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Role of Social Demography Factors in Economic Growth and Sustainability Models: Evidence from selected emerging economies

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Abstract
This study investigates the influence of emerging economies' social demography characteristics alongside technology diffusion on economic growth and sustainability. A static panel data analysis on the sustainable development of 10 emerging economies from 2006 until 2020 is presented. The findings reveal that social demography factors (fertility rate and population dynamics) pose a strong negative impact on economic growth and sustainability. Meanwhile, urbanisation and technology diffusion contribute positively to both economic models. This paper recommends that governments should prioritise allocating public services to urban areas, creating livable environments that may unlock human potential.

Keywords: Economic growth, sustainable development, emerging economies

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1.0 Introduction

The decades long adoption of Gross Domestic Product (GDP) as the indicator of a country's growth performance, had led to the emergence of the concept of 'sustainable development', which became a global buzzword by the early 1980s. Brundtland et al. (1987) defined the concept as a "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". The concept was derived from Solow (1974), who extended the economic growth model to include comprehensive development. A general sustainable development concept encompasses the complex means of societal development

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from three main perspectives: economic, social, and ecological. The Brundtland Report introduced a new vision to capital by replacing the gross national product (GNP) concept with “green national product”. This concept eliminates the inequality in the equitable return of essential resources between developed and less-developed countries. In maintaining comprehensive development, societal stability in a country’s economic progress has been perceived as critical in recent years. Social demography elements such as fertility, population growth, age distribution or mentality have become essential in fostering sustainable development via economic growth.

1.1 Indicators for Measuring Sustainable Development – the Adjusted Net Saving (ANS)

The fundamental elements of sustainable development widely cover economic, social, and ecological factors. The three outlined pillars have inspired researchers and policymakers to propose a comprehensive measurement. The Adjusted Net Saving (ANS) indicator for sustainable development is based on the net national saving (NNS) measurement (Pearce & Atkinson, 1992). The measurements further deduce the rents on natural resources (energy and minerals) and environmental degradation (carbon dioxide emissions), as shown in (Fig. 1). The ANS measures a country's economically sustainable development path by obtaining the level of genuine saving. The indicator is typically expressed as a percentage of gross national income (GNI).

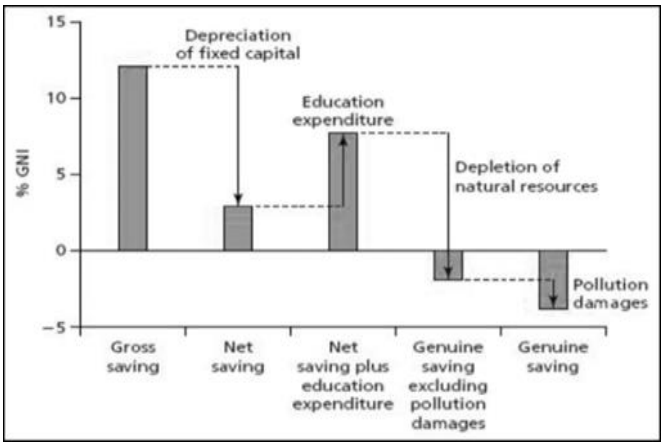

Fig. 1: Method of Calculation for Adjusted Net Savings Rate
(Source: World Bank, 1998)

The World Bank annually publishes a complete set of ANS databases of countries worldwide through their World Development Indicator’s (WDI) report. The indicator is popular among researchers for its simple calculation, which represents the genuine investment made from the accumulated wealth of nations. It can also be utilised for measuring a country’s path to economic sustainability. A consistently positive ANS rate shows that the country is sustainable, while a persistently negative rate implies otherwise. ANS rate is widely used to trace the development progress of countries, especially emerging economies.

1.2 Background and Scope of the Study

Emerging economies refer to countries that have achieved some standards of a developed nation. They typically feature a unified currency, stock market, and banking system. This study focuses on finding the connection between social demography factors and economic sustainability in emerging economies. Emerging countries are classified by income, as specified by the International Monetary Fund (IMF). Subject to the availability of data, a sample of 10 emerging economies was selected (Table 1).

Table 1. List of Emerging Economies (as of 2022)

No.	Countries	Income Category
1.	Thailand	UMIC
2.	Malaysia	UMIC
3.	Indonesia	LMIC
4.	Philippines	LMIC
5.	Argentina	UMIC
6.	Brazil	UMIC
7.	Chile	UMIC
8.	Colombia	UMIC
9.	Egypt	LMIC
10.	India	LMIC

Notes: UMIC: Upper-Middle Income Country; LMIC: Lower-Middle Income Country.
The income category is classified by the International Monetary Fund (IMF).
(Source: World Bank, May 2022)

Over the past 15 years, emerging economies have accounted for almost two-thirds of the world's GDP growth and more than half of new consumption. However, economic performance and sustainability paths among individual countries were found to vary substantially. Fig. 2 shows that, the 10 selected countries' economic growth (GDP) has rapidly increased over the years. On the contrary, some countries experienced an unsustainable development path, according to the ANS rate indicator. Over the years, the dynamic changes in population and demography characteristics have strongly influenced the economic landscape across nations, including in emerging economies. Before the global coronavirus outbreak, economic activities among the emerging economies were heavily intensified. The contradicting trends between economic growth and the sustainable development path of these emerging economies have raised questions and gaps to be analysed. There might be narratives about connections between social demography and ICT advancement in these emerging economies. Therefore, the main objectives of this study are:

i) To identify the impact of social demography on economic growth.

ii) To identify the impact of social demography on economic sustainability.

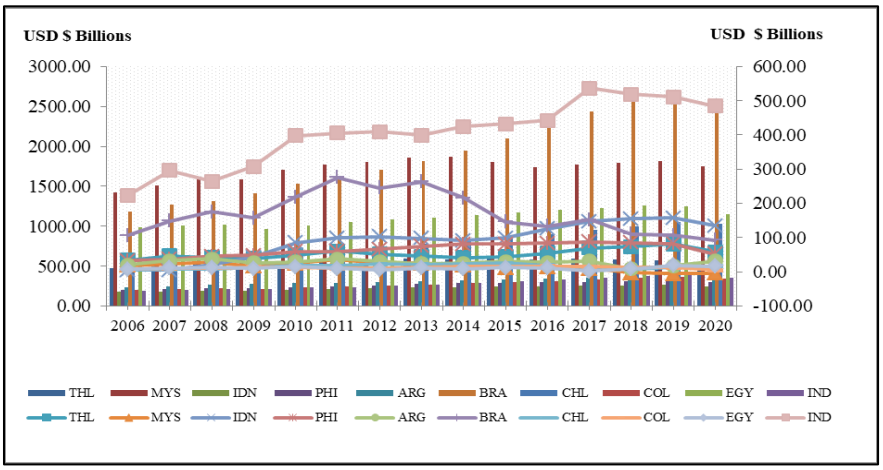

Fig. 2: GDP and ANS in 10 Emerging Economies (2006 – 2020)

Notes: The line Chart represents ANS (2006 – 2020), and the Bar Chart represents GDP (2006 – 2020). All figures are in the current USD Billion

(Source: World Development Indicator (WDI) Report, World Bank, various years)

2.0 Literature Review

In recent years, social demography literature has shed new light on the ability of economic growth to deliver sustainability. The interactions between demographics and economics are the object of a growing body of theoretical and empirical studies (Gori & Sodini, 2021). A theoretical framework suggests that a reduction in fertility below replacement levels can result in a sharp decline in the working-age share of the population (Jones, 2022). Burlacu et al. (2022) additionally proposed that a dramatic increase in population would increase purchasing power and consumption, eventually deteriorating the stock of capital resources. A higher fertility rate would impact the ecological footprint more, as demonstrated by Kazemzadeh et al. (2023). Other studies by Bairoliya and Miller (2021) and Yang (2023) further suggested that the fertility rate would increase public spending on education, which would in turn cause the spillover effects of urbanisation on economic growth in China.

Meanwhile, there are debates on whether urbanisation is relevant to socio-economic development. Nguyen (2018) analysed a sample of ASEAN countries and found a causal relationship between urbanisation and economic growth. The regional analysis by Hong et al. (2021) found the mixed effects of urbanisation on economic growth in China provinces. Over-urbanised cities may negatively impact economic growth. In terms of the effects of the largest cities' population on economic growth, Frick and Rodríguez-Pose (2018) concluded that a large urban population share of more than 10 million inhabitants would only promote growth in countries with an urban population of 28.5 million and more. The findings of Dzator et al. (2022) indicate that urbanisation negatively affects economic growth and increases carbon emissions. The contradicting argument by Brunt García-Peñalosa (2022) suggests that urbanisation affect economic growth positively in the European economies. Population drawn to larger cities generates higher productivity, leading to economic growth. Another critical factor in economic growth is ICT infrastructure development. ICT infrastructure accelerates economic growth effectively, as found in various research studies. Using Malaysia's health production model, Afroz et al. (2020) examined the association between ICT, economic growth, and population, and concluded that ICT inclusion improves human health and longevity. Relatively, Ramasubramanian et al. (2021) presented a data-driven narrative on how ICT affects economic sustainability in high and low-income countries. Low-income economies tend to posit negative behaviour (in sustainable growth) against ICT development, additionally raising the question of whether these economies will be able to meet the United Nations (UN) sustainable development goals (SDG). Sharma et al. (2021) further suggested that adopting ICT-enabled technologies will bring innovative changes and increase

economic growth in developing countries. In connection with environmental degradation, ICT is found to positively mitigate carbon dioxide emissions across nations (Awad, 2023).

3.0 Research Methodology

3.1 Model Specification

This study investigates the impact of social demography dynamics on economic growth (LGDP) and sustainable development (LANS) of 10 emerging economies, as stated previously. The analysis period covers15 years, from 2006 to 2020, with a total of 150 observations. This study's research framework is based on the ground theory of economic growth and sustainable development. Hence, two simple models are derived from the aforementioned indicators (Fig. 3). The lists of variables are described in the next section.

3.2 Variable Description

The main variables included in this study are sub-categorised into the dependent variables of economic growth and economic sustainability. Dependent variables are listed as GDP (LGDP) for the economic growth model (Model 1) and ANS (LANS) for the sustainable development model (Model 2). The independent variables are meticulously chosen from previous literature with diverse expected signs of correlations to one another. The variables representing social demography changes are total fertility, total population in the largest cities, total urban population and population growth. Meanwhile, the number of subscriptions to mobile cellular telephones is regarded as an ICT advancement.

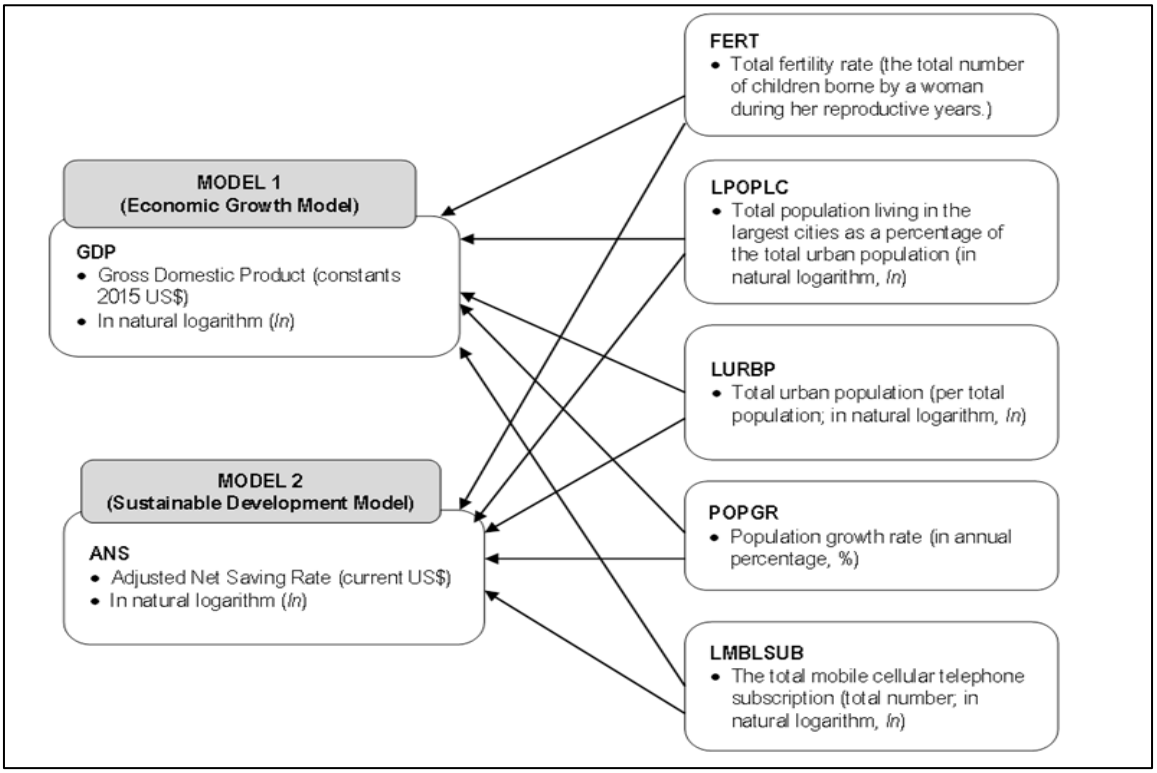

Fig. 3: Research Framework of Economic Growth and Sustainable Development Models of Selected Emerging Economies
(Data Source: World Development Indicator (WDI) Report, World Bank, various years)

This study is based on a simple static panel data analysis, utilising the secondary data available from the World Bank's WDI report. The equations representing both economic models are written as:

MODEL 1

$$LGDP : f\left[FERT, LPOPC, LURBP, POPGR, LMBLSUB\right] \quad (1)$$

MODEL 2

$$LANS : f\left[FERT, LPOPC, LURBP, POPGR, LMBLSUB\right] \quad (2)$$

From (1) AND (2), the following models are derived:

MODEL 1

$$LGDP_{it} = \alpha_{it} + \beta_2 FERT_{it} + \beta_3 LPOPLC_{it} + \beta_4 LURBP_{it} + \beta_5 POPGR_{it} + \beta_6 LMBLSUB_{it} + \varepsilon_{it} \quad (3)$$

MODEL 2

$$LANS_{it} = \alpha_{it} + \beta_2 FERT_{it} + \beta_3 LPOPLC_{it} + \beta_4 LURBP_{it} + \beta_5 POPGR_{it} + \beta_6 LMBLSUB_{it} + \varepsilon_{it} \quad (4)$$

Whereby,
LGDP = Gross Domestic Product for country, *i* at the time, *t*
LANS = Adjusted Net Saving for country, *i* at the time, *t*
FERT = Total fertility rate for country, *i* at the time, *t*
LPOPLC = Population living in the largest city for the country, *i* at time, *t*
LURBP = Urban population for country, *i* at time, *t*
POPGR = Annual population growth rate for country, *i* at time, *t*
LMBLSUB = Total number of mobile cellular subscriptions for country, *i* at time, *t*

The regression analysis of the pooled OLS model was first conducted with the assumption that the intercepts and slope coefficients are constant. The error term is assumed to capture differences in cross-sections (countries) over the period. Next, the generalised least-square (GLS) method of the fixed-effect (FE) model analysis with cross-sectional intercepts was conducted. Finally, the GLS random-effect (RE) model analysis was employed to address the random condition of intercepts and slope coefficients.

To capture the elements of the heterogeneity of each country in the analysis, this study further adopted the least squares dummy variable (LSDV) model. Country dummies were assigned in this model and written as:

MODEL 1

$$\begin{aligned} LGDP_{it} = {} & \delta_{it} + \delta_1 D_{1i} + \delta_2 D_{2i} + \delta_3 D_{3i} + \delta_4 D_{4i} + \delta_5 D_{5i} + \delta_6 D_{6i} + \delta_7 D_{7i} + \delta_8 D_{8i} + \delta_9 D_{9i} + \delta_{10} D_{10i} \\ & + \beta_1 FERT_{it} + \beta_2 LPOPLC_{it} + \beta_3 LURBP_{it} + \beta_4 POPGR_{it} + \beta_5 LMBLSUB_{it} + u_{2it} \end{aligned} \quad (5)$$

MODEL 2

$$\begin{aligned} LANS_{it} = {} & \delta_{it} + \delta_1 D_{1i} + \delta_2 D_{2i} + \delta_3 D_{3i} + \delta_4 D_{4i} + \delta_5 D_{5i} + \delta_6 D_{6i} + \delta_7 D_{7i} + \delta_8 D_{8i} + \delta_9 D_{9i} + \delta_{10} D_{10i} \\ & + \beta_1 FERT_{it} + \beta_2 LPOPLC_{it} + \beta_3 LURBP_{it} + \beta_4 POPGR_{it} + \beta_5 LMBLSUB_{it} + u_{2it} \end{aligned} \quad (6)$$

Where D_{1i}…… D_{10i} are the intercept dummies for every 10 cross-sections or countries.

4.0 Findings

The average mean value for LGDP and LANS highlighted that the countries were mainly on an upbeat track of economic growth and sustainability (Table 2). The data distributions of these two variables were highly skewed to the right (positive symmetric), which means that they were somehow bent to the negative values at a particular time over 15 years. The kurtosis value means that the distribution was moderately peaked (leptokurtic). In total fertility rate, the mean value shows an average of 2.3 children borne by women across the sample. This means that the fertility rate was slightly low in emerging economies.

Additionally, the skewness values show that fertility data were skewed to the right (positively symmetrical). Fertility data across the sample can be seen as moderately skewed, suggesting that fertility somewhat deviates from the given distribution. The kurtosis value of fertility data showed a platykurtic distribution, meaning that the distribution is shorter due to the potential to lack of outliers in the data. The data on urban population living in the most extensive cities indicates a mean value of 16.4%, meaning that only a tiny portion of the urban population resides in the metropolitan area. The data distribution was skewed to the left (negative skewness), suggesting that the urban population living in the largest cities was fairly distributed across the sample. The kurtosis value of this variable was within the acceptance range of normal univariate distribution. The urbanisation data distribution showed a moderately skewed distribution, while the kurtosis value further implied that it was platykurtic-shaped (kurtosis <3), meaning that it has low outliers. The population growth rate data skewness showed a similar trend to previous variables. However, it was highly distributed as its kurtosis values are greater than the threshold of 3, suggesting a leptokurtic shape of data distribution. The mobile cellular telephone subscription represents the technology variable, showing an average of 18.3 values in the logarithm, indicating that the elasticities are relatively high. The data is positively skewed to the right and symmetrical, implying that the number of mobile telephone subscriptions among the selected emerging economies is above the average. The Jarque-Bera probability test statistics indicated that all variables were against normality.

Table 2. Descriptive Statistics of the Regression Variables for Selected Emerging Economies (2006 – 2020)

MODEL: ECONOMIC GROWTH (GDP) and SUSTAINABILITY (ANS)							
	LGDP	LANS	FERT	LPOPLC	LURBP	POPGR	LMBLSUB
Mean	26.901	24.379	2.255	16.369	17.812	1.315	18.344
Median	26.615	24.203	2.210	16.432	17.489	1.289	18.238
Std. Dev.	0.765	1.277	0.540	0.470	0.974	0.351	1.050
Skewness	0.775	0.269	0.678	-0.232	0.790	0.809	0.608
Kurtosis	2.306	2.298	2.5703	1.845	2.561	3.140	2.980
Jarque-Bera	18.025***	4.892**	12.649***	9.685***	16.820***	16.495***	9.251***

Notes: (***) indicates a 99% level of confidence to reject the null hypothesis

Consecutively, the estimation results are presented in Table 3. In the pooled OLS model, the fertility rate had a strong negative impact on both the economic growth and sustainability models for emerging markets. The other variables namely population living in the largest cities, urban population, population growth and mobile cellular telephone subscription significantly influenced economic growth. On the contrary, the population living in the largest cities and urban population showed a strong negative influence on ANS. The population growth was insignificant in the OLS model to affect economic sustainability. The ICT variable was found to be significantly positive in the economic growth model, but it otherwise showed a non-significant impact on economic sustainability. The R-squared value was significantly high, denoting that the variance of the selected social demography and lifestyle variables was substantial for explaining economic growth and sustainability. FERT and LPOPLC have significant negative effects on the GLS-FE Model 1 and Model 2. On the other hand, the LURBP and LMBLSUB positively influenced both economic models. POPGR showed a non-significant coefficient in the FE model, defining its uncorrelated effects on economic progress and performance.

The estimated model analysis for the GLS-RE showed a similar trend to the GLS-FE models beforehand. Social demography variables (except population growth) and ICT advancement presented a mixed correlation with the economic models. The R-squared values between the FE and RE models are slightly different, whereby the FE models indicated a higher value, suggesting that the variations of the independent variables may be weaker in explaining economic growth and sustainability.

The Hausman test, as introduced by Hausman (1978), served as a specification test for examining the presence of endogeneity between the individual unobserved effects. The result exhibited that the FE model is more acceptable than the RE. Therefore, the FE model is chosen, concluding that each of the period and cross-sectional countries had its distribution properties. Next, the Wald test (Wald, 1943) was performed to ascertain the consistency of the GLS-FE estimation. The test result supported the FE model as the most appropriate, confirming that there was a strong connection between social demography and economic growth and sustainable development.

Table 3. Estimation Result

MODEL 1: SOCIAL DEMOGRAPHY AND ECONOMIC GROWTH
Dependent Variable: ***LGDP***
Sample: 2006 – 2020 (10 EMERGING ECONOMIES)

	Pooled OLS	**GLS-Fixed Effect (FE)**	**GLS-Random Effect (RE)**
Constant	7.613*** (15.733)	3.563** (2.115)	7.312*** (5.600)
FERT	-0.327*** (-13.327)	-0.369*** (-8.813)	-0.386*** (-10.685)
LPOPLC	0.391*** (10.554)	-0.460*** (-4.505)	-0.002 (-0.020)
LURBP	0.734*** (58.811)	1.720*** (21.685)	1.070*** (23.203)
POPGR	0.166*** (4.760)	-0.028 (-0.958)	-0.018 (-0.648)
LMBLSUB	0.018*** (1.035)	0.060*** (3.424)	0.079 (4.792)
Observation	150	150	150
R-Squared	0.966	0.996	0.880
F-statistic	808.370***	2561.59***	210.228***
Hausman Test (FE vs. RE)		***110.998******	
Wald Test (OLS vs. GLS – Fixed Effect)		***F-statistic***	***142.375******
		Chi-Square	***1281.378*****

MODEL 2: SOCIAL DEMOGRAPHY AND ECONOMIC SUSTAINABILITY
Dependent Variable: ***LANS***
Sample: 2006 – 2020 (10 EMERGING ECONOMIES)

	Pooled OLS	GLS-Fixed Effect (FE)	GLS-Random Effect (RE)
Constant	4.926** (2.001)	51.919** (3.167)	20.714** (2.518)
FERT	-0.387*** (-3.097)	-1.074*** (-2.635)	-0.390 (-1.417)
LPOPLC	-0.020 (-0.104)	-4.186*** (-4.215)	-1.467*** (-2.815)
LURBP	1.080*** (16.980)	1.650** (2.137)	1.017*** (4.238)
POPGR	-0.136 (-0.768)	-0.317 (1.110)	-0.545** (-2.173)
LMBLSUB	0.087 (0.963)	0.742*** (4.356)	0.530*** (3.638)
Observation	150	150	150
R-Squared	0.966	0.996	0.871
F-statistic	808.370***	2561.59***	65.245***
Hausman Test (FE vs RE)		***12.671****	
Wald Test (OLS vs GLS – Fixed Effect)		***F-statistic***	***17.912****
		Chi-Square	***161.212****

Notes: 1. (*), (**), (***) denote significance levels at 10%, 5% and 1%. 2. Values in parenthesis are t-statistic

5.0 Discussion

From the empirical analysis, several findings may be concluded for this study. Firstly, the social demography factors such as fertility and population in the largest cities had a strong negative influence on economic growth and sustainability in the emerging markets over the last 15 years, consistent with previous findings (Gori & Sodini, 2021). Declining fertility may induce higher investments in health and human capital, which can offset some of the adverse effects of ageing. A lower fertility rate can also cause higher physical capital accumulation by encouraging workers to save for retirement rather than rely on their children for old-age support (İmrohoroğlu & Zhao, 2018). The negative effect arising from the increased population in the largest cities is also consistent with the theory, which suggests that it would deteriorate economic growth and sustainability in the long run because of the externalities.

Urbanisation and mobile cellular telephone subscriptions were found to be significant factors in both economic models. The findings implied that urbanisation was the most crucial factor contributing to economic performance in emerging markets rather than sustainability. The use of mobile telephony services as ICT advancement in emerging economies was highly significant in the sustainable development model. Mobile cellular subscriptions are perceived to be essential in ensuring an efficient social lifestyle that is highly required in the modern business world. Conclusively, the mobile telecommunications and social demography factors are perceived to work together to define their influential roles in ensuring the economic growth and sustainability of emerging economies. Hence, the findings may be interpreted as successfully fulfilling the two main objectives of this study, which are to identify the impact of social demography on economic growth and economic sustainability in the selected emerging economies.

6.0 Conclusion and Recommendation

In conclusion, while the findings are consistent with the previous literature, this study highlights a unique coexisting relationship between ICT and social demographic impact on both economic indicators. There were several limitations while conducting this study. Emerging economies often have limited resources for data collection and analysis, leading to incomplete or unreliable data on environmental, social, and economic indicators. This study suggests that the result should be interpreted cautiously as data availability limits a more accurate measurement to enable sectorial composition and contextual factors. Emerging economies are a diverse group with varying historical, cultural, and political contexts, demanding nuanced approaches to sustainable development. As the analysis employed a mixed combination of social demography variables and ICT advancement, emphasis shall be put on the coefficient outcome of each variable. The extent to which social quality and ICT can be used to harness improvements in society's well-being should also be taken into account. For future analysis, it is proposed that the social demography model of economic growth and sustainability to be improved by adding a more focused set of variables such as life expectancy or mortality rate. With the global coronavirus pandemic becoming less severe, countries have resumed with their development plans. As restrictions on travelling and business activities have been lifted, an economic rebound will be seriously needed. Thus, designing appropriate policies to foster economic growth and further ensure economic sustainability must become the ultimate objective for most governments, especially for emerging economies.

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Paper Contribution to Related Field of Study

This study will contribute to the area of economic growth and sustainable development.

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