

Thailand 4.0 Readiness

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ABSTRACT

This paper presents a situation analysis for a development policy called Thailand 4.0. Thailand 4.0 aims to achieve economic prosperity, social well-being, human values and environmental protection. Two research questions are presented. Firstly, does Thailand have characteristics of a developed economy? To answer this question, we use the 10-Factors Test of developed economy. Secondly, does Thailand have sustainable economy? We tested 20 factors of ADB's standards for sustainability. Macroeconomic data from annual reports of ADB, WEF and IMF were used. Thailand scores $U = 0.29 \pm 0.08$ or has 29% of the developed economy characteristics using Kahnman-Tversky prospect theory. The test for sustainability looked at improving and deteriorating factors. Improving factors include: participation prior to primary school, proportion women in parliament, GDP growth of employed persons, commercial banks, mobile phone coverage, household income, GDP growth, value added to GDP, investment, and fiscal balance. Deteriorating factors include: Gini coefficient, global poverty, national poverty, maternal mortality, infant mortality, traffic death, and external debt. Among the ASEAN group, Thailand showed one significant indicator. Within ASEAN, Thailand shows no significant improvement. According to the 10 characteristics of the First World Economy, Thailand scores 0.295 or achieved 29.5% probability of the expected value or succeeded 57.84% in achieving FWE status. According to the ADB's partial indicators for sustainable economy, Thailand still has not met the standard.

Keywords: Development model, prospect theory, Thailand 4.0

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1.0 INTRODUCTION

The economic development of Thailand is divided into three stages. The first stage was called Thailand 1.0; the country was an agriculture based economy. The second stage was called Thailand 2.0, the country's developmental engine came from light industry. The third stage was called Thailand 3.0; the country focused on heavy industry as the engine of growth. By the end of the first decade of the 21st century, Thailand realized that it was caught in a developmental trap of (i) being

middle income country, (ii) income inequality, and (iii) socio-economic imbalance. In response, Thailand announces Thailand 4.0 development policy.

Thailand 4.0 aims to achieve economic prosperity, social well-being, human values and environmental protection. These goals will be achieved through raising competitiveness in four main sectors. First, in the agricultural sector, Thailand 4.0 calls for the transformation of traditional farming to “smart farming.” Second, traditional SMEs will be transformed into “smart SMEs.” Third, where the economy had long been sagged with low value services, Thailand 4.0 wants the country to focus on “high value services.” Fourth, unskilled labor will be transformed into “skilled labor.”

To achieve economic prosperity, Thailand 4.0 calls for the use of technology, innovation and creativity. Specifically, the country will commit 4% of the GDP to R&D and raising the per capita earning to \$15,000 by 2032. To achieve social-well being of the first world economy, Thailand 4.0 will introduce smart farmers in 5 years and having a functional welfare system in 20 years. The problem in income inequality will also be lessened. To achieve the rise in human value, the new development policy will create a new Thai 4.0 citizenry that would equate Thais to first world citizen. The HDI will be raised to 0.80 from its current position of 0.74. In 20 years time, at least 5 universities in Thailand will be in the top 100 universities of the world. Lastly, on the environmental front Thailand 4.0 will create the world’s 10 most livable cities in Thailand, reduce carbon emission, adjust to climate changes and reduce terrorism. The ultimate goal of Thailand 4.0 is to transform Thailand from a developing economy into a developed economy or First World Economy (FWE).

This paper presents two research questions. Firstly, *does Thailand have characteristics of a developed economy?* To answer this question, we use the 10-Factors Test of developed economy. Secondly, *does Thailand have sustainable economy?* We tested 20 factors of ADB’s standards for sustainability. Macroeconomic data came from annual reports of ADB, WEF and IMF.

2.0 LITERATURE REVIEW

The literature on economic development may be categorized into 3 lines of thinking, namely classical, neo-classical and contemporary models of economic growth. Among the classical school, there were three prominent models. First, the linear-stages-of-growth models asserts that economic growth depends on savings and investment (Rostow, 1960; Harrod, 1948; and Domar, 1947). Second, the structural change model of the classical school contends that economic growth comes from the transferring of economic resources from low-productivity to high-productivity activities. For instances, resources from the agricultural sector are allocated to the industrial sector (Lewis, 1954, and Cheenery, 1960). Third, international-dependence model was the last school of the classical thinking. International-dependence model advocated the withdrawal from the international economy and pursue self-sufficiency or autarky (Cohen, 1973, and Dos Santos, 1973).

The second line of economic development model is the neo-classical school. This school of economics calls for liberalization, stabilization and privatization. Liberalization means the elimination of price distortion by government interference in the market, such as protectionism, subsidy and public ownership (Bauer, 1984; Lal, 1983; Johnson, 1971; and Little, 1982). Stabilization may be achieved by increasing capital and improving technology (Solow, 1956).

In contrast to the classical and neo-classical theories, the third line of developmental model advocates the new growth theory. According to the new growth theory, technological changes must also bring about the production of knowledge in order to achieve growth (Romer 1986; Lucas 1988; Aghion and Howitt 1992). Growth comes from the increasing return of the use of knowledge, not just a combination of labor and capital. The role of investment shifts to human capital, infrastructure and R&D. Whereas governmental interference in the market had been condemned by neo-classical theorist, contemporary developmental theorists embraces the state’s role in promoting human capital formation and knowledge-intensive industries (Meir, 2000).

Thailand 4.0 is the application of the contemporary economic development theory. However, the contemporary developmental school is not without criticism. The theory has been criticized for overlooking the role of social and institutional infrastructure (Skott and Auerbach 1995). These infrastructures may include the availability of adequate capital and goods market (Cornwall and Cornwall 1994). Thailand 4.0 seems to take these facts into consideration in pronouncing its four objectives: economic prosperity, social well-being, human values and environmental protection. These objectives appear to agree with the world consensus on development. In 2000, the UN announced the Millennium Development Goals (MDG) to include eight components, namely poverty and hunger, primary universal education, gender equality, child health, maternal health, HIV/AIDS, environmental sustainability and global partnership. However, unlike MDG whose development goal is specific, Thailand 4.0's goal is more general. It intends to drive Thailand into the first world economy within 20 years. Thus, as a situation analysis paper, we ask two questions: (i) Does Thailand have characteristics of a developed economy? and (ii) Does Thailand have sustainable economy?

Table 1. Thailand 4.0 compared to Millennium Development Goals (MDG)

Thailand 4.0* 20 years target (2012-2032)	Millennium Development Goals** 15 years target (2000 – 2015)
1. Economic prosperity 2. Social well-being 3. Raising human values 4. Environmental protection	1. Poverty and hunger reduction 2. Primary universal education 3. Gender equality 4. Child health 5. Maternal health 6. HIV/AIDS 7. Environmental sustainability 8. Global partnership

*A national development policy with 20 years horizon. **Involving 191 member nations and 22 international organizations. By 2016, MDG was replaced by the Sustainable Development Goals (SDG) involving 193 member nations with a target end year in 2030. The new SDG has 17 goals and 169 targets.

In analysis of these two issues, we keep these three development goals as the guiding principle, namely economic growth, improving quality of life, and sustainable development. Economic growth is measured by the country's gross national product (Todaro and Smith 2009). This growth is then quantified into per capita level to reflect the increase in economic benefits at per capita level (Jaffee 1998). Economic growth at the national level should not come at the expense of the environment and income inequality among the people. This concerned was summarized, thus: "[t]o maximize income growth, environmental considerations were left to languish on the sidelines; the standard of living was often allowed to slide; large inequalities between classes, regions, and genders were ignored; and poverty was tolerated more than it should have been in the rush to generate maximum growth" (Basu 2000, p. 64).

Secondly, economic growth must come with the security of the quality of life for the people. "Quality of life" may be measured by the level of poverty, inequality and unemployment in the country (Seers, 1969). This implies that Thailand 4.0 must also include income distribution, environment, health and education Stiglitz (1998). Thailand 4.0's commitment to well-being of the people is consistent with what contemporary growth theorists requiring that economic development must transcend the promotion of growth to the promotion of well-being (Sen, 1985, 1992, 1999). In this paper, we also attempt to assess this life quality goal, i.e. health, education and the environment (Berenger and Verdier-Chouchane 2007).

Lastly, in order to be successful, Thailand 4.0 must be sustainable. Sustainable development means that economic growth must involve "maximizing the net benefits of economic development,

subject to maintaining the services and quality of natural resources over time” (Pearce and Turner 1990, p. 24). There had been debates as to what should be included in sustainable development. The term may be ambiguous (Redclift 1992; Daly 1996; Payne and Raiborn 2001). This ambiguity is reduced into two questions “What should be sustained” and “What should be developed” (Kates *et al.* 2008). It is clear that sustainability includes economic prosperity, social equity and environmental protection. This paper assesses Thailand 4.0 on these bases.

3.0 METHODOLOGY

3.1 Data Source

Secondary data were used in this paper. Macroeconomic data used in this paper came from annual reports of ADB, WEF and IMF. The 20 factors used for sustainability came from the ADB’s sustainability indicators (ADB 2017). Data on the competitiveness level came from the WEF annual report (WEF 2017). Other macroeconomic data, such as GDP and Gini coefficient were obtained from the IMF’s World Economic Outlook annual report (IMF 2017).

The 10 factors used for situation analysis, of how far is Thailand from becoming the First World Economy, were constructed using the following: *competitiveness index, corruption index, disposable income 1st Economy, GDP gap ratio, Gini, HDI (0.788 threshold), Industrialization, rural-Urban migration, service sector predominance, and sovereign risk*. The ASEAN 10 countries were used as a bench mark group. Thailand is used as a subject country. The Z score was used as observed values and the corresponding CDF or $\Phi(z)$ was used as the individual probability of each factor to calculate the Kahnman-Tvertsky index (Kahnman and Tvertsky, 1979). The Kahnman-Tvertsky U index is used to gauge the current situation of Thailand in comparison to the ideal condition of the First World Economy. To that end, Singapore is used as a reference country for being a developed economy in the ASEAN. The Kahnman-Tvertsky index is obtained by:

$$U = \sum w_i p_i x_i \quad (1)$$

where U = probability indicator; w = weight of the factor or 0.10 for each factor, p = probability of each factor, and x = observed value for each factor. In this case, $x = (k - \bar{k}) / s$ or the standard score of the observed factor in the ASEAN 10 countries.

To answer the question of whether Thailand has sustainable economy, 20 factors were used. These 20 factors were based on the ADB’s sustainability of indicators: *Gini, pop. Below \$1.90/day (%), pop. Below national poverty line (%), maternal mortality per 100,000, infant mortality per 1,000, death rate due to traffic per 100,000, participating 1 year before primary school %, proportion of seats held by women in the National Assembly, pop. Access to electricity (%), real growth % GDP per employed person, commercial banks per 100,000, population covered by mobile network (%), household expenditure or income growth (%), forest area as % of total land, per capita gross national income (\$), real growth of GDP, real growth of value added to GDP, domestic investment (% GDP), external debt % of GNI, and fiscal balance (ADB 2017)*. These 20 factors were categorized into two groups: (i) targeted low value factors, and (ii) targeted high value factors, see Table 4. The ASEAN 10 countries were used as a bench mark group. For hypothesis testing, sustainable economy is found where there is a significant low among the targeted low-valued factors and significantly high among the targeted high-valued factors. If no statistical significance exists then sustainability is not found.

3.2 Sample size determination

Macroeconomic data, such as GDP, and Gini coefficient were taken from ten years: 2008-2017. The sample size for the data is determined by log Monte-Carlo simulation approach. The minimum sample size obtained from Monte-Carlo simulation is given by:

$$\langle n \rangle = \ln(N\alpha^2) \tag{2}$$

where n = minimum sample size, N = Monte Carlo iteration counts and α = level of precision. The Monte Carlo iteration is determined by:

$$N = \left(\frac{3\sigma}{E}\right)^2 \tag{3}$$

where $\sigma = [(\bar{x} - \mu) / z] \sqrt{n}$ taken from the components of Monte Carlo three elements: $x_1 = \max, x_2 = \min$ and $x_3 = (\max + \min) / 2$; and mid-point of the distribution curve $E = [(\max - \min) / 2] \div 50$. This log Monte-Carlo approach yields a minimum sample size of 6.27. In the present case, macroeconomic data spanning 10 years were used. The number is consistent with the minimum sample size requirement under Anderson-Darling test for normal distribution where $n > 5$ (Anderson and Darling, 1952).

3.3 Data Testing

Test of distribution characteristics were employed to determine assess the current situation for Thailand 4.0 policy status. Firstly, skewness was used to determine the leaning of the data distribution. A normal distribution has zero skewness. If the threshold value lies above the mean and median, a positive skew means that the country falls short of the expected value. Secondly, kurtosis was used to test the peakedness or the extremity of the tail of the data distribution. Excess kurtosis means that the error spread (tail extremity) is greater than normally expected. In our analysis, excess kurtosis means that the data falls far away from the expected target. A kurtosis of less than ± 3.00 means that the distribution does not have extremity in its tail. Skewness and kurtosis were determined by:

$$S_{skew} = \frac{n}{(n-1)(n-2)} \sum \left(\frac{X_i - \bar{X}}{S} \right)^3 \tag{4}$$

$$Kurt = \left[\left(\frac{n}{(n-1)(n-2)} \sum \left(\frac{X_i - \bar{X}}{S} \right)^4 \right) - \frac{3(n-1)^2}{(n-2)(n-3)} \right] \leq 3.0 \tag{5}$$

Table 2: Skewness and kurtosis of $\Phi(z)$

Description	Skew	Kurt	Result Skew	Result Kurt
GDP gap ratio	0.42	-3.36	Fail	Fail
10 factors FWE	0.01	-2.10	Fail	Fail
20* factors sustainability ADB: HI = 12x	1.66	-4.03	Fail	Fail
20 factors sustainability ADB: LO = 7x	2.55	-5.40	Fail	Fail

*Per capita GDP has been taken out due to extreme values.

Per capita GDP is discussed separately elsewhere.

4.0 FINDINGS AND DISCUSSION

The paper presents three main findings. First, the GDP gap for Thailand for the past 10 years (2008 – 2017) remains stable. Second, according to the 10 characteristics of the First World Economy, Thailand scores 0.295 or achieved 29.5% probability of the expected value or succeeded 57.84% in

achieving FWE status. If the threshold is set at 51%, it means that Thailand has 21.5% points to climb. Third, according to the ADB’s partial indicators for sustainable economy, Thailand still has not met the standard.

4.1 GDP gap as an indication of social inequality

The general indication for economic inequality is given by the Gini coefficient. However, this number has limited information about the general distribution of income and possible social inequality in the country. In general, the Gini coefficient is determined by:

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2n \sum_{i=1}^n x_i} \tag{6}$$

where x_j = income per person i in a population j . This measure cannot tell the exact amount of income inequality; it could only tell the lower half of the population that fails to participate in the income distribution.

In our analysis of the 10 characteristics of FWE, we constructed a new measure called GDP gap ratio. GDP gap ratio is defined as the ratio of the difference between the reported per capita GDP and the per capita GDP earned under the country’s minimum wage: $GDP_{gap} = (Y_{report} - Y_{min}) / Y_{report}$. This new measure provides two pieces of information: (i) gap between the reported GDP and actual earning of the common people working at minimum wage, and (ii) whether the economic well being of the people had been achieved.

Table 3. GDP gap and gap ratio from 2008 - 2017

Year	GDP per capita	Actual GDP Min. wage	Difference	Gap Ratio	Gini Coefficient
2008	4,379.53	2,215.22	2,164.31	0.49	0.40
2009	4,207.58	2,129.37	2,078.21	0.49	0.40
2010	5,065.38	2,337.96	2,727.42	0.54	0.39
2011	5,482.40	2,539.37	2,943.03	0.54	0.37
2012	5,850.30	3,476.02	2,374.28	0.41	0.39
2013	6,157.36	3,516.77	2,640.59	0.43	0.41
2014	5,921.09	3,325.12	2,595.96	0.44	0.41
2015	5,799.39	3,153.28	2,646.11	0.46	0.41
2016	5,899.42	3,060.36	2,839.07	0.48	0.41
2017	6,265.29	3,138.045	3,127.25	0.50	0.41

4.2 First World Economy characteristics

The ultimate goal of Thailand 4.0 is to achieve FWE status, thus, a Thai citizen in Thailand 4.0 is a “First World Citizen.” In this aspect of Thailand 4.0, we ask whether Thailand possesses FWE characteristics? A negative answer to this question is a foregone conclusion. Thus, if Thailand does not possess full characteristics of FWE, how far is it from becoming FWE? In answering this question, we defined the threshold for FWE as having 51% of the characteristic, i.e. predominantly FWE if the economy manifests more than half of the characteristic found in FWE.

The Prospect Theory by Kahnman-Tversky was used to obtain the percentage probability of FWE characteristic. The Prospect Theory is given by $U = \sum w_i p_i x_i$. Presently, Thailand has 0.295. If the threshold for FWE is 0.51, Thailand has 0.215 points to climb.

Table 4. First World Economy Indicators

Characteristics of Developed Economy: each weight 0.10	Thailand X_{obs}	Expected X_{θ}	Prob. p_i	U Index U_i
Competitiveness Index	4.64	4.60	0.5320	0.004
Corruption index	101.00	92.30	0.5750	0.011
Disposable income FWE	5,720	12,000	0.2266	(0.008)
GAP gap ratio	0.49	0.48	0.5990	0.015
Gini	0.39	0.36	0.6030	0.016
HDI (0.788 threshold)	0.74	0.79	0.3264	(0.012)
Industrialization	0.36	0.51	0.2266	(0.015)
Rural-Urban migration	12,272	3,168.01	0.9930	0.246
Service sector predominance	0.55	0.51	0.5710	0.010
Sovereign risk	0.63	0.50	0.6630	0.028
Total U index under Kahnman-Tvertsky: $U = \sum w_i p_i x_i$				0.295

4.3 Sustainable economy as development goal

The development goal for the 21st Century is no longer confined to economic growth. The growth has to be sustainable. In order to be sustainable, the economy must contribute to value additivity in people's lives. The ADB has produced 50 indicators as relevant factors for sustainability. We selected 20 factors and used them to test whether Thailand's economy is currently sustainable? If not, how much does it need to improve?

The 20 factors are categorized into low and high targeted values. Low values are those that in order to optimize, the value must be minimal. There are 7 such factors listed in Table 5. The result of the testing shows that Thailand has two significant factors: Gini coefficient and death due to traffic accident. These two factors made Thailand failing the first category of sustainable economy. For low-value targets, Thailand achieved 0.66 while Singapore achieved 0.94. If the threshold is set at 0.80 under 80/20 rule, then Thailand has 0.14 points to climb.

Table 5: Low target for sustainability indicators

ADF Sustainable Economy Indicator: 7 factors = the lower the better	Thailand $\Phi(Z)$ *	Singapore $\Phi(Z)$ **	pValue* $1 - \Phi(z)$
Gini coefficient	0.709	0.074	0.03
Pop. Below \$1.90/day (%)	0.227	0.227	0.50
Pop. Below national poverty line (%)	0.440	0.106	0.16
Maternal mortality per 100,000	0.147	0.106	0.45
Infant mortality per 1,000	0.258	0.106	0.33
Death rate due to traffic per 100,000	0.977	0.061	0.00
External debt % of GNI	0.363	0.997	0.98

*The ASEAN 10 countries were used to obtain Thailand's CDF.

**Singapore is a First World Economy in the ASEAN. Singapore is used as a threshold value.

Source: https://en.wikipedia.org/wiki/Sustainable_Development_Goals. Accessed May 30, 2017.

The second prong of sustainability consists of 12 factors of the ADB indicators for economic sustainability. Table 6 lists these high-value targets. Using Singapore as a reference developed economy in the ASEAN group, Thailand failed 9 out of 12 indicators for sustainability. The achievement of sustainability is determined by: $1 - U$ where $U = \sum w_i p_i x_i$. Thailand achieved 0.71 while Singapore achieved 0.78. If the threshold is set at 0.80 under 80/20, then Thailand has 0.09 points to climb. Note that under 80/20 threshold, Singapore also failed in sustainability test.

Table 6: High target for sustainability indicators

ADF Sustainable Economy Indicator: 7 factors = the lower the better	Thailand $\Phi(Z)$ *	Singapore $\Phi(Z)$ **	pValue* $1 - \Phi(z)$
Participating 1 year before primary school %	0.9330	0.2266	0.08
Proportion of seats held by women in NA	0.2578	0.4404	0.00
Pop. Access to electricity (%)	0.9550	0.9550	0.03
Real growth % GDP per employed person	0.2266	0.2266	0.03
Commercial banks per 100,000	0.2266	0.2266	0.03
Population covered by mobile network (%)	0.9480	0.9550	0.03
Household expenditure or income growth (%)	0.2578	0.2266	0.05
Forest area as % of total land	0.5240	0.3632	0.13
Real growth of GDP	0.2578	0.2266	0.05
Real growth of value added to GDP	0.2266	0.1977	0.04
Domestic investment (% GDP)	0.4013	0.4404	0.80
Fiscal balance	0.1977	0.2266	0.03

*The ASEAN 10 countries were used to obtain Thailand's CDF.

**Singapore is a First World Economy in the ASEAN. Singapore is used as a threshold value.

Source: https://en.wikipedia.org/wiki/Sustainable_Development_Goals

Accessed May 30, 2017.

5.0 CONCLUSION

Thailand 4.0 is a development blue print for Thailand with 20 years horizon to achieve its targets. The objective of Thailand 4.0 is to achieve economic prosperity, social well-being, human values and environmental protection. The ultimate goal of Thailand 4.0 is for Thailand to achieve a status of First World Economy. To that end, this paper presented two research questions: (i) Does Thailand have characteristics of a developed economy? and (ii) Does Thailand have sustainable economy? Our analysis showed that there are many hurdles Thailand needs to overcome in order to attain World First Economy status and the current economy still fall short of sustainability expectation. For the time being, Thailand 4.0 is a road map to reach a goal. This paper provides a situation analysis to help Thailand see where is now stands in the cross-road between being a developing economy and becoming a developed economy.

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