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Part I

1. Subject of the Project

Study for providing future visions and policy recommendations to Association of Southeast Asian Nations (ASEAN) Member States (AMS) to deal with the increased number of industrial property applications and backlogs, based on the economic growth outlook and number of industrial property applications of AMS.

2. Background and Objectives of the Project

2.1. Background

The number of industrial property applications in AMS has been increasing in recent years due to the rapid economic growth in the region. This increase is expected to continue in the future. Accordingly, the workload of the examination process in Intellectual Property Offices (IPOs) is also expected to continue to increase. Therefore, unless each IPO takes measures against the increasing workload, it could result in an increase in backlogs and delays in the responses from IPOs (office actions). Delays in the responses from IPOs will be detrimental to the rapid progress of technological innovation and will probably not be welcomed by domestic or international companies. In this context, the IPOs of AMS should take the appropriate measures to improve the delivery of Intellectual Property (IP) services and prevent the increase in backlogs. Quantitative analysis through the 'IPO outlook approach' is needed for examining the potential for workload reduction for each IPO.

2.2. Objectives

The objective of the study is to clarify the outlook for AMS by presenting an outlook on economic growth and the number of industrial property applications for AMS based on the current economic data; to calculate how the examination period and the backlog situation will change; and to identify the similarities and differences in the measures and practices among the AMS. This study will suggest the measures and practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in AMS. Moreover, it will provide helpful information for companies that are in, and will be in, AMS.

In addition, another objective of this study is related to the number of residential patent applications in AMS. We will focus on the factors that have positive impacts on increasing the

number of patent applications by local applicants. There must be certain drivers that increase the number of residential patent applications. We will clarify these driving factors and propose necessary actions together with future estimates of residential patent applications.

3. Countries Surveyed

ASEAN Member States and Japan

4. Survey Items:

1) Economic data that are available in AMS
2) Statistical data that are available in AMS
3) Outlook for the economic growth of each AMS
4) Outlook for the number of industrial property applications in each IPO in the AMS
5) Outlook for the examination period and the backlog situation
6) Measures (legal systems, fee schedules, human resources, information technology (IT), operations management, and outsourcing of operations, etc.) and practices taken in the past at each IPO in the AMS
7) Measures (legal systems, fee schedules, human resources, IT, operations management, and outsourcing of operations, etc.) and practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in the AMS
8) Driving factors to increase the number of residential patent applications
9) Measures for increasing the number of residential patent applications in the AMS

5. Initial Methodologies of the Project

Economic data for all possible countries, including for Europe, the United States (US), Japan, China, the Republic of Korea (hereafter, Korea), and other ASEAN countries, to carry out statistical analysis to extract the influential factors on gross domestic product (GDP) and its growth rate The influential factors are defined in a group of developed countries and a group of developing countries, which can be used for the estimation of industrial property applications. Based on the estimates, collaboration with IP experts in targeting countries will

be conducted for analysing the number of industrial property applications and the backlog situation, etc. by collecting domestic data.

More specifically,

5.1. The Working Group (hereafter referred to as the WG) collects the necessary current economic data available in AMS.

5.2. Based on the collected economic data and calculation model, the WG calculates the outlook for the economic growth of each AMS.

5.3. The WG collects the necessary statistical data available at the IPOs in AMS.

5.4. Based on the outlook for economic growth of each AMS, the collected statistical data, and the calculation model, the WG calculates the outlook for the number of industrial property applications in each IPO, particularly in technical fields for which number of industrial property applications is increasing significantly.

5.5. The driving factors to increase the number of residential patent applications will be extracted by regression analysis

5.6. Based on the outlook of the number of industrial property applications in each IPO, the WG calculates how the examination period and backlog situation will change.

5.7. The WG investigates the measures (legal systems, fee schedules, human resources, IT, operations management, outsourcing of operations, etc.) and practices taken in the past to address the increase in applications at the IP Offices.

5.8. The WG identifies similarities and differences in the measures and practices among the AMS utilizing the latest data and existing reports (i.e. 'Surveillance Study Report on Patent and Trademark Examination Manuals in ASEAN and Taiwan')[1]

5.9. The WG identifies the measures and practices to be taken to improve the delivery of IP services, including reducing the backlog situation at each IPO in AMS.

[1] Published in March 2015 by AIPPI–JAPAN.

6. First Approach

6.1. Influential factors

In economics, total factor productivity (TFP) is used to measure economic efficiency. Thus, the WG decided to verify whether TFP can be an influential factor.

The formula used is as follows:

$$Growth(TFP)=Growth(Output) - (Growth(Input_1)+Growth(Input_2)+Growth(Input_3))*(1/3)$$

where *output* is the total value of output (2000 prices in millions of yen), and the inputs are the intermediate input (2000 prices in millions of yen)$_1$, indices of man-hours (2000=1)$_2$, and indices of capital input (2000=1)$_3$. The data source is the Japan Industrial Productivity (JIP) data.

6.2. Regression analysis on industrial property applications in Japan

$$Growth(TFP) = \alpha + \beta \cdot Growth(Application\ of\ Industrial\ Property)$$

The regression analysis for Japan was conducted on the growth of TFP against the growth of each IP application (patent, design, trademark, and utility model) for both residents and non-residents with the growth of TFP as a dependent variable and growth of IP applications as an independent variable for the period from 1983 to 2012 (database: WIPO statistics).

Figure 1. Japan TFP Growth and Patent Application Growth (Resident)

```
. regress tfpgrowthver2 patentresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      3.10
       Model |  .000467821         1  .000467821   Prob > F        =    0.0898
    Residual |  .004080696        27  .000151137   R-squared       =    0.1029
-------------+----------------------------------   Adj R-squared   =    0.0696
       Total |  .004548517        28  .000162447   Root MSE        =    .01229

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
patentresi~h |   .0877365   .0498684     1.76   0.090    -.0145851    .1900581
       _cons |   .0034502   .0023271     1.48   0.150    -.0013246     .008225
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 2. Japan TFP Growth and Patent Application Growth (Non-resident)

```
. regress tfpgrowthver2 patentnonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      0.05
       Model |  8.0756e-06         1  8.0756e-06   Prob > F        =    0.8282
    Residual |  .004540442        27  .000168165   R-squared       =    0.0018
-------------+----------------------------------   Adj R-squared   =   -0.0352
       Total |  .004548517        28  .000162447   Root MSE        =    .01297

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
patentnonr~h |   .0028578   .0130411     0.22   0.828    -.0239002    .0296159
       _cons |   .0041251   .0024688     1.67   0.106    -.0009404    .0091906
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 3. Japan TFP Growth and Design Application Growth (Resident)

```
. regress tfpgrowthver2 design_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      0.57
       Model |  .00009451         1   .00009451   Prob > F        =    0.4557
    Residual |  .004454007        27  .000164963   R-squared       =    0.0208
-------------+----------------------------------   Adj R-squared   =   -0.0155
       Total |  .004548517        28  .000162447   Root MSE        =    .01284

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
design_res~h |   .0423217   .0559136     0.76   0.456    -.0724035     .157047
       _cons |    .005216   .0027085     1.93   0.065    -.0003415    .0107735
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 4. Japan TFP Growth and Design Application Growth (Non-resident)

```
. regress tfpgrowthver2 design_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =     14.83
       Model |  .00161265         1   .00161265   Prob > F        =    0.0007
    Residual |  .002935868       27  .000108736   R-squared       =    0.3545
-------------+----------------------------------   Adj R-squared   =    0.3306
       Total |  .004548517       28  .000162447   Root MSE        =    .01043

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
design_non~h |   .0709389   .0184205     3.85   0.001     .0331432    .1087346
       _cons |    .000781    .002135     0.37   0.717    -.0035997    .0051617
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 5. Japan TFP Growth and Trademark Application Growth (Resident)

```
. regress tfpgrowthver2 trademark_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.53
       Model |  .000243294         1  .000243294   Prob > F        =    0.2274
    Residual |  .004305223       27  .000159453   R-squared       =    0.0535
-------------+----------------------------------   Adj R-squared   =    0.0184
       Total |  .004548517       28  .000162447   Root MSE        =    .01263

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
trademark_r~ |   .0256856   .0207941     1.24   0.227    -.0169803    .0683515
       _cons |   .0043835   .0023476     1.87   0.073    -.0004333    .0092003
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 6. Japan TFP Growth and Trademark Application Growth (Non-resident)

```
. regress tfpgrowthver2 trademark_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      4.88
       Model |  .000696534         1  .000696534   Prob > F        =    0.0358
    Residual |  .003851984        27  .000142666   R-squared       =    0.1531
-------------+----------------------------------   Adj R-squared   =    0.1218
       Total |  .004548517        28  .000162447   Root MSE        =    .01194

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
t~nonresid~h |   .0417566    .018898     2.21   0.036     .0029812     .080532
       _cons |    .003214   .0022665     1.42   0.168    -.0014364    .0078645
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 7. Japan TFP Growth and Utility Model Application Growth (Resident)

```
. regress tfpgrowthver2 utilitymodel_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.22
       Model |  .000195993         1  .000195993   Prob > F        =    0.2799
    Residual |  .004352524        27  .000161205   R-squared       =    0.0431
-------------+----------------------------------   Adj R-squared   =    0.0076
       Total |  .004548517        28  .000162447   Root MSE        =     .0127

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
utilitymod.. |   .0146072   .0132475     1.10   0.280    -.0125745    .0417888
       _cons |   .0054977   .0026174     2.10   0.045     .0001272    .0108682
------------------------------------------------------------------------------
```

Source: Authors' calculation.

Figure 8. Japan TFP Growth and Utility Model Application Growth (Non-resident)

```
. regress tfpgrowthver2 utilitymodel_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.89
       Model |  .000298279         1  .000298279   Prob > F        =    0.1800
    Residual |  .004250238        27  .000157416   R-squared       =    0.0656
-------------+----------------------------------   Adj R-squared   =    0.0310
       Total |  .004548517        28  .000162447   Root MSE        =    .01255

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
u~nonresid~h |   .0348658   .0253287     1.38   0.180    -.0171044     .086836
       _cons |   .0036307   .0023721     1.53   0.138    -.0012364    .0084979
------------------------------------------------------------------------------
```

Source: Authors' calculation.

6.3. Validation

Although there were a few IPs for which the P-values were lower in the applications for patents by residents, design, and trademarks by non-residents, as shown in Figures 1, 4, and 6, the coefficients were not high enough to support the statement that IP applications will affect their country's TFP. Given that there was no significant correlation found in terms of applications in IP and TFP in Japan, this parameter cannot be applied to ASEAN countries. In addition, there are not sufficient data available in public databases to calculate the TFP. Labour productivity is publicly available for OECD countries in the OECD's database, including Indonesia but excluding the other ASEAN countries. Moreover, ASEAN countries are not capable of providing their own internal data within the designated period. Therefore, it is not possible to validate the correlation between TFP (even labour productivity) and IP applications in ASEAN countries.

7. Second Approach

7.1. Correlation between macroeconomic and IP-related data and industrial property applications in Japan

Correlation analysis was performed on the following variables against the growth rate in IP applications during 1997–2015 in Japan.

1. Growth in GDP
2. Growth in manufacturing (% of GDP)
3. Growth in population
4. Growth in research and development expenditure (% of GDP)
5. Growth in researchers in research and development (R&D)
6. Growth in birth rate
7. Growth in labour force participation rate, total (% of total population aged 15+) (national estimate)
8. Growth in patent office's revenue
9. Growth in patent office's expenditure
10. Growth in number of IP examiners
11. Growth in number of IP staff
12. Growth in business enterprise expenditure on R&D

Positive correlations were found in the analysis, with P-values less than 0.2, such as 'growth in patent resident and non-resident applications' against 'growth in business enterprise expenditure on R&D', for which the correlation coefficients were 0.422 and 0.400, respectively; 'growth in design resident applications' against 'growth in manufacturing (% of GDP)' and 'growth in design non-resident applications' against 'growth in business enterprise expenditure on R&D', for which the correlation coefficients were 0.299 and 0.400, respectively; 'growth in trademark resident and non-resident applications' against 'growth in GDP', for which the correlation coefficients were 0.231 and 0.451, respectively; 'growth in trademark resident and non-resident applications' against 'growth in manufacturing (% of GDP)', for which the correlation coefficients were 0.440 and 0.506, respectively; and 'growth in utility model residents' against 'growth in number of IP examiners' and 'growth in number of IP staff', for which the correlation coefficients were 0.482 and 0.483, respectively.

7.2. Correlation between macroeconomic and IP-related data and applications of industrial property by residents in Viet Nam, Philippines, Brunei Darussalam, and Malaysia

According to the correlation analysis, there were no significant variables that we could use for multi-regression analysis to forecast the countries' IP applications, except for limited outcomes, such as that patent and design are correlated with GDP and population in Viet Nam, trademark is correlated with GDP in the Philippines and Brunei Darussalam, and design and trademark are correlated with population and birth rate in Viet Nam. Therefore, it is not possible to conduct a forecast of each country's IP applications from such macroeconomic variables.

8. Third Approach

It is not necessary to set common variables for all the ASEAN countries in the analysis since each country's economy is different. In order to find the different sets of variables for each country, data were extracted from the World Bank database based on categories, i.e. economy and growth; education; energy and mining; science and technology; and trade.

9. Actual Methodologies

The number of industrial property applications in the future can be estimated by multiple-regression analysis as below.

$$\text{Growth ratio (IP applications by residents)} = a_1X_1+a_2X_2+a_3X_3+\ldots+\text{constant}$$

$$\text{Growth ratio (IP applications by non-residents)} = b_1X_1+b_3X_3+b_5X_5\ldots+\text{constant}$$

X_1, X_2… are the factors (e.g. R&D expenditure, foreign direct investment (FDI), GDP, and education) that show significance for the number of applications. The applied factors are different from country to country, but the factors are within the following categories.

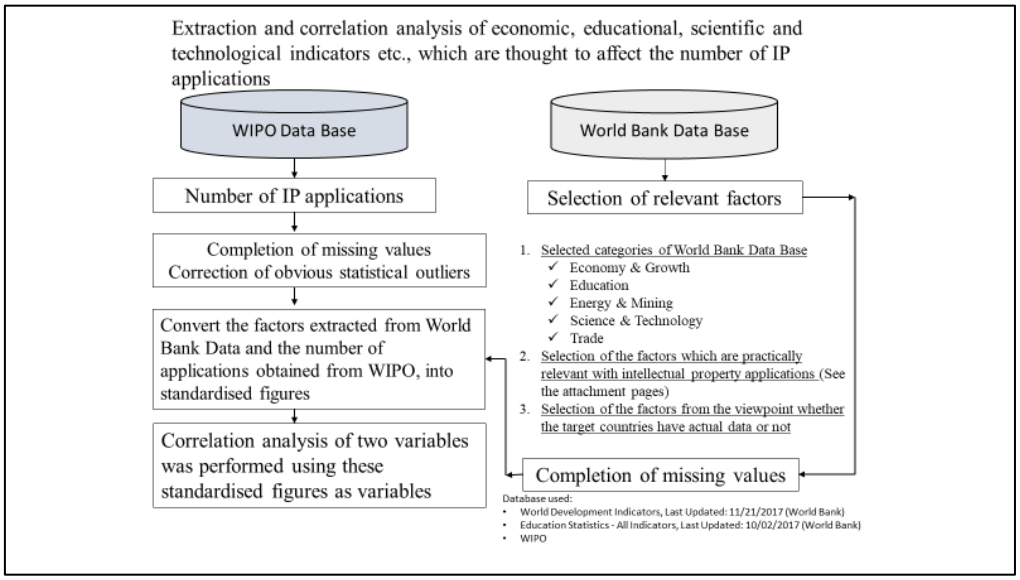
- ✓ Economy and growth
- ✓ Education
- ✓ Energy and mining
- ✓ Science and technology
- ✓ Trade

In the selection of the relevant factors X_1, X_2, …, for countries with too many variables to run the multi-regression analysis, resulting in errors due to exceeding the software (SPSS) limit,

correlation analysis was performed using World Bank data (e.g. R&D expenditure, FDI, GDP, and education) and the number of applications in each country. The factors that show sufficient correlation have been selected.

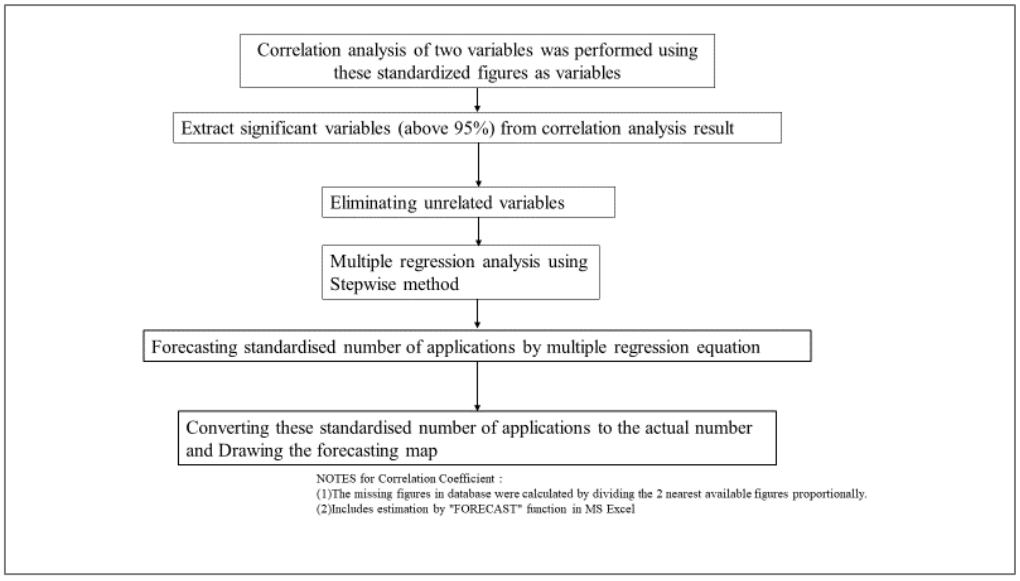
Coefficients a_1, b_1, … are calculated by using multiple regression analysis with a stepwise method. X1, X2, … are the driving factors that have positive impacts on increasing the number of IP applications, and the number of applications is calculated by using these results with linear approximation.

Figure 9. Analysis flow (1)



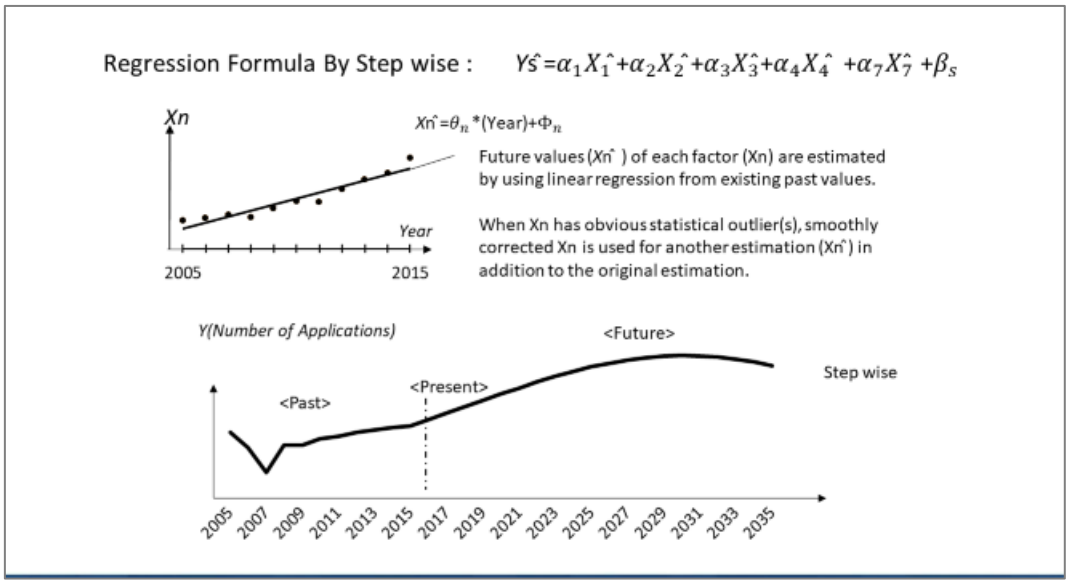
Source: Authors' calculation.

Figure 10. Analysis flow (2)



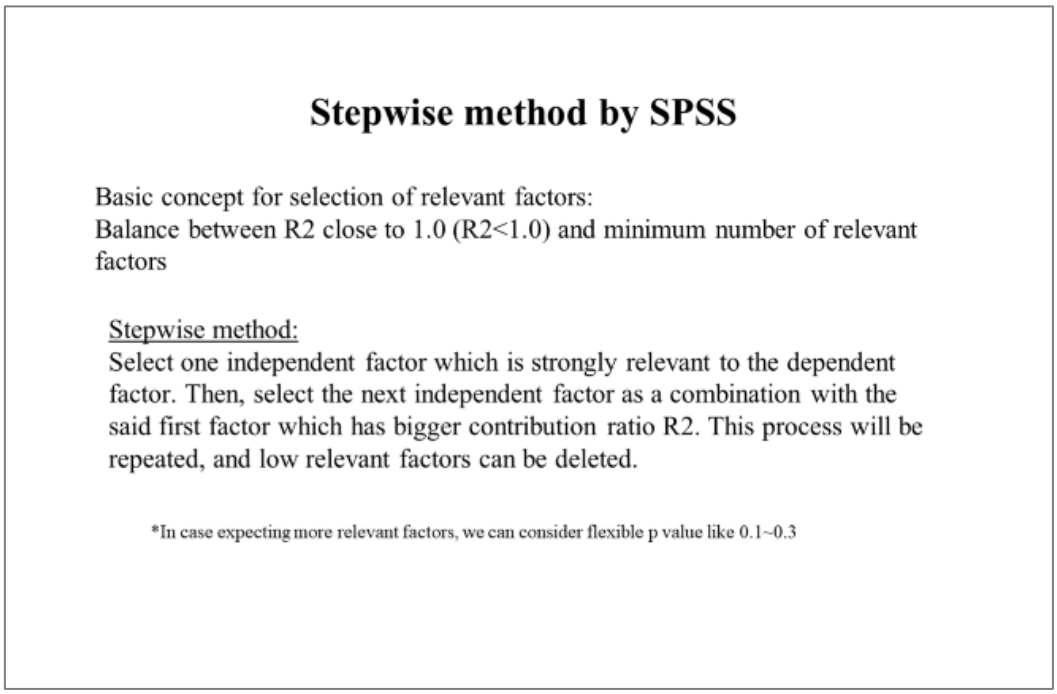
Source: Authors' calculation.

Figure 11. Future Prediction



Source: Authors' calculation.

Figure 12. Stepwise Method by SPSS



Source: SPSS guidebook

Figure 13. How to read the analysis results? (1)

Some hints from correlation analysis can be obtained for policy making

(Country α) (Correlation Coefficient, significant level *, **)

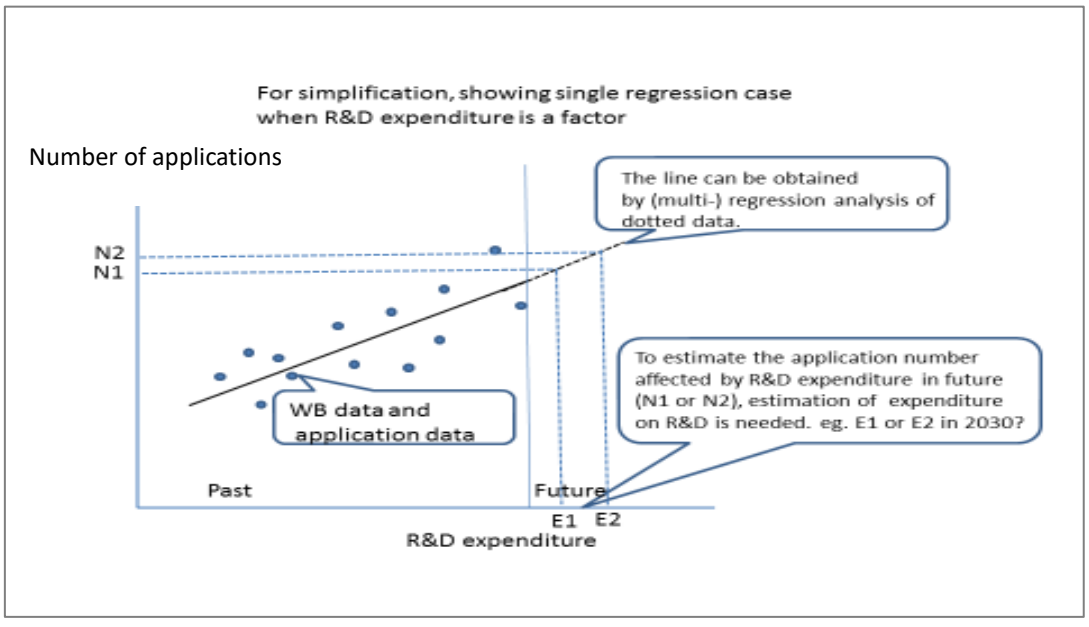
(Factor)	X1	X2	X3	X4	X5	X6
P^ Patent Application by Residents or Non-residents	.489**	.427*	.474*	.410*	.771**	-.918**
D^ Design Application by Residents or Non-residents	¦	¦	¦	¦	¦	
T^ Trademark Application by Residents or Non-residents	¦	¦	¦	¦		
U^ Utility Model Application by Residents or Non-residents	.827**	.832**	.839**	.844**	.861**	-.633*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlation Coefficient	Factor *Xn*	***P^***	
+	↗	↗	In order to increase ***P^***, this Factor Xn shall be increased.
	↘	↘	
-	↗	↘	
	↘	↗	In order to increase ***P^***, this Factor Xn shall be decreased.

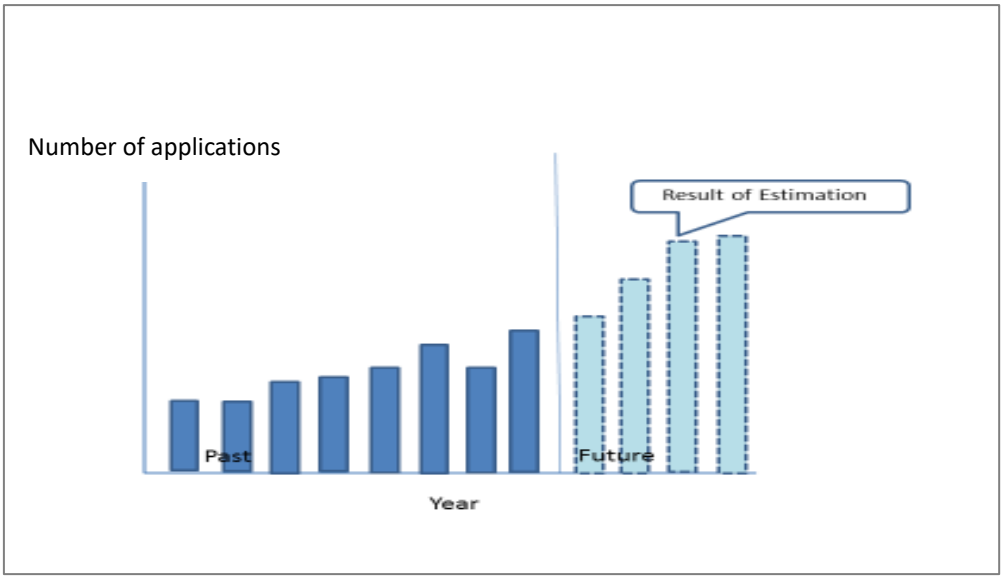
Source: Authors' calculation.

Figure 14. How to read the analysis results? (2)



Source: Authors' calculation.

Figure 15. Output Image



Source: Authors' calculation.