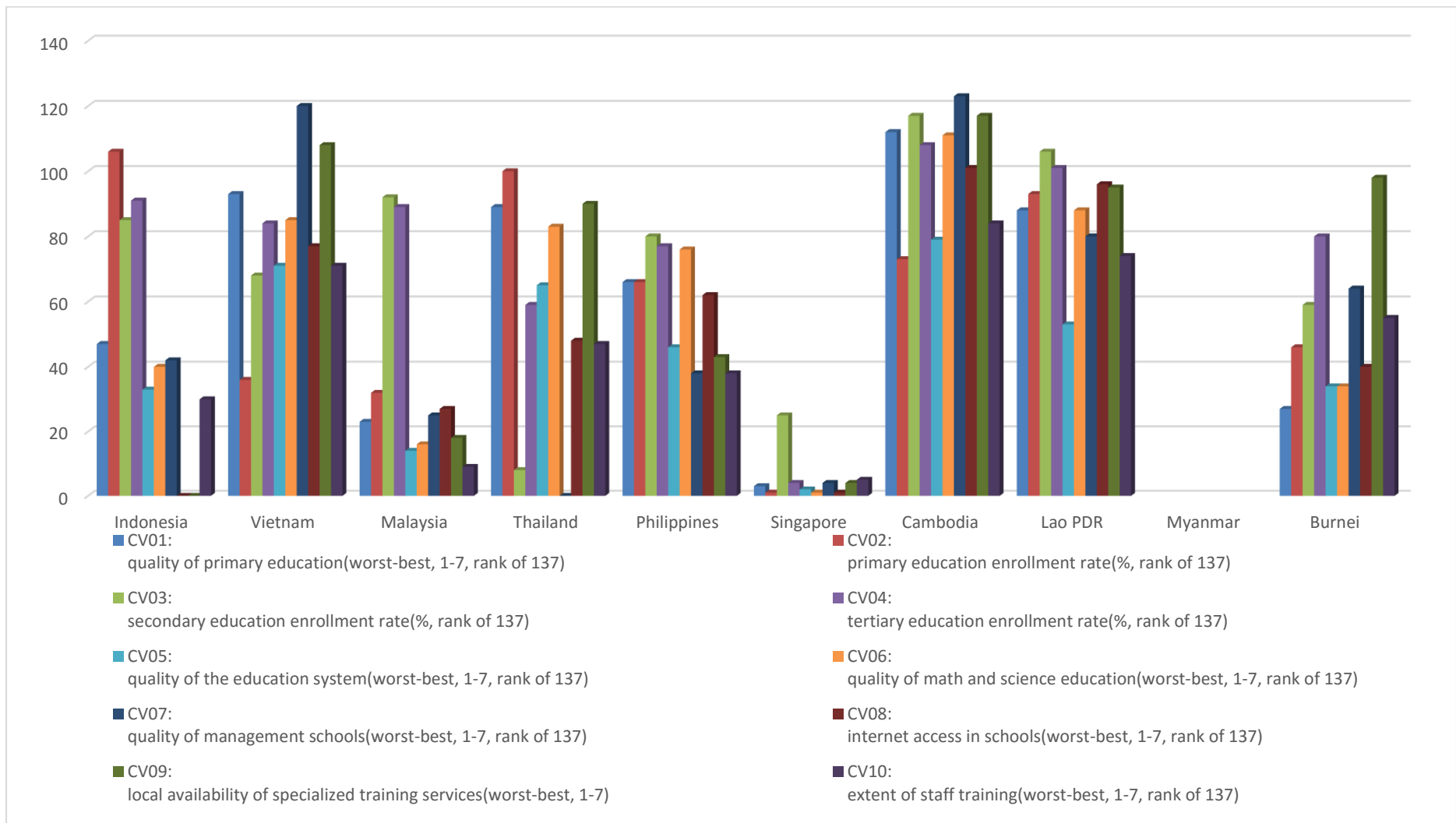


Figure 4 The Statistical Chart of CV01-CV10

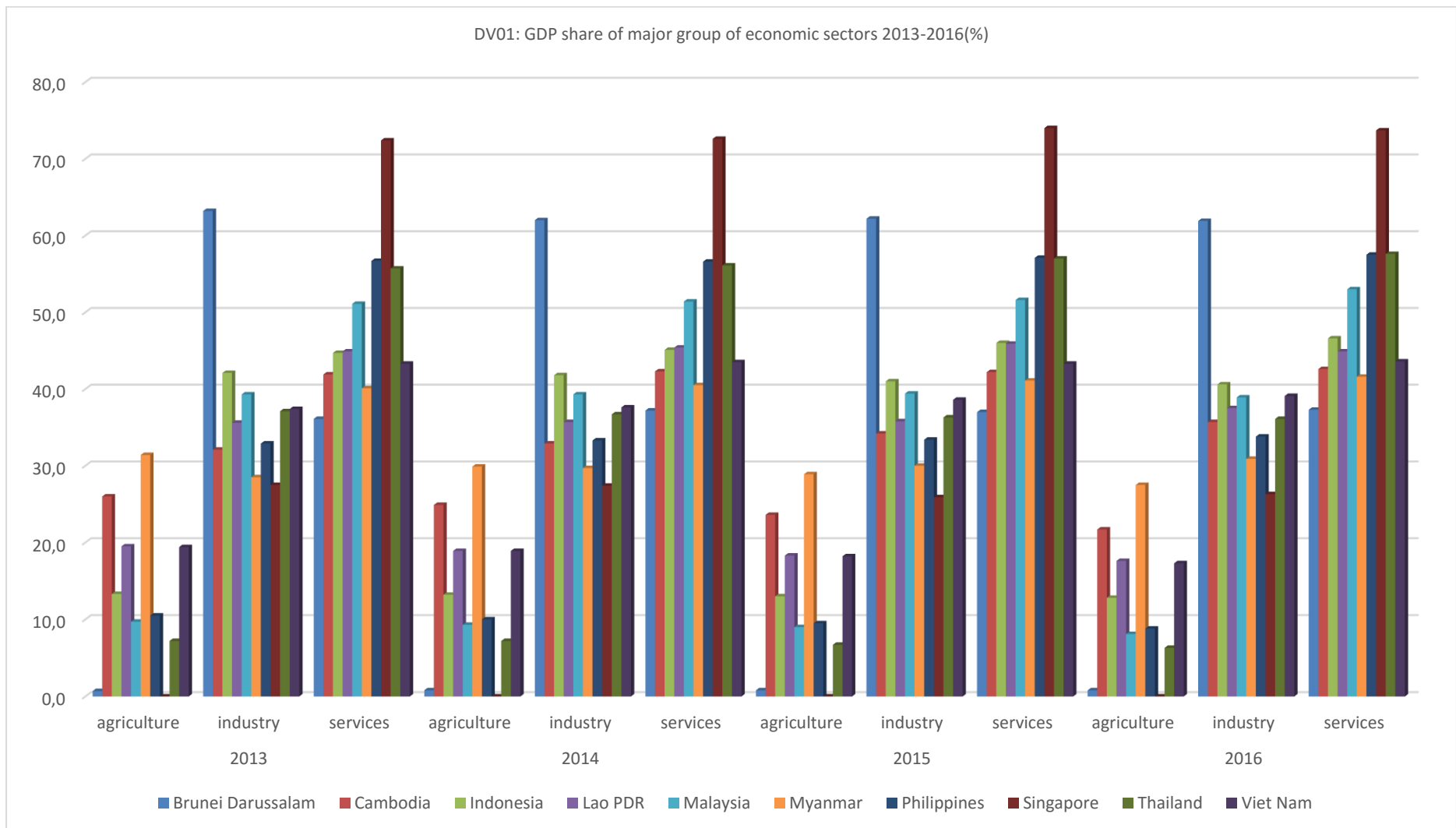


Figure 5 The Statistical Chart of DV01

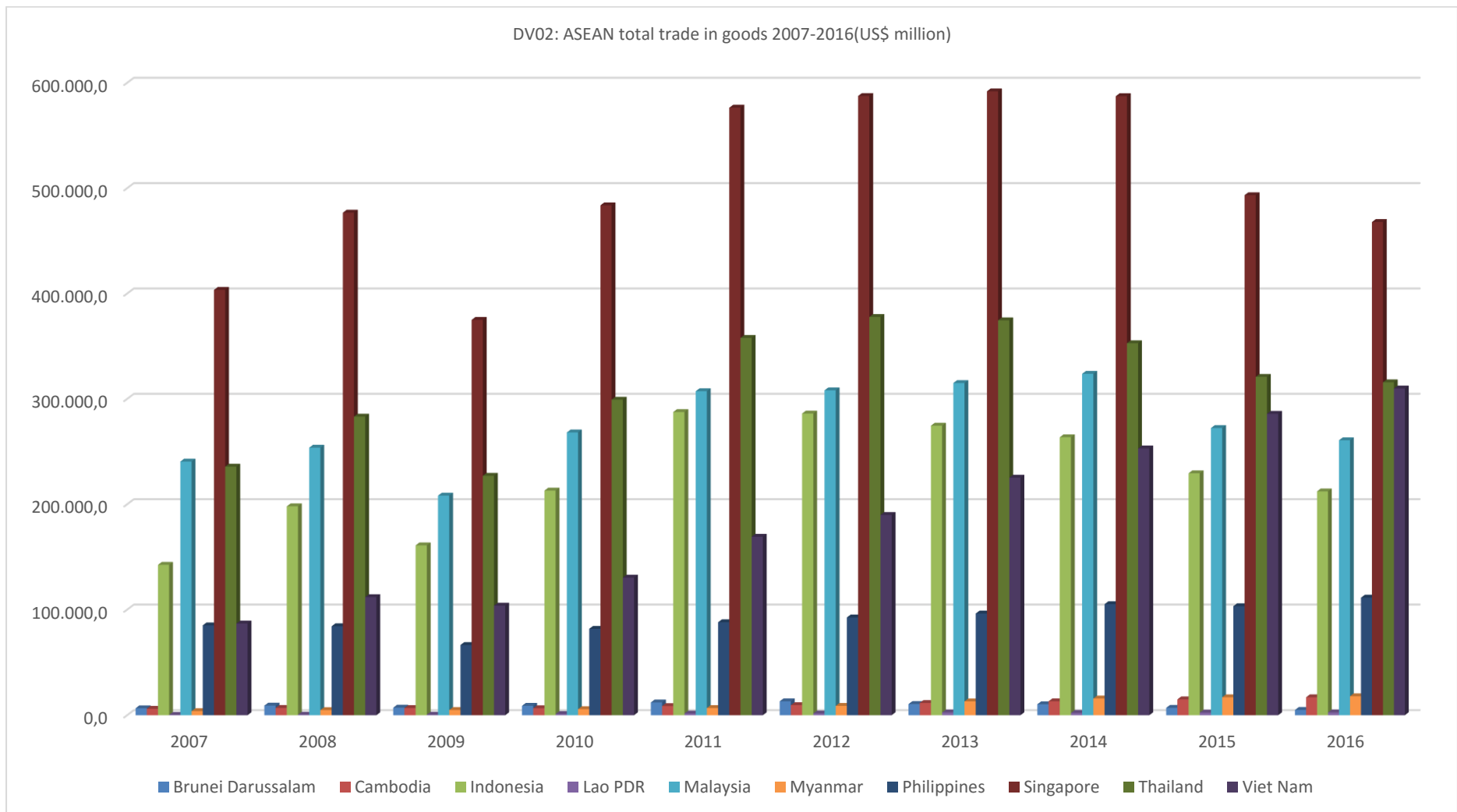


Figure 6 The Statistical Chart of DV02

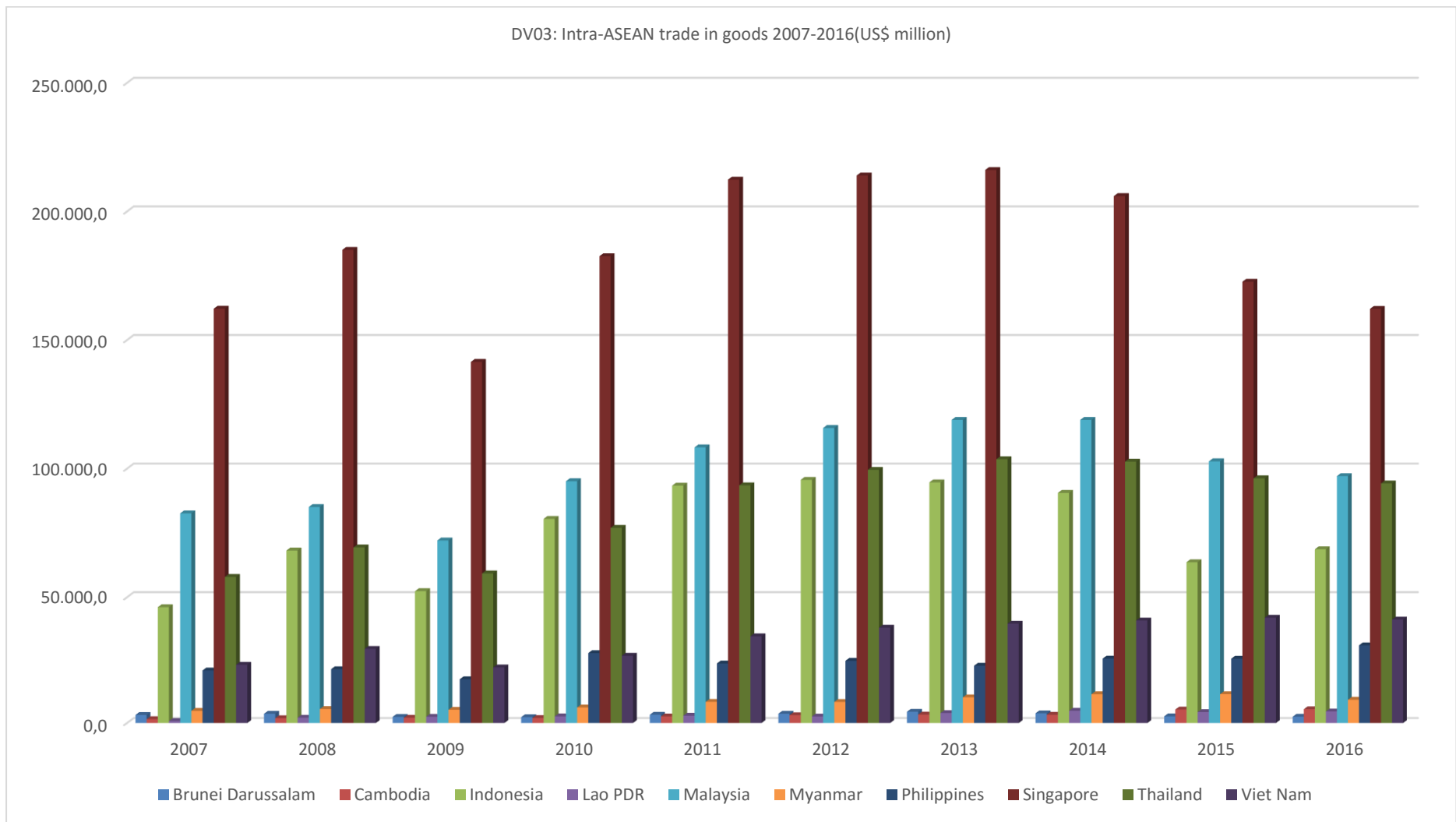


Figure 7 The Statistical Chart of DV03

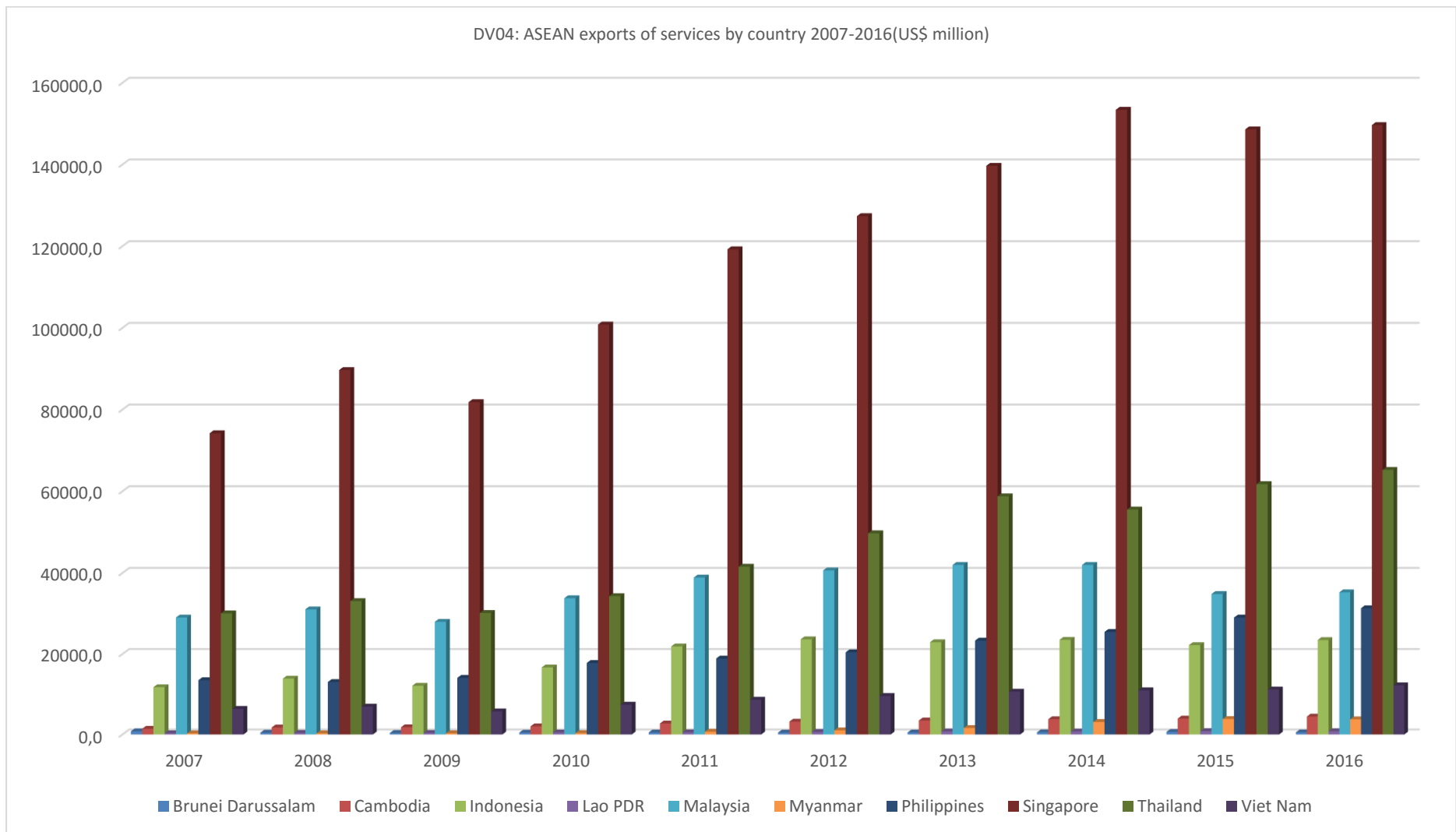


Figure 8 The Statistical Chart of DV04

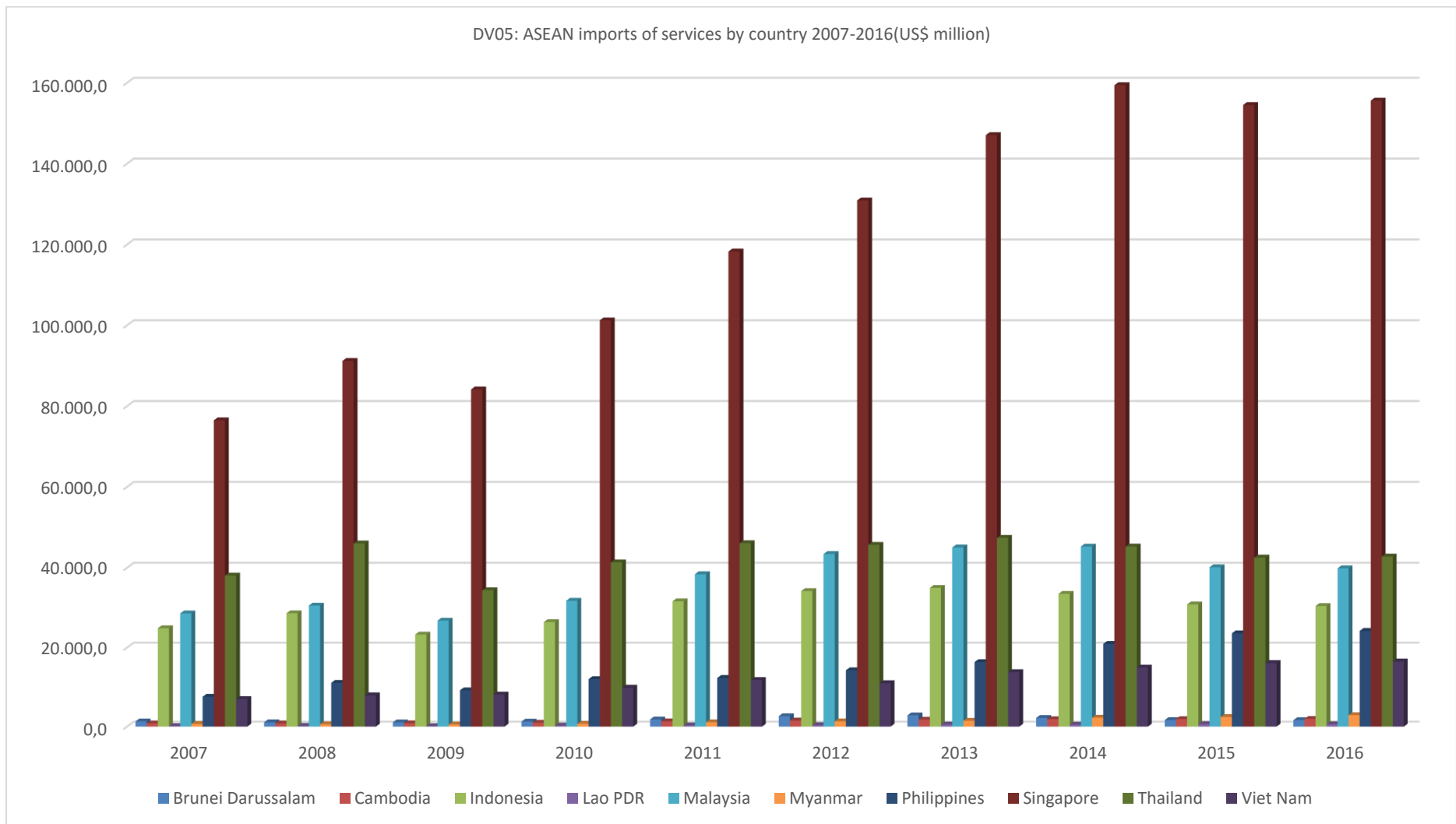


Figure 9 The Statistical Chart of DV05

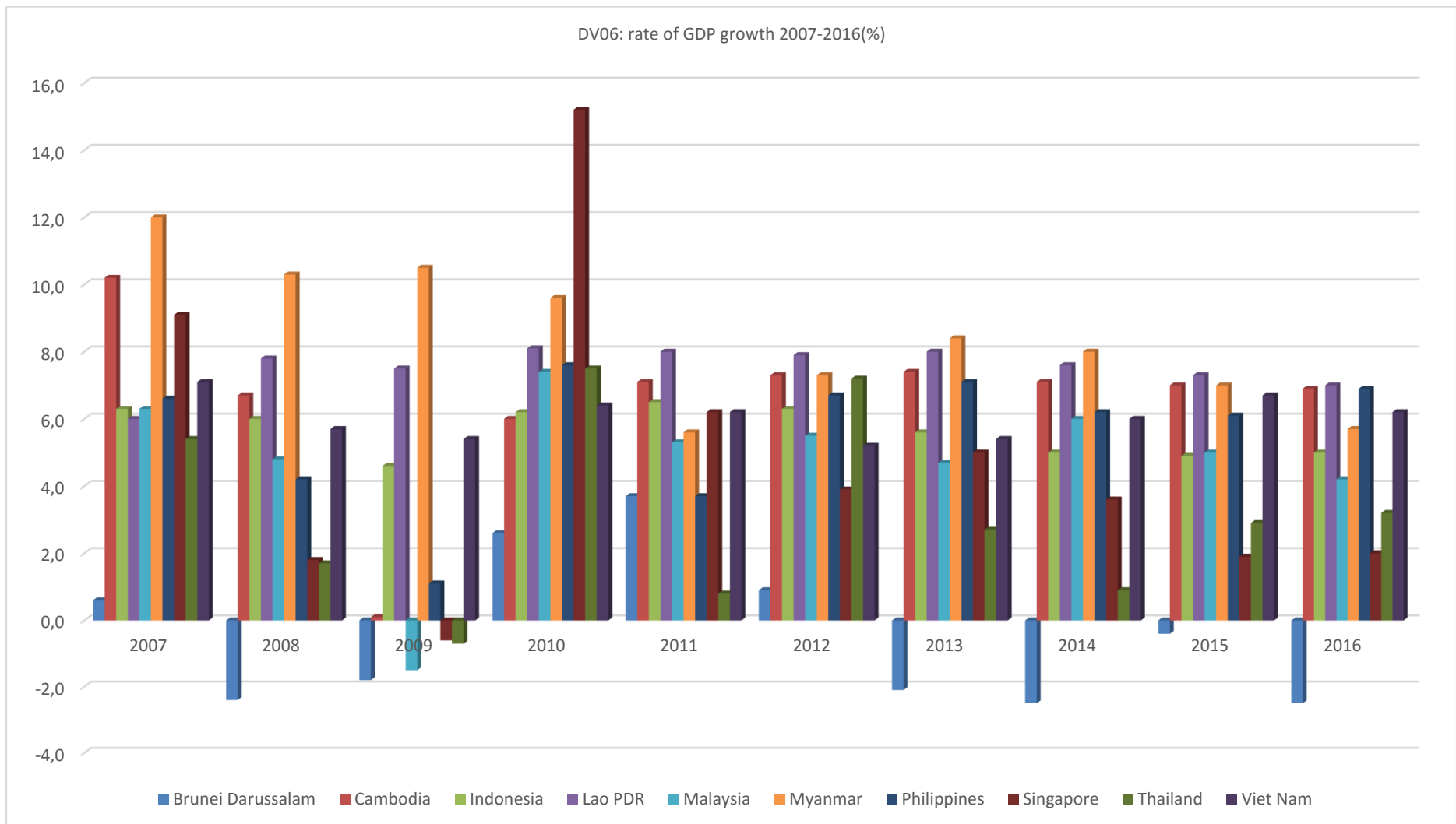


Figure 10 The Statistical Chart of DV06

## **Conclusion - Education Benchmark Road Map Construction**

Observing analysis results of all of the variables from background domain, education domain, and economic outcome domain, there are several road maps are constructed as well as the test results of the two hypotheses as the following details.

### **Road Map Construction by Variables of Background Domain**

According to the analysis of IV01, Indonesia, Philippines, Singapore, and Taiwan are the countries which assess the problematic factor of the “inadequately educated workforce” as the less problematic factor with the domestic impacts on the environment of doing business; therefore, the skilled workforce from Indonesia, Philippines, Singapore, and Taiwan might have the qualified competencies to migrate (flow) to the rest of the countries in Southeast Asia, especially focus on the skill flowing destination of Vietnam, Cambodia, and Lao PDR.

Besides, based on the analysis of IV02, Thailand, Philippines, Singapore, Taiwan, and Cambodia are the countries which assess the problematic factor of the “poor work ethic in national labor force” as the less problematic factor with the domestic impacts on the environment of doing business; therefore, the skilled workforce from Thailand, Philippines, Singapore, Taiwan, and Cambodia might have the qualified competencies to migrate (flow) to the rest of the countries in Southeast Asia, especially focus on the skill flowing destination of Vietnam and Brunei.

Moreover, observing the analysis of IV03, Vietnam, Cambodia, and Lao PDR are the top three countries with the high labor force participation rates in the Southeast Asia area; and it also replies that these three countries can be identified as the labor-intensive economies. For the purpose of economic upgrading for these three countries, skilled labors from the rest of the countries can migrate (flow) into these three countries.

Furthermore, based on the analysis of IV04, Malaysia is the top one countries with the lowest value of youth not in employment, education or training in all of the Southeast Asian countries; therefore, the youth workforce are assumed to accept employed, educated or trained more adequately than the rest of the ASEAN member countries, and the skilled labors (youth skilled labors) from Malaysia might have the adequately competencies to flow into the other ASEAN membership such as Indonesia, Philippines, or Myanmar with high rates.

Observing the values of IV05, the road map can be drawn by 8 different major industry groups. For the industry group of “agriculture & fishery, forestry”, skilled labors from Vietnam and Cambodia might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “manufacturing”, skilled labors from Vietnam, Malaysia, and Thailand might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “construction”, skilled labors from Malaysia, Philippines, and Taiwan might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “wholesales & retail trade, restaurants & hotels”, skilled labors from Malaysia, Thailand, Philippines, and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “transportation, storage, communication”, skilled labors from Philippines and



Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “finance, insurance, real estate and business services”, skilled labors from Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “public services”, skilled labors from Indonesia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the industry group of “others (mining, quarrying, electricity, gas & water, unknown)”, skilled labors from Malaysia and Thailand might have the qualified competencies to flow into the rest of the countries in the Southeast Asia.

Observing the values of IV06, the road map can be drawn by 7 different occupations. For the occupation of “professionals, technical and related workers”, skilled labors from Malaysia, Singapore, and Brunei might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “administrative, executive and managerial workers”, skilled labors from Philippines and Brunei might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “clerical and related workers”, skilled labors from Singapore and Brunei might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “sales workers and services workers”, skilled labors from Indonesia, Malaysia, Brunei, and Taiwan might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “agricultural, animal husbandry and forestry workers; fishermen and hunters”, skilled labors from Indonesia and Cambodia might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “production and related workers, transport equipment operators and labour”, skilled labors from Indonesia and Taiwan might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For the occupation of “others”, skilled labors from Vietnam and Brunei might have the qualified competencies to flow into the rest of the countries in the Southeast Asia.

#### Road Map Construction by Variables of Education Domain

Based on the results of data compare of CV01, “quality of primary education”, skilled labors from Malaysia, Singapore, and Brunei might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. Observing the data compare of CV02, “primary education enrollment rate”, skilled labors from Vietnam, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. Besides, according to the results of data compare of CV03, “secondary education enrollment rate”, skilled labors from Vietnam, Thailand and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. Furthermore, based on the data compare of CV04, “tertiary education enrollment rate”, skilled labors from Thailand, Philippines and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. Meanwhile, observing the data compare of CV05, “quality of the education system”, skilled labors from Indonesia, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. In addition, according to the data compare of CV06, “quality of math and science education”, skilled labors from Malaysia, Brunei and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. And based on the data compare of CV07, “quality of management schools”, skilled labors

from Philippines, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. For observing the data compare of CV08, “internet access in schools”, skilled labors from Brunei, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. According to the data compare of CV09, “local availability of specialized training services”, skilled labors from Philippines, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia. Finally, observing the data compare of CV10, “extent of staff training”, skilled labors from Indonesia, Malaysia and Singapore might have the qualified competencies to flow into the rest of the countries in the Southeast Asia.

#### Road Map Construction by Variables of Economic Outcome Domain

Based on the data compare all of the 6 dependent variables, at least six skilled labor migration road lines are constructed for the holistic road map. First of all, according to the data compare of DV01, skilled labors from the countries with high GDP share of services sector might have the qualified competencies to flow into the countries with low GDP share of services, industry, and agriculture sectors, like Taiwan, Malaysia, Philippines, Singapore and Thailand; and skilled labors from the countries with high GDP share of industry sector might have the qualified competencies to flow into the countries with low GDP share of industry, and agriculture sectors, such as Indonesia, Malaysia and Brunei.

In addition, based on the data compare of DV02, skilled labors from the high Value (US\$ million) group countries such as Singapore, Thailand and Malaysia might have the qualified competencies to flow into the rest of the Southeast Asian countries; and skilled labors from the middle value (US\$ million) group countries such as Indonesia, Vietnam and Philippines might have the qualified competencies to migrate to the low value (US\$ million) group countries such as Lao PDR, Myanmar and Cambodia.

Moreover, according to the data compare of DV03, skilled labors from the high Value (US\$ million) group countries such as Singapore, Indonesia and Malaysia might have the qualified competencies to flow into the rest of the Southeast Asian countries; and skilled labors from the middle value (US\$ million) group countries such as Thailand, Vietnam and Philippines might have the qualified competencies to migrate to the low value (US\$ million) group countries such as Lao PDR, Myanmar and Cambodia.

Besides, based on the data compare of DV04, skilled labors from the high Value (US\$ million) group countries such as Singapore, Thailand and Malaysia might have the qualified competencies to flow into the rest of the Southeast Asian countries; and skilled labors from the middle value (US\$ million) group countries such as Indonesia, Vietnam and Philippines might have the qualified competencies to migrate to the low value (US\$ million) group countries such as Lao PDR, Myanmar and Cambodia.

Furthermore, according to the data compare of DV05, skilled labors from the high Value (US\$ million) group countries such as Singapore, Thailand and Malaysia might have the qualified competencies to flow into the rest of the Southeast Asian countries; and skilled labors from the middle value (US\$ million) group countries such as Indonesia, Vietnam and Philippines might have the qualified competencies to migrate to the low value (US\$ million) group countries such as Lao PDR, Myanmar and Cambodia.

Finally, several countries with high rate of GDP growth, such as Cambodia, Lao PDR and Myanmar, would be the migration destination countries of skilled labors since the countries with the high demands of economic development might have the demands of skilled labors (based on the data compare of DV6).

#### Test of Hypothesis 01

Hypothesis 01: The low-quality independent variables (such as the relative high unemployment rate and the relative low labour participation rate; further details are as following, high score of *IV01 inadequately educated workforce*, high score of *IV02 poor work ethic in national labor force*, low *IV03 labour force participation rate*, high *IV04 youth not in employment, education or training rate*, low *IV05 percentage of employment by major industry group 2007-2016*, low *IV06 percentage of employment by occupation 2007-2016*) will cause the low performance of control variables (such as the relative low quality of primary education or the relative low tertiary education enrollment rate; further details are as following, low *CV01 quality of primary education*, low *CV02 primary education enrollment rate*, low *CV03 secondary education enrollment rate*, low *CV04 tertiary education enrollment rate*, low *CV05 quality of the education system*, low *CV06 quality of math and science education*, low *CV07 quality of management schools*, low *CV08 internet access in schools*, low *CV09 local availability of specialized training services*, low *CV10 extent of staff training*).

According to the data compare of all of IVs and CVs, data from three countries can support hypothesis 01, including Vietnam, Cambodia and Lao PDR. These three countries get relative low scores of IVs, and the values of the rank of percentage in all of the 10CVs are also relatively low. Therefore, the three countries can support hypothesis 01, and the skilled labors from the rest of the countries in ASEAN membership including Taiwan might have the qualified competencies to flow into these three countries.

#### Test of Hypothesis 02

Hypothesis 02: The low quality of control variables (such as the relative low quality of primary education or the relative low tertiary education enrollment rate; further details are as following, low *CV01 quality of primary education*, low *CV02 primary education enrollment rate*, low *CV03 secondary education enrollment rate*, low *CV04 tertiary education enrollment rate*, low *CV05 quality of the education system*, low *CV06 quality of math and science education*, low *CV07 quality of management schools*, low *CV08 internet access in schools*, low *CV09 local availability of specialized training services*, low *CV10 extent of staff training*) will lead the results of relative low quality and quantity of dependent variables (such as the relative low value of GDP or the relative low US\$ of PPP of mean monthly earnings; further details are as following, low *DV01 GDP share of major group of economic sectors 2013-2016*, low *DV02 ASEAN total trade in goods 2007-2016*, low *DV03 Intra-ASEAN trade in goods 2007-2016*, low *DV04 ASEAN exports of services by country 2007-2016*, low *DV05 ASEAN imports of services by country 2007-2016*, and low *DV06 rate of GDP growth 2007-2016*).

According to the data compare of all of CVs and DVs, data from two countries can support hypothesis 02, including Cambodia and Lao PDR. These two countries get

relative low scores of CVs, and the values of DVs are also relatively low. Therefore, the two countries can support hypothesis 02, and the skilled labors from the rest of the countries in ASEAN membership including Taiwan might have the qualified competencies to flow into these two countries. However, according to the data of DV01 and DV06, the data of these two countries are not supporting hypothesis 02 since the GDP share of these two countries of major group of economic sectors are not the lowest two countries, and the rates of GDP growth are the worst countries, either.

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