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THAILAND 4.0: A Macroeconomic Perspective in Modern Development

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ABSTRACT

Thailand 4.0 is a development policy aiming to achieve economic prosperity, social well-being, human values and environmental protection. The goal of Thailand 4.0 is to transform Thailand into a First World Economy by 2032. This paper answers two research questions: (i) How far is Thailand from becoming a First World Economy? To answer this question, we use the 10-factor test of developed economy; and (ii) What does Thailand need to do in order to fulfill the requisite of economic sustainability? Secondary data used in this paper consists of annual reports of ADB, WEF and IMF. Kahnman-Tversky's prospect theory was used to assess Thailand FEW characterization and economic sustainability. Ten common characteristics of the First World Economy were used to benchmark Thailand's 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 achieved 9 out of 20 indicators for sustainability. Thailand 4.0 is a road map for development, our findings provide the distance of reaching the country's development target.

Keywords: Development Model, Prospect Theory, Sustainable Development, Thailand 4.0

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INTRODUCTION

The economic development of Thailand is divided into three stages. The first stage called Thailand 1.0 was an agriculture-based economy. The second stage was called Thailand 2.0 in which economic growth depended on light industry. The third stage was called Thailand 3.0 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 puts forth Thailand 4.0 development policy. Thailand 4.0 is not a development theory. It is an application of endogenous growth theory based on endogenous growth model.

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." SMART is an acronym for specific, measurable, achievable, relevant and timely. 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 citizens. 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 50 factors for sustainability.

LITERATURE REVIEW

We review three classes of development theories in a historical perspective: classical, neo-classical and contemporary modern development models. The Harrod-Domar is used to illustrate the classical model of development (Harrod, 1939; Domar, 1946). The Solow-Swan is used to illustrate the neo-classical development model (Sato, 1964). Lastly, the Mankiw-Romer-Weil model is used to illustrate the contemporary economic development model (Breton, 2013a). Although not all economic development theories had directly related to Thailand's developmental experience, we present all such theories in order to see Thailand's experience in the broader context.

A. Classical Model of Economic Development

The literature on economic development theory may be categorized into 3 lines of literature, 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; 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 instance, resources from the agricultural sector are allocated to the industrial sector (Lewis, 1954; Chenery, 1960). Third, international-dependence model was the last category of the classical thinking. International-dependence model advocated the withdrawal from the international economy and pursue self-sufficiency or autarky (Cohen, 1973:15; Dos Santos, 1973). We reproduce the Harrod-Domar model as an illustrative example of the classical model.

The Harrod-Domar model (Harrod, 1939) makes the following assumptions: (i) output is a function of capital stock: $Y = f(K)$; (ii) marginal product of capital is constant; production function has constant return to scale which implies that capital is marginal and the average products are equal: $\frac{dY}{dk} = c \Rightarrow \frac{dY}{dk} = \frac{Y}{K}$; (iii) capital is necessary for output: $f(0) = 0$; (iv) the product of savings rate and output equals savings which is equal to investment: $sY = S = I$; and (v) the change in capital stock equals investment less the depreciation of the capital stock: $\Delta K = 1 - \delta K$. The derivation of the output growth rate is given by:

$$c = \frac{dY}{dK} = \frac{Y(t+1) - Y(t)}{K(t) + sY(t) - \delta K(t) - K(t)} \tag{1}$$

which is simplified as:

$$c = \frac{Y(t+1) - Y(t)}{sY(t) - \sigma\left(\frac{dK}{dY}Y(t)\right)}$$

$$c(SY(t)) - \delta\left(\frac{dK}{dY}Y(t)\right) = Y(t+1) - Y(t)$$

$$cY(t)\left(S - \frac{dK}{dY}\right) = Y(t+1) - Y(t)$$

$$cs - c\delta\frac{dK}{dY} = \frac{Y(t+1) - Y(t)}{Y(t)}$$

$$S\frac{dY}{dK} - \delta\frac{dY}{dK}\frac{dK}{dY} = \frac{Y(t+1) - Y(t)}{Y(t)}$$

Finally, the output growth rate becomes:

$$sc - \delta = \frac{\Delta Y}{Y} \tag{2}$$

Savings rate times the marginal product of capital minus depreciation rate equal the output growth rate. Increasing savings rate, increasing the marginal product of capital, or decreasing depreciation rate will increase the growth rate of output. This is how to achieve economic growth under Harrod-Domar model in classical Keyesian economics. This model later became the precursor to the exogenous growth model (Hagemann, 2009).

B. Neo-Classical Model of Economic Development

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; Little, 1982). Stablization may be achieved by increasing capital and improving technology (Solow, 1956). Privatization may be achieved through the government's divestment from profit making enterprises (Gylfason, 1997). We use the Solow-Swan model to illustrate the neo-classical model of development (Swan, 1956).

The neo-classical model claimed that the Harrod-Domar model had short comings (Scarfe, 1977). Thus, the Solow-Swan model was introduced (Sato, 1964). The Solow-Swan growth model makes the following assumptions: (i) there is a single output using two inputs namely labor and capital; and (ii) the elasticity of substitution must be asymptotically equal to one. The model is formally given by:

$$Y(t) = K(t)^{\alpha} A(t) L(t)^{1-\alpha} \tag{3}$$

where t = time period, α = elasticity of output with respect to capital where the range is $0 < \alpha < 1$; $Y(t)$ = total production at period t; A = labor augmented technology or "knowledge"; and AL = effective labor (Solow, 1956). The model assumes that all factors are employed with initial condition of $A(0)$, $K(0)$ and $L(0)$. Labor and technology grow at a rate of:

$$L(t) = L(0)e^{nt} \tag{4}$$

$$A(t) = A(0)e^{gt} \tag{5}$$

The number of effective labor is defined as $A(t)L(t)$ with a growth rate of $(n+g)$. The stock of capital depreciates at a constant rate of δ. Only a fraction of the output is consumed: $cY(t)$ where $0<c<1$. What is left from consumption is saved. The saved share of the output is $s=1-c$ which is used for investment. Thus, the capital stock at a given period t is given as:

$$\hat{K}(t) = sY(t) - \delta K(t) \tag{6}$$

where $\hat{K} = \frac{dK(t)}{dt}$ or the change in capital stock with respect to time. Since the production function $Y(K, A, L)$ has a constant return to scale, it can be written as output for effective unit of labor, thus:

$$y(t) = \frac{Y(t)}{A(t)L(t)} = k(t)^a \tag{7}$$

where k = capital intensity or capital stock per unit of labor and α = effect of physical capital. The long-run pattern is given by the Solow-Swan model:

$$\hat{K}(t) = sK(t)^{\alpha} - (n+g+\delta)\,\mathrm{K}(t) \tag{8}$$

where $sK(t)^{\alpha} = sY(t)$ which is the actual investment per unit of effective labor. The fraction s of the output per unit of effective labor $y(t)$ that is saved and invested; $(n+g+\delta)$ = break-even investment or the amount of investment that must be invested to prevent K from falling.

Equation (8) implies that $K(t)$ converges to steady-state value of K^* defined by: $sK(t)^{\alpha} = (n+g+\delta)K(t)$. At the steady-state, there is no increase or decrease of capital intensity:

$$K^* = \left(\frac{s}{n+g+\delta}\right)^{\frac{1}{1-\alpha}} \tag{9}$$

The Solow-Swan model predicts that an economy will converge to a balanced-growth equilibrium. The growth of the output per worker is determined solely by the rate of technological progress. Since $\frac{K(t)}{Y(t)} = k(t)^{1-a}$ at equilibrium K^*, the rate of change of capital with respect to output is $\frac{K(t)}{Y(t)} = \frac{s}{n+g+\delta}$.

At equilibrium, capital/output rate depends on savings, growth, and depreciation rates. Solow-Swan allows us to track the effect of the economic growth from changes in technology, capital and labor (Haines & Sharif, 2006). Under Solow-Swan model, the marginal product of capital in rich and poor countries is the same (Caselli & Feyrer, 2007). Therefore, these poor countries are poor because of low productivity. This low productivity may be explained by the low level of human capital (Lucas, 1990).

The Solow-Swan model has been modified by Mankiw-Romer-Weil by adding human capital to the equation (Mankiw, Romer, & Weil, 1992):

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} A(t) L(t)^{1-\alpha-\beta} \tag{10}$$

where $H(t)$ is the stock of human capital which, like physical capital, depreciates over time at a rate of δ and β is the effect of human capital. The savings in investment in physical and human capital is: $S = s_K + s_H$. The dynamic equations are given by:

$$\bar{k} = s_K k^{\alpha} h^{\beta} - (n + g + \delta)k \tag{11}$$

$$\bar{h} = s_H k^{\alpha} h^{\beta} - (n + g + \delta)h \tag{12}$$

The steady-state growth path is $\bar{k} = \bar{h} = 0$ which means that $s_K k^{\alpha} h^{\beta} - (n + g + \delta)k = 0$ and $s_H k^{\alpha} h^{\beta} - (n + g + \delta)h = 0$ at steady-state. Therefore, the steady-state k and h is:

$$k^* = \left(\frac{s_K^{1-\beta} S_H^{\beta}}{n + g + \delta} \right)^{\frac{1}{1-\alpha-\beta}} \tag{13}$$

$$s^* = \left(\frac{s_K^{\alpha} S_H^{1-\alpha}}{n + g + \delta} \right)^{\frac{1}{1-\alpha-\beta}} \tag{14}$$

$$y^* = (k^*)^{\alpha} (h^*)^{\beta} \tag{15}$$

It has been shown that the effect of human capital is greater at the national level as indicated by economic growth than it is on a micro-level as measured by worker's salary (Klenow & Rodriguez-Clare, 1997). Research had further shown that human capital and technology had multiplicative effect on production (Breton, 2013b). Therefore, even if the effect of human capital (β) does not directly cause the worker's salary to increase, its indirect effect to push up the per capita earning of the population in the country is worth investing in human capital.

C. Modern Contemporary Model of Economic Development

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 & 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 (Meier, 2000). The general model is given as:

$$Y = AK^{\alpha}L^{1-\alpha} \tag{16}$$

where K = factor of production, L = labor and α = output elasticity of capital. If $\alpha = 1$, Y becomes linear in capital and does not show a return to scale in capital stock. The following terms are defined, thus: n = population growth rate; δ = depreciation rate; k = capital per worker; y = output/income per worker; L = labor force; s = savings rate; A= level of technology; and K = volume of capital. The savings may vary from country to country (Breton, 2013b). The output per capita is: $\frac{Y}{L} = A\left(\frac{K}{L}\right)$ or $y = Ak$ where $A > 0$. The assumptions of the endogenous growth model are: (i) average product of capital is equal to marginal product of capital which is $A > 0$, and (ii) labor force is growing at a constant rate n and there is no depreciation of capital: $\delta = 0$. The growth model then is:

$$\begin{aligned} k(t) &= s\big(f(k)\big) - nk \\ \frac{k(t)}{k} &= s\left(\frac{f(k)}{k}\right) - n \end{aligned} \tag{17}$$

If $\frac{f(k)}{k} = A$, then $\frac{k(t)}{k} = SA - n$ (Romer, 1986). One tenet of this model is that in the long run, poor countries will catch up with rich countries in terms of income. This is known as convergence effect. Convergence condition may include factors such as education, institutional structure and commitment to free market (Breton, 2013a). The convergence may be measured through regression modeling by verifying if a poor country is following the growth path of the rich country (Barro & Sala-i-Martin, 2004).

D. Thailand 4.0 in Context of Contemporary Development Model

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 & Auerbach, 1995). These infrastructures may include the availability of adequate capital and goods market (Cornwall & 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.

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	1. Poverty and hunger reduction
2. Social well-being	2. Primary universal education
3. Raising human values	3. Gender equality
4. Environmental protection	4. Child health
	5. Maternal health
	6. HIV/AIDS
	7. Environmental sustainability
	8. Global partnership

Note: *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.

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? In answering these two questions, 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 & 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 concern 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 which require economic development to 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 & 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 & 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 & Raiborn, 2001). This ambiguity is reduced into two questions "What should be sustained?" and "What should be developed?" (Kates, Parris & Leiserowitz, 2008). It is clear that sustainability includes economic prosperity, social equity and environmental protection. This paper assesses Thailand 4.0 on these bases.

METHODOLOGY

A. Data Source and Selection

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 Kahneman-Tversky index (Kahneman & Tversky, 1979). The Kahneman-Tversky 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 Kahneman-Tversky index is obtained by:

$$U = \sum w_i p_i x_i \tag{18}$$

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 partially based on the ADB's 50 sustainability indicators (APPENDIX 5): 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.

B. 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:

$$\langle n \rangle = \ln\left(N\alpha^2\right) \tag{19}$$

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

$$N = \left(\frac{3\sigma}{E}\right)^2 \tag{20}$$

where $\sigma = [(\bar{x} - \mu)/z]\sqrt{n}$ taken from the components of Monte Carlo three elements: $x_1 = max$, $x_2 = min$ and $x_3 = \frac{max+min}{2}$ and mid-point of the distribution curve $E = \frac{(max-min)/2}{50}$. 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 & Darling, 1952).

C. Data Testing

Test of distribution characteristics were employed to assess the current situation for Thailand 4.0 policy status. Firstly, skewness was used to determine the leaning of the data distribution (NIST, 2012). 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 of the data distribution (Westfall, 2014). Excess kurtosis means that the error spread (tail extremity or heaviness of the tail) is greater than normally expected (Balanda & MacGillivray, 1988). 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:

$$S_{skew} = \frac{n}{(n-1)(n-2)} \sum \left(\frac{X_i - \bar{X}}{S} \right)^3 \tag{21}$$

$$Kurt = \left[\left(\frac{n}{(n-1)(n-2)} \sum \left(\frac{X_i - \bar{X}}{S} \right)^4 \right) - A \right] \tag{22}$$

where $A = 3(n-1)^2 / (n-2)(n-3)$.

TABLE 2 Skewness and Kurtosis $\Phi(z)$

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

Note: *Per capita GDP has been taken out due to extreme values. Per capita GDP is discussed separately elsewhere.

D. GDP Gap as 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:

$$G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right|}{2n \sum_{i=1}^{n} x_i} \tag{23}$$

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:

$$GDP_{gap} = \left(Y_{report} - Y_{\min} \right) / Y_{report} \tag{24}$$

This new measure is an improvement over the Gini coefficient because it provides two additional 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.

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, using equation (18) Thailand scores U = 0.295 or achieved 29.5% probability of the expected value. If the threshold for achieving FWE is 51% of the 10 factors, by having a prospect score of 29.5%, Thailand would have 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 (20 out of 50 factors) for sustainable economy, Thailand still has not met the standard.

One of indicators used to assess the country's development is income inequality. Income inequality is generally evaluated by using the Gini coefficient. In this paper, we assert that the Gini coefficient is too broad. We proposed the use of a new measurement called the GDP gap ratio using the minimum wage in the country as the basis to determine the gap ratio from the stated per capita GDP. The comparative result of the GDP gap is presented in Table 3.

TABLE 3 GDP gap and gap ratio from 2008 – 2017

Y	GDP per capita	Actual GDP Min. wage	Difference	GDP Gap	Gini
08	4,379.53	2,215.22	2,164.31	0.49	0.40
09	4,207.58	2,129.37	2,078.21	0.49	0.40
10	5,065.38	2,337.96	2,727.42	0.54	0.39
11	5,482.40	2,539.37	2,943.03	0.54	0.37
12	5,850.30	3,476.02	2,374.28	0.41	0.39
13	6,157.36	3,516.77	2,640.59	0.43	0.41
14	5,921.09	3,325.12	2,595.96	0.44	0.41
15	5,799.39	3,153.28	2,646.11	0.46	0.41
16	5,899.42	3,060.36	2,839.07	0.48	0.41
17	6,265.29	3,138.045	3,127.25	0.50	0.41

The difference between the gap and the Gini is statistically significant: T = 4.78 (p = 0.00000041). The long-tern mean for the GDP gap is μ = 0.45 ± 0.05 for the Gini is μ = 0.40 ± 0.01. The Gini coefficient is underreported. In the context of Thailand 4.0's development goal of improving human value and the quality of life of the Thai populace, the GDP gap ratio is a better indicator to assess income distribution in the country. It is recommended that the GDP gap ratio and Gini coefficient be read side-by-side when assessing income distribution because the Gini coefficient alone may not be adequate.

A. 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 characteristics found in FWE. The Prospect Theory by Kahneman-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 a shortfall of 0.215 points.

As FWE, Thailand targets the per capita GDP level to be $15,000. In 2017, the per capita GDP in Thailand stands at $5,720. Using ASEAN as a reference group and $15,000 as the reference threshold level, Thailand achieved 0.291 or 29.21% of its target. The percentage probability is obtained through the standard score: $Z = (X_i - 15,000) / S_{asean}$ where X_i is the per capita GDP in the ASEAN countries and S_{asean} is the standard deviation of the GDP among the ASEAN group. The percentage probability is given by $F(Z)$.

B. 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 increased value 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 Appendix 2. 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 Pareto rule, then Thailand has 0.14 points below standard.

The second prong of sustainability consists of 12 factors of the ADB indicators for economic sustainability. Appendix 3 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.

As a policy recommendation, in order to be consistent with the overarching goal of Thailand 4.0 to escape from the middle income gap and improve human value, the issue of inequality in income distribution may be addressed by improving replacing minimum wage with living wage. The wage adjustment must be consistent with the economic health of the country. Raising the minimum wage for the sake of per capita earning adjustment would not solve the significantly high income gap, such wage increase would only bring about inflationary effect because the expansion of M1 is not offset by other economic fundamentals, such as value-added job creation in the manufacturing and service sectors.

Secondly, sustainability is also a core value of Thailand 4.0. Among the 12 factors used for assessing sustainability (Appendix 3), Thailand currently finds its strength in early age participation in education (Φ = 93.3%), access to electricity (Φ = 95.5%) and mobile phone coverage (Φ = 94.8%). These strengths would later serve to provide opportunity for the country to overcome its challenges in achieving sustainability. There are two weaknesses in Thailand's sustainability indicators, namely gender equality as measured by the number of seats in the National Assembly held by women (Φ = 25.78%) and fiscal balance (Φ = 19.77%). The remaining 7 factors, Thailand is on equal standing with ASEAN's standard setter: Singapore.

Sustainability factors consist of 6 social and 6 economic categories. Thailand's strength currently is found in the social factors. Among the 6 economic factors, Thailand remains weak. Among the 6 social factors, Thailand found its strength in early age participation in education, access to electricity and mobile phone coverage. To improve the economic factors, such as real GDP growth, foreign investment, and fiscal balance, success of Thailand 4.0 would largely depend on infrastructural investment, such as R&D, and input cost control to attract foreign investment.

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. First World Economy requires economic growth to be sustainable. 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. As an economy in transition trapping in a middle-income stage, Thailand needs to work on sustainability in order to achieve the First World Economy status. Sustainability requires advances in economic prosperity, social equity and environmental protection. Thailand 4.0 appears to emphasize economic prosperity and environmental protection. In the field of social equity, as evidenced by per capita GDP gap and gender equality, there is still room for improvement. Since the implementation window is 20 years, only time could tell the potential of success of Thailand 4.0.

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APPENDIX

Appendix Table 1 Per Capita GDP of ASEAN and WFE Status

Country	Per capita GDP	S_{asean}	$\hat{X} = 15,000^{*}$	Critical Value: Z	Probability $F(Z)$
Brunei	38,010.00	17,988.52	15,000	1.28	0.9000
Cambodia	1,070.00	17,988.52	15,000	(0.77)	0.1977
Indonesia	3,440.00	17,988.52	15,000	(0.64)	0.2578
Laos	1,740.00	17,988.52	15,000	(0.74)	0.2266
Malaysia	10,570.00	17,988.52	15,000	(0.25)	0.4013
Myanmar	1,160.00	17,988.52	15,000	(0.77)	0.1977
Philippines	3,550.00	17,988.52	15,000	(0.64)	0.2578
Singapore	52,090.00	17,988.52	15,000	2.06	0.9965
Thailand	5,720.00	17,988.52	15,000	(0.52)	0.2921
Vietnam	1,990.00	17,988.52	15,000	(0.72)	0.2266

Note: *Threshold value given by the Thai government as per capita GDP level for FEW.

Appendix Table 2 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

Note: *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.)

Appendix Table 3 High Target for Sustainability Indicators

ADF Sustainable Economy Indicator: 12 factors = the higher 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

Note: *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.)

Appendix 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)
GDP 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 Kahneman-Tversky:				**0.295**

Appendix Table 5 ADB Sustainable Development Goals, Basic Statistics 2017

1.1	Proportion of population below $1.90 PPP a day
1.2	Proportion of employed population below $1.90 PPP a day
2.1	Proportion of population living under national poverty line
2.2	Prevalence of undernourishment
3	Prevalence of stunting among children under 5 years of age
4.1	Prevalence of malnutrition (wasting) children under 5 years of age
4.2	Prevalence of malnutrition (over weight) children under 5 years of age
5	Maternal mortality ratio
6	Proportion of birth attended by trained health personnel
7	Under 5 mortality rate Infant mortality rate
8	Neonatal mortality rate
9	Number of new HIV infections
10	Tuberculosis incidence
11	Incidence of malaria
12	Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease
13	Death rate due to traffic injuries
14	Proportion of women married or in union of reproductive age satisfied by modern healthcare
15	Adolescent birth rate
16	Mortality rate attributed to household or ambient air pollution
17	Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene
18	Participation rate in organized learning (1 year before primary school)
19	Proportion of teachers received at least the minimum organized teacher training
20	Proportion of seats held by women in national parliaments
21	Proportion of population using improved drinking water sources
22	Proportion of population using improved sanitation facilities
23	Proportion of population with access to electricity
24	Renewal energy shared in the total energy consumption
25	Annual growth rate of real GDP per employed person
26	Unemployment rate by sex
27	Proportion of youth (age 15-24) not in education, employment or training
28	Number of commercial bank branches and ATMs
29	Proportion of adults (15 years or older) with an account at a bank of other financial institution
30	CO2 emission
31	Total official flows for infrastructure
32	Proportion of population covered by mobile network

Appendix Table 5 (Continued)

33.1	Growth rate of household expenditure or income per capita among bottom 40% of population
33.2	Growth rate of household expenditure or income per capita
34	Proportion of urban population living in slums
35	Average annual mean of particulate matter of 2.5 microns per meter in urban area
36	Material footprint
37	Domestic material consumption
38	Coverage of protected areas in relations to marine areas
39	Forest area as proportion of total land area
40	Proportion of children under 5 years of age whose birth had been registered
41	Volume of remittances in US dollars as proportion of GDP total
42	Debt service as percentage of exports of goods and services
43	Fixed broadband subscription
44	Proportion of individuals using the internet
45.1	Per capital national gross income
45.2	Annual real GDP growth rates
	Growth domestic product
	Valued added
45.3	Gross domestic investment
45.4	Inflation rate
46	Annual change in money supply
47	Balance of payment
	Growth rate of merchandise export
	Growth rate of merchandise import
	Trade balance
	Current account balance
48	Gross international reserves
49	External debt
50	Central government finance
	Revenues
	Expenditures
	Fiscal balance