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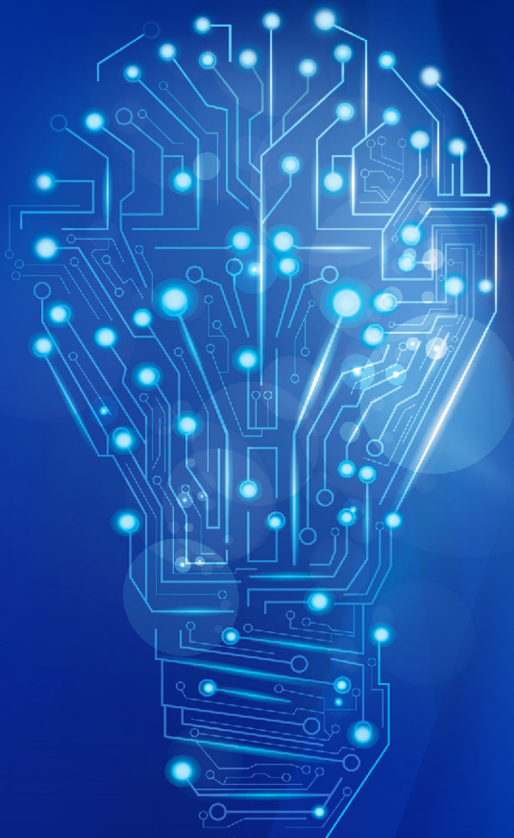

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COVID19- Implications on IsDB Member Countries Sustainable Digital Economies

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معهد الشرق الأوسط للاقتصاد المبني على المعرفة
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Abstract

Purpose

The study aims to examine the Islamic Development Bank (IsDB) Member Countries (MCs) digital transformation into digital economies via digital technology applications at both the macro and micro levels.

Design/Methodology/Approach

A mixed methodology is used. This is based on the modified models and frameworks to be employed by IsDB MCs at both the macro and micro level to utilise the digital technology applications that will help in transforming them into digital economies to sustain their economic development. They will also be used to reduce the negative impact of COVID-19 and future pandemics via facilitating economic activities under uncertainties through using the digital technology applications proposed.

Findings

The study provided digital economy frameworks and policies to help in implementing digital transformation, and to develop and use the new technologies needed for IsDB MCs; sustainable economic growth through technological progress, human capital skills development and environmental protection. The study proposed solutions to transform IsDB MCs public and private sectors into a digital economy to achieve the Sustainable Development Goals' (SDGs) agenda, and to overcome the negative impact of COVID-19 and future pandemics.

Originality/Value

The study contributes to the body of knowledge via proposed mixed method frameworks and models that examine IsDB MCs digitisation. The IsDB aggregate economies, industries and companies will be provided with frameworks and guidelines to implement digital technology applications that will help them to transform into digital sustainable economies.

Keywortds

IsDB MCs, digital economies, COVID-19, SMEs, digital transformation

Introduction

The United Nations (UN) Sustainable Development Summit held in New York in September 2015, approved the goal of the sustainable development agenda by 2030 (UN, 2015). The UN summit proposed a new indicator framework, associated with global and universal indicators, for international cooperation to achieve sustainable development between 2015 and 2030, including 17 new Sustainable Development Goals (SDGs).

The Islamic Development Bank (IsDB) has its headquarters located in Jeddah, Kingdom of Saudi Arabia and consists of 57 countries around the globe. It started its transformation programme through considering science, technology, and innovation at the heart of its Member Countries (MCs) growth strategy. IsDB MCs' transformation programme invested heavily in these sectors via its flagship programmes (the Engage Platform and Transform Fund). The Engage Platform is a digital hub that is closely aligned to the UN SDGs; it created a global innovation ecosystem for IsDB MCs and Non-IsDB MCs communities to connect the innovation with market opportunities and funding sources. The IsDB Engage programme focuses on accelerating progress towards achieving greater food security, healthier lives, inclusive and equitable education, sustainable management of water sanitation, access to affordable and clean energy, sustainable industrialisation across IsDB MCs and non-IsDB MCs in developing countries. The IsDB Engage programme does not have considered funds at the IsDB MCs' economic level that can be transformed into a digital economy through building digital economy foundations to facilitate the IsDB Engage programme at the micro-level. Therefore, this study fills this gap by proposing digital transformation for IsDB MCs to develop digital economies that facilitate the IsDB Engage programme in achieving its SDGs by transforming IsDB MCs into seasonable digital economies.

There is no one standard definition of the digital economy. However, an acceptable definition must place importance on the generation and exploitation of knowledge through digital technology applications to create new value in the economy. Indeed,

knowledge is information that is put to productive work through digital technology applications. Knowledge includes information in any form, know-how and know-why. The digital economy is not confined to information and communication technology (ICT). Before the evolution of ICT, it was the knowledge that was embodied in human beings' "human capital" and technology that was embodied in the capital investment undertaken by the Asian economies that brought about the so-called Asian miracle.

Meanwhile, changes in productivity are a major concern in any economy because of the link between productivity and living standards (Ahmed, 2018, 2019, 2020a). The ultimate goals of productivity improvement are greater competitiveness, higher profitability, higher living standards, and better economic and social prosperity. In this respect, Total Factor Productivity (TFP), described as the contribution of quality of the factors of production, and an indicator of the technological progress that shows the spillover effects that must transfer the technology to the hosting economy and upgrade the skills of its human capital combined, that is what is called productivity driven. TFP can explain the growth in a knowledge-based (k-based) economy because it captures endogenous technical change and other characteristics of the digital economy, including diffusion of digital knowledge, organisation, restructuring, networking, and new business models that would contribute to market efficiency and productivity (Ahmed, 2017, 2018, 2020b).

According to the World Bank Digital Dividends Report (2016), digital technology in the form of the Internet, mobile phones and all the other tools used to collect, store, analyse and share information digitally, has grown rapidly around the globe. It is estimated that 70% more households have mobile phones than have access to electricity and clean water in developing countries. The number of Internet users has more than tripled in a decade (1 billion in 2005, 3.2 billon by the end of 2015). This means businesses, people and governments are more connected than before the digital revolution. The digital divide shows the gap in access to ICT applications within nation or between nations. Digital dividends are the broader development that benefits from using digital technologies. In many instances, digital technologies boosted growth, expanded opportunities, and improved service delivery. Their aggregate impact has fallen short and is unevenly distributed. In order for digital technologies to benefit everyone around the world, it would be necessary to close the remaining digital divide, especially in Internet access. However, greater digital adoption will not be enough.

IsDB MCs Digital Economy Flagships and Pillars

IsDB MCs digital economy flagships and pillars should be developed as the foundation for the digital economy to be developed. Some of IsDB MCs 57 members are in an advanced stage in establishing digital economy flagships and pillars. Malaysia developed their knowledge economy master plan in 1996 and implanted the digital economy flagships in stages that should be completed in 2020. Some other countries are ongoing in developing the digital economy foundation, and some are in the early stages of development. Studying the experience of the countries that planned and developed their economies into digital economies, such as countries in America, Europe, and Southeast Asia, it should be noted that the Malaysian experience is a good example to follow as the country planned well for the digital economy foundations, using, for example, Multimedia Super Corridor (MSC), digital economy flagships and pillars, and economic corridor regions around Malaysian states (Ahmed, 2018).

To benefit significantly from the digital revolution, countries also need to work on the "analog complements" (World Bank, 2016); they should do this by strengthening regulations that ensure competition among businesses, by adapting workers' skills to the demands of the new economy, and by ensuring that institutions are accountable. It should be noted that developing human capital (skilled workers) is a perquisite of developing and implementing ICT applications in IsDB MCs economic sectors. With the right human skills, ICT will facilitate economic activities; this is because technology in general, and ICT in particular, are facilitators that need the right human skills to function.

To develop a competitive edge in a digital economy, IsDB MCs would need a highly skilled labour force. A highly skilled labour force is also fuel to the engine of growth in a k-based economy. They provide the 'know-how' that goes into the production of innovative products to enable a company or a country to be competitive in the global market place. In addition, out-migration drains the limited talent pool: many professional and technical personnel have migrated abroad. IsDB MCs students overseas are another source of potential out-migration. The only other alternative is to bring in the requisite skilled labour from outside,

and conditions in the country should be liberalised for their recruitment. IsDB MCs produced a huge number of university graduates and postgraduates; these should be trained to upgrade their skills so they can contribute to the development of IsDB MCs digital economy foundations and activities. It is urgent that schools and universities in IsDB MCs are improved by developing good infrastructure and infostructure. This would make the IsDB MCs education institutions play a significant role as the source of the human capital development considered to be one of the important pillars to develop a digital economy in IsDB MCs.

Another important challenge that IsDB MCs would face in their effort to move to a k-based economy would be their ability to build an innovative capacity in the country so they can develop innovative goods and services for the digital economy (Ahmed and Ammar, 2020). With increased liberalisation of economies and the removal of tariff barriers, goods and services produced by IsDB MCs companies and workers will have to compete with multinationals and those of other developing countries.

The current amount of resources allocated to Research and Development (R&D) in the country as a percentage of GDP is lower compared with other countries. To bring about innovation, the government must foster an environment where creative and innovative thinking are rewarded. Incentives should therefore be given to those who come up with cutting-edge ideas and recognition should accompany such discoveries. The award and recognition should be strictly for the contribution of an innovative product and process or processes that would enhance IsDB MCs' innovative capacity and competitive standing in the global marketplace.

IsDB MCs are highly qualified to be education centres that attract students from the Middle East and Africa. They could also attract students from other countries if the education institutions developed more while serving IsDB MCs. It should be recalled that with the current situation, IsDB MCs graduates are the most important source of Gulf countries' human capital. If the education institutions developed more, IsDB MCs graduates could compete around the globe through developing IsDB MCs economy into a k-based economy with the right foundations. The current business model practiced in IsDB MCs should be developed to meet the requirements of digital economy foundations. By doing so, improving the current business model will contribute and add economic value to the development of IsDB MCs, and achieve the desired digital economy if planned for it well in short period of time as the later countries will catch up very fast to achieve their objectives. In this respect, Small and Medium Enterprises (SMEs) are considered to be the backbone of economies around the globe; they account for 90-99% of the companies in every country. In most IsDB MCs, SMEs are not well classified and do not even exist in some countries. It should be noted that SMEs are at the centre point of the digital economy in transferring the technology and upgrading the local work force skills via Foreign Direct Investment (FDI) spillover effects (Ahmed and Ammar, 2020).

Cyber laws should be introduced to overcome the cyber problems associated with digital economy activities. Cyber-crimes may take place abroad and, in this respect, there is an urgent need for collaboration around the globe to overcome cyber-crimes.

The definitive currency of a digital economy is intellectual property rights (IPRs); these include copyrights, patents, trademarks, service marks and goods of geographical indication. In a way, IPRs are legal monopolies awarded to original owners of copyrights and patents to enable them to benefit from their discoveries. They are also a way of ensuring the effective distribution of those inventions into an economy (Ahmed, 2020a).

The first step for IsDB MCs to move to a digital economy is for them to develop a digital economy master plan to address the policies and developing digital economy institutions. This study will be useful for ICT policy formulation in IsDB MCs as a foundation of digital economy development. In this context, a comparison of the contributions of ICT and productivity growth in each of the East Asian countries will provide guidelines for the policy-makers in IsDB MCs to formulate appropriate national and international ICT policies. The findings from this study will also help policy formulation in promoting ICT investment and in developing the human capital and infrastructure needed to support effective use of the digital technology in IsDB MCs. It is possible that IsDB MCs can capitalise on its synergy with other nations and make full use of the competitive advantages in other countries to overcome its insufficiencies. In that case, IsDB MCs will be able to accelerate the movement towards a technology-savvy nation that has been achieved by Japan, South Korea, China and other countries.

According to Ahmed (2020a), there is a need to address security issues associated with technology applications so as to ensure the success of the implementation of technology applications. More specifically, the issues that need to be addressed are to ensure security and privacy of existing e-channels, such as ATM and EPOS, and to resolve all network problems. Building people awareness and informing the public about the benefits and use of new technology and services is required. There should be rigorous campaigns

to educate the public, especially targeting the urban and rural communities, so they are aware of the digital economy concept and dimensions to create the knowledge sociality that is required on which a digital economy would be based. A proper regulatory environment, respecting user guidelines, trusts, rights and protections, proper integration and partnership between mobile network operators and the economy sectors, adequate staff training and introducing client literacy for proper use, developing reliable and adequate ICT infrastructure and better product and service design are necessary to implement digital economy applications. Finally, collaboration and cooperation between private and public sectors in order to build a digital economy is urgently needed (Smart Partnership). Between 1979 and 1981, the Kenana Sugar Company was shown to be a very good model of collaboration and cooperation between private and public sectors in the form of Foreign Direct Investment (FDI) (Ahmed and Anwar, 2020).

Finally, as Ahmed (2018, 2020b) indicated, the sustainability of higher economic growth will continue to be productivity driven. This will be through the enhancement of TFP as technological progress in IsDB MCs nations that combined the three dimensions of sustainable development (economic development, environmental protection, and social sustainable development via human capital development). Such an enhancement needs to emphasise the quality of the workforce, demand intensity, economic restructuring, capital structure, technical progress and environmental standards. Green productivity through green TFP demonstrates the sustainable development concept of progressing technologically and environmentally. It will ensure the rights of the future, as well as current, generations for them to enjoy a better life. Moreover, Romer (1986, 1987a, b, 1990, 1993) emphasised how the economy can expand the boundaries, and thus the possibilities, of its future activities. In his focus on the fundamental challenges of climate change, Nordhaus and Romer (2018), and Nordhaus (1974, 1975, 1977, 1994a, b, 2013, 2014, 2017, 2018) stressed the importance of the negative side, and thus the restrictions, of the endeavours in bringing about future prosperity.

As has been mentioned earlier, in many instances digital technologies boosted growth, expanded opportunities, and improved service delivery. Their aggregate impact has fallen short and is unevenly distributed. For digital technologies to benefit everyone everywhere requires closing the remaining digital divide, especially in Internet access. To develop a competitive edge in a digital economy, IsDB members would need a highly skilled labour force. A highly skilled labour force is the fuel to the engine of growth in the digital economy. They provide the 'know-how' that goes into the production of innovative products that enable companies or countries to be competitive in the global market place.

COVID-19 and its economic impact, and the need to work from home to sustain economic activity, required high involvement so the digital technology could run daily activities through electronic governance. This study developed frameworks and models to be employed by IsDB MCs. It empirically

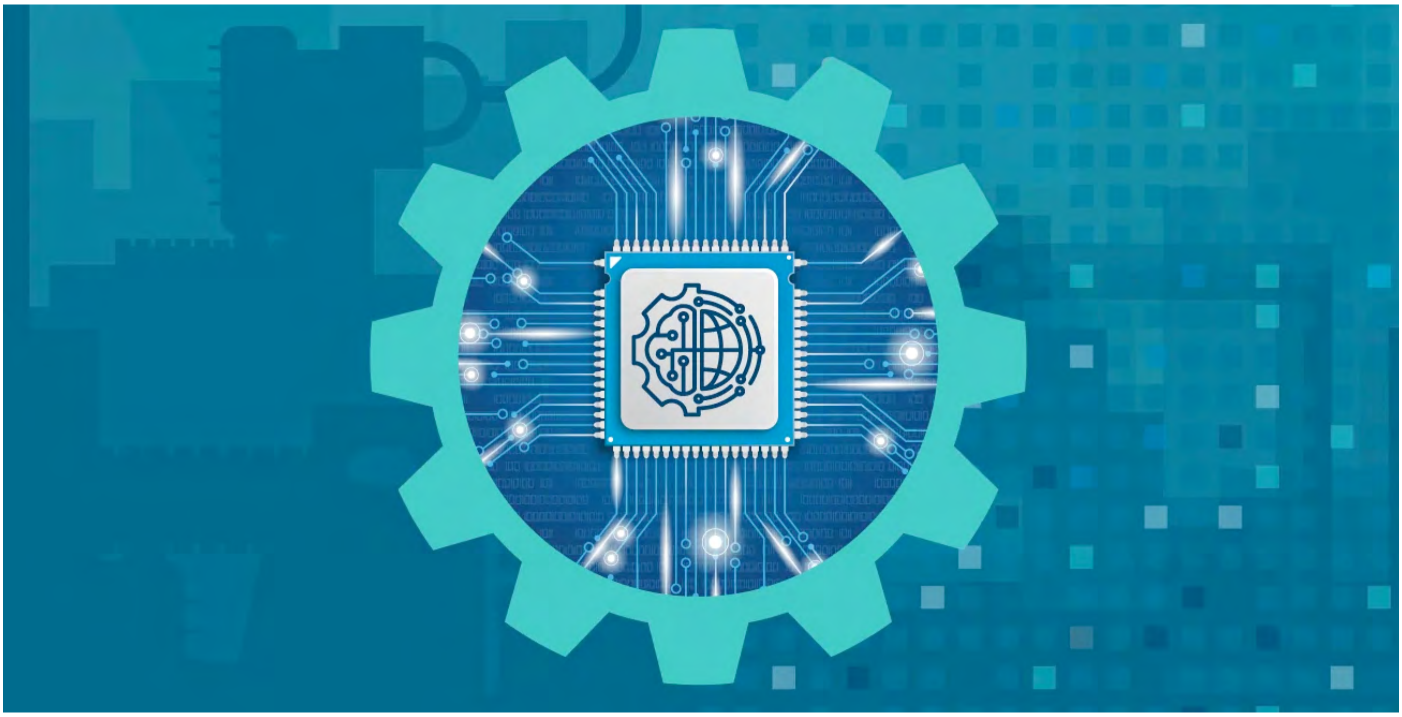
examined the impact of COVID-19 and the role of digital technologies in sustaining the economic growth in the IsDB MCs economies, both public and private sectors. In addition, the study provides policy implications towards developing IsDB MCs into digital economies that would sustain economic development under any undesirable conditions, such as COVID-19 that caused huge economic losses. IsDB MCs' digital economic development will reduce the economic losses associated with future global pandemics. The main objective of this research is to model and examine the digital economy's positive and negative externalities spillover effects on the IsDB MCs' sustainable economic growth through employing a mixed method approach, consisting of quantitative and qualitative analysis at IsDB MCs macro and micro levels.

Methodology Development Process

Digital economy's positive and negative externalities were considered in developing the study frameworks and models in this this chapter. At the IsDB MCs macro and micro levels, this research intends to use a mixed approach of quantitative and qualitative analysis. In this section, a parametric analysis based on a combined method of parametric analysis at the IsDB MCs macro level is developed. The IsDB MCs at the macro-level method combines both growth accounting, that is non-parametric, and econometric a parametric estimation.

This method was developed to be applied in two steps: the first step is an econometric approach to estimate the study parameters (explanatory variables coefficients), whereas the second step plugs these parameters into the models to calculate the productivity indicators. For the purpose of the paper, three frameworks and models have been developed based on Ahmed (2006, 2007, 2009, 2010, 2017, 2018, 2020a) modified extensive growth theory and intensive growth theory (labour productivity and capital productivity. Ahmed›s above mentioned studies modified and combined the production function and Solow's residual (Solow, 1955) to fill the gaps in both approaches that cast doubts on the results generated by both. The framework (Figure 1) is an extensive growth theory presentation of Model 1 that consists of the output (Gross Domestic Product [GDP]) as a function of capital, labour, digital technology, and pollutant emissions for pollution are the explanatory variables based on their quantity. In addition, the framework presents TFP that combined the inputs quality contribution (explanatory variables) that indicated that IsDB MCs' technological progress to be transformed into sustainable digital economies.

This paper proposes a digital productivity framework, a digital labour productivity framework, and digital capital productivity framework (Figures 1, 2 and 3) to be used at the country level. The frameworks will measure the IsDB MCs' digital economy productivity implications via the collection of a primary data survey and the analysis of qualitative focus groups interviews with IsDB MCs concerned experts. This will capture data that have not been published in the form of secondary data and information.



The production function for an economy can be characterised as follows:

$$GGDPt,i = F\,(Kt,i,\ Lt,i,\ DTt,i,\ Pt,i,\ Tt,i)$$

where country i = 1, 2, …57 in Years t, output real GDP is a function of real fixed physical capital input K, labour input L, DT for digital technology, while P represents the pollutants emissions, and time T proxies for TFP as a technological progress of the digital economies and sustainable development indicator.

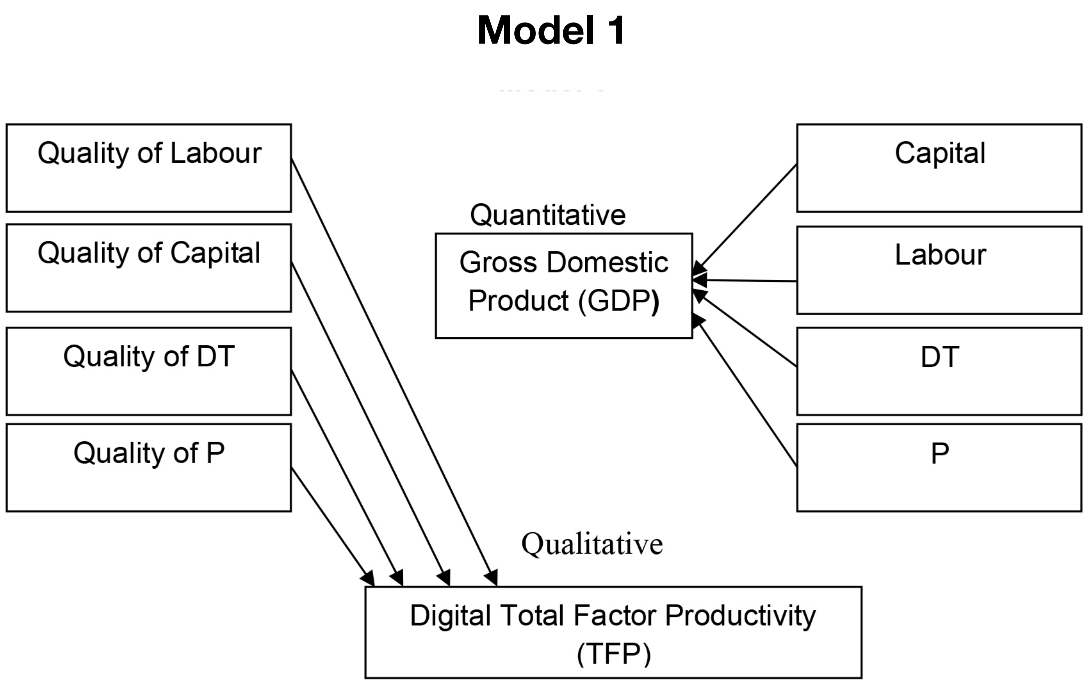


Figure 1: Productivity Framework, Extensive Growth Theory

Source: Modified from Ahmed, 2020a

Extensive growth theory

This subdivision presents the extensive growth theory based on GDP that is decomposed into physical capital, employment, digital technology (DT) and pollutants' emissions (P). The current study attempts to fill the gap found in Jorgenson et al.'s (1987) study via modifying this model into a parametric model, and providing statistical analysis for it in the first step, as follows:

$$\Delta \ln GDPt,i = a + \alpha . \Delta \ln Kt,i + \beta . \Delta \ln Lt,i + \lambda . \Delta \ln DTt,i + \theta . \Delta \ln Pt,i + \varepsilon t,i \quad (2)$$

t = Number of years and i is number of countries

where

α	is the output elasticity with respect to capital
β	is the output elasticity with respect to labour
λ	is the output elasticity with respect to digital technology
θ	is the output elasticity with respect to pollutants' emissions
a	is the intercept or constant of the model[1]
ε	is the residual term[2]
ln	is the logarithm to transform the variables
Δ	is the difference operator denoting proportionate change rate.

Since the intercept (a) in Equation 2 has no position in the calculation of the productivity growth indicators, a second step was proposed. This step calculates the growth rates of productivity indicators, transforming Equation 2 as an extension of the basic growth accounting framework. The production function is specified in the parametric form of the above equation as follows:

$$\Delta \ln TFPit = \Delta \ln GDPit - [\alpha . \Delta \ln Kit + \beta . \Delta \ln Lit + \lambda . \Delta \ln DTit + \theta . \Delta \ln Pt,i] \quad (3)$$

where the weights are given by the average value shares as follows:

$\Delta \ln GDPit$	is the growth rate of output
$\alpha . \Delta \ln Kit$	is the contribution of the aggregate physicall capital
$\beta . \Delta \ln Lit$	is the contribution of the aggregate labour
$\lambda . \Delta \ln DTit$	is the contribution of the digital technology
$\theta . \Delta \ln Pit,i$	is the contribution of the pollutants' emissions
$\Delta \ln TFPit$	is the total factor productivity growth

[1] The intercept term, as usual, gives the mean or average effect on dependent variables of all the variables excluded from the model.

[2] The residual term proxies for the total factor productivity growth that accounts for the technological progress of the economy through the quality of input terms.

The model decomposes the growth rate of GDP into the contributions of the rates of growth of the aggregate physical capital, labour, digital technology and pollutants' emissions, plus a residual term, characteristically referred to as the growth rate of TFP.

Intensive growth theory (labour productivity)

This subsection demonstrates an intensive growth theory framework (Figure 2) for Model 2, the labour productivity or output per labour (GDP)/labour as a function of capital per labour, digital technology per labour, and pollutants' emissions per labour are the explanatory variables based on their quantity. Moreover, the framework presents the total TFP per labour (TFP/L) that is expressed as the combined contribution of the quality of the explanatory variables.

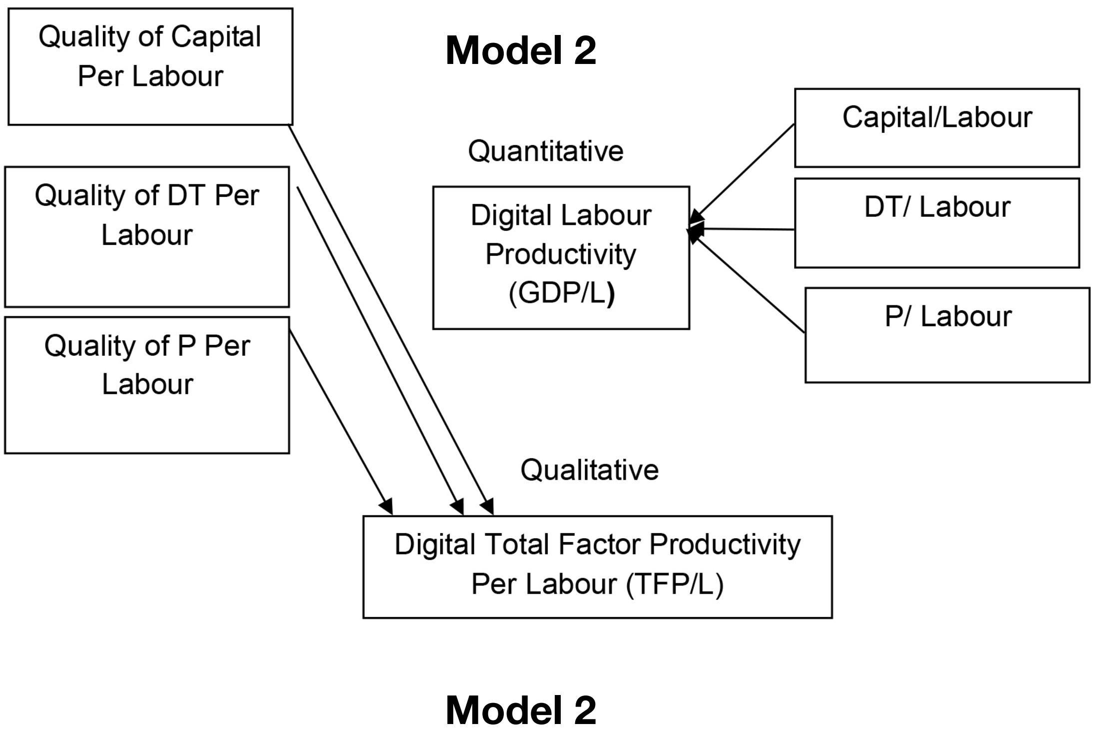


Figure 2: Total Factor Productivity per Worker Framework, Intensive Growth Theory

Source: Modified based on Ahmed, 2020a

This subsection demonstrates the decomposition of labour productivity into capital deepening, increased usage of digital technology per unit of labour, and pollutants' emissions per unit of labour. Moreover, following Dollar and Sokoloff (1990), Wong (1993), Felipe (2000), and Ahmed (2006, 2007), when constant returns to scale $\beta = (1 - \alpha - \lambda)$ ion 2 becomes:

$$\ln GDPt,i = a + \alpha.\ln Kt,i + \lambda.\ln DTt,i + \theta.\ln Pt,i + (1 - \alpha - \lambda - \theta).\ln Lt,i + \varepsilon t,i \quad (4)$$

$$t = \text{Number of years}$$

However, there are two options for dividing the variables by L:

1. Dividing the variables (data) by L before the analysis, in which the equation is given as:

$$\ln(GDP/L)_T = a + \alpha \ln(K/L)_T + \lambda \ln(DT/L)_T + \theta.\ln(P/L)_T$$

This will not be used in this study.

2. Dividing the variables by L during the analysis through programming the variables that will be used in this study, as follows:

$$\ln(GDP/L)_T = a + \alpha_1 \ln(K/L)_T + \alpha_2[\ln (K/L)_T]^2 + \lambda_1 \ln(DT/L)_T + \lambda_2[\ln (DT/L)_T]^2 + \theta_1 \ln(P/L)_T + \theta_2[\ln (P/L)_T]^2$$

The output elasticity is calculated with respect to capital per labour, digital technology per labour, and pollutants' emissions per labour, i.e., $\alpha = \alpha 1 + \alpha 2$, $\lambda = \lambda 1 + \lambda 2$ and $\theta = \theta 1 + \theta 2$, respectively. Following Dollar and Sokoloff (1990) and Ahmed (2006), the production function can be in the form:

$$\begin{aligned}\Delta\ln(GDP/L)t,i = {} & a + \alpha_1.\Delta\ln (K/L)t,i + \alpha_2[\Delta\ln (K/L)t,i]^2 + \lambda_1.\Delta\ln (DT/L)t,i \\ & + \lambda_2[\Delta\ln (DT/L)t,i]^2 + \theta_1.\Delta\ln (P/L)t,i + \theta_2[\Delta\ln (P/L)t,i]^2 + \varepsilon t,i \quad (5) \\ t = {} & Numberofyears\end{aligned}$$

It then follows that:

$\Delta\ln(GDP/L)t,i$ is the digital labour productivity contribution (output per worker)

$\bar{\alpha}\Delta\ln\overline{(K/L)} = \alpha_1.\Delta\ln(K/L)t,i + \alpha_2[\Delta\ln (K/L)t,i]^2$

is the contribution of the capital deepening

$\bar{\lambda}.\Delta\ln\overline{(DT/L)} = \lambda_1.\Delta\ln(DT/L)t,i + \lambda_2[\Delta\ln (DT/L)t,i]^2$

is the contribution of the digital technology per labour

$\bar{\theta}.\Delta\ln\overline{(P/L)} = \theta_1.\Delta\ln(P/L)t,i + \theta_2[\Delta\ln (P/L)t,i]^2$

is the contribution of the pollutants' emissions per labour

$\varepsilon t,i$ is the residual term that proxies for TFP per labour growth($\Delta\ln(TFP/L)t,i$)

Δ is the difference operator denoting proportionate change rate

The intercept (a) has no position in the calculation of the productivity growth rate indicators as mentioned in extensive growth theory. Consequently it develops:

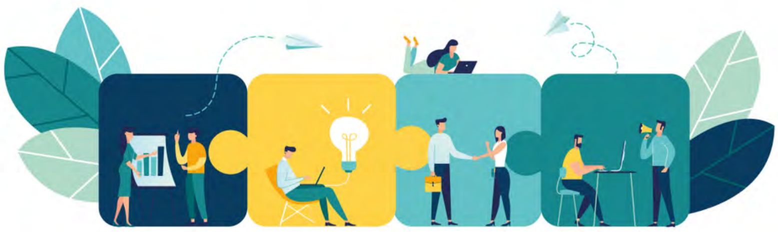
$$\Delta \ln(DP/L)t,\ i \ = \overline{\alpha}.\Delta \ln\ \overline{(K/L)}\,t,i + \overline{\lambda}.\Delta \ln\ \overline{(DT/L)}\,t,i\ + \overline{\theta}.\Delta \ln\ \overline{(P/L)}\,t,i + \Delta \ln(TFP/L)t,\ i \qquad (6)$$

Where $\overline{\alpha}$, $\overline{\lambda}$ and $\overline{\theta}$ denote the shares of capital per labour, digital technology per labour, the pollutants' emissions per labour. TFP per labour (TFP/L) is the TFP per worker contribution as an indicator of digital productivity and sustainable development spillover effect.

Moreover, to calculate the TFP per worker, and other productivity indicators contributions, Equation 6 converts:

$$\Delta \ln(TFP/L)\ t,i = \Delta \ln(GDP/L)\ \ t,i - [\overline{\alpha}\ .\Delta \ln\ \overline{(K/L)}\ \ t,i + \overline{\lambda}\ .\Delta \ln\ \overline{(DT/L)}\ \ t,i + \overline{\theta}\ .\Delta \ln\ \overline{(P/L)}\ \ t,i] \qquad (7)$$

Consequently, Equation 7 couriers the decomposition of digital labour productivity growth into the contributions of capital per labour, increasing the production rate of digital technology per labour and the pollutants' emissions per worker production as a by-product or unpriced products beside the main products, as well as the combined contribution of the mentioned input quality. This is expressed as digital TFP per labour contribution.



Intensive growth theory (capital productivity)

The intensive growth theory (digital capital productivity) framework for Model 3 (Figure 3) is a presentation of the digital capital productivity or output per capital (GDP)/capital as a function of labour per capital, digital technology per capital and the pollutants' emissions per capital; this is because they are the explanatory variables based on their quantities. Moreover, the framework presents the digital TFP per capital (TFP/K) as the combined contribution of the quality of the inputs involved.

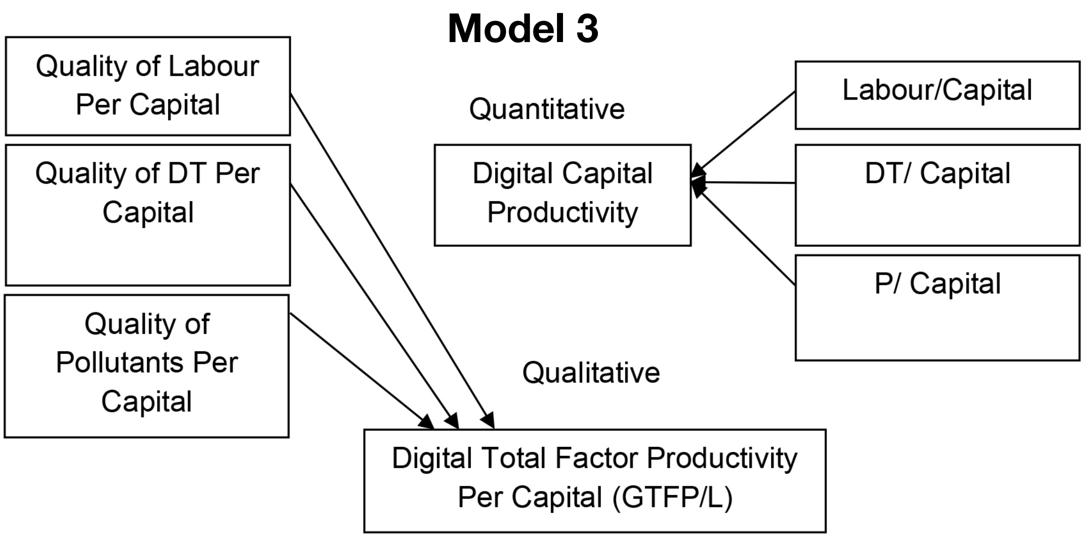


Figure 3: Digital Capital Productivity Framework, Intensive Growth Theory

Source: Modified based on Ahmed, 2020a

In this subcategory, the digital capital productivity decomposes into labour per capital, digital technology per capital and the pollutants' emissions per capital, as presented in Ahmed (2017, 2018, 2020a). When constant returns to scale $[\alpha(1-\beta-\lambda-\eta)]$ has been imposed, Equation 2 becomes:

$$\ln GDP_{t,i} = a + (1-\beta-\lambda-\delta).\ln K_{t,i} + \beta \ln L_{t,i} + \lambda.\ln DT_{t,i} + \delta.\ln P_{t,i} + \varepsilon_{t,i} \quad (8)$$
$$t = Number of years$$

For the purposes of this study, Equation 8 has been transformed by dividing each term by K (capital input). The output elasticity was then calculated with respect to labour per capital, digital technology per capital and the pollutants' emissions per capital, i.e., $\beta = \beta 1 + \beta 2$, $\lambda = \lambda 1 + \lambda 2$, $\delta = \delta 1 + \delta 2$ respectively. Conferring to Ahmed (2017, 2018, 2020a), the production function can be in the form:

$$\Delta\ln(GDP/K)_{t,i} = a + \beta_1\Delta\ln(L/K)_{t,i} + \beta_2[\Delta\ln(L/K)_{t,i}]^2 + \lambda_1\Delta\ln(DT/K)_{t,i} + \lambda_2[\Delta\ln(DT/K)_{t,i}]^2 + \delta\Delta\ln(P/K)_{t,i} + \delta\Delta\ln[\Delta\ln(P/K)_{t,i}]^2 \varepsilon_{t,i} \quad (9)$$
$$t = Number of years$$

Then, it follows that:

$\Delta\ln\,(GDP/K)t,i$ is the digital capital productivity contribution (output per capital)

$\bar{\beta}\Delta\ln\overline{(L/K)} = \beta_1\Delta\ln(L/K)t,i + \beta_2[\Delta\ln\,(L/K)t,i]^2$

is the contribution of the labour (labour per capital)

$\bar{\lambda}\Delta\ln\overline{(DT/K)} = \lambda_1\Delta\ln(DT/K)t,i + \lambda_2[\Delta\ln\,(DT/K)t,i]^2$

is the contribution of the digital technology per capital (DT)

$\bar{\delta}\Delta\ln\overline{(P/K)} = \delta_1\Delta\ln(P/K)t,i + \delta_2[\Delta\ln\,(P/K)t,i]^2$

is the contribution of the pollutant emissions per UNIT OF CAPITAL (P)

$\varepsilon t,i$ is the residual term that proxies for digital TFP (TFP per unit of capital) growth $(\Delta\ln(TFP/K)t,i)$

Δ is the difference operator denoting proportionate change rate

It should be recalled that the intercept (a) has no position in the calculation of the productivity growth indicators, consequently it develops:

$$\Delta\ln(GDP/K)t,\ i = \bar{\beta}.\Delta\ln\overline{(L/K)}t,i + \bar{\lambda}.\Delta\ln\overline{(DT/K)}t,i + \bar{\delta}.\Delta\ln\overline{(P/K)}t,i + \Delta\ln(TFP/K)t,\ i \quad (10)$$

Where $\bar{\beta}$, $\bar{\lambda}$ and $\bar{\delta}$ denote the shares of labour per unit of capital, the digital technology per unit of capital, the pollutants' emissions per unit of capital and (TFP/K), is the digital TFP per unit of capital contribution as an indicator digital technology spillover effect to transform IsDB MCs into sustainable digital economies.

To calculate the average annual growth rate contribution of the TFP per unit of capital, as well as of other productivity indicators' contributions in the model, Equation 10 becomes:

$$\Delta\ln(TFP/K)t,\ i = \Delta\ln(GDP/K)\ t,i - [\bar{\beta}.\Delta\ln\overline{(L/K)}\ t,i + \bar{\lambda}.\Delta\ln\overline{(DT/K)}\ t,i + \bar{\delta}.\Delta\ln\overline{(P/K)}\ t,i\ ] \quad (11)$$

The digital capital productivity growth decompresses into the labour per unit of capital contribution, increasing production of the digital technology per unit of capital and the pollutants' emissions per capital as a by-product or unpriced products, as well as the digital TFP per unit of capital contribution based on the quality of inputs, including the privates' inputs (the pollutants' emissions) as restated in Equation 11.

Conceptual Framework for SMEs and Clients

For the IsDB MCs' microeconomic side, the study proposed two frameworks based on technology acceptance theories. In this respect, Sekaran and Bougie (2016) were quoted to have stated that "a theoretical framework is a conceptual model of how many theories or concepts make logical sense of the relationship among several factors (variables)". This study combined the Unified Theory of Acceptance and Used of Technology (UTAUT) and other theories used to measure the IsDB MCs SME customers' acceptance of mobile banking and other digital applications (such as electronic procurements) in the demand side of the IsDB MCs economies. For the supply side, however, the study modified the Technology Organisation Environment (TOE) to measure the IsDB MCs SMEs mobile banking and other digital technology applications adoption.

In this respect, it had been reported that 42% of the studies reviewed used the Technology Acceptance Model (TAM). The authors further mention that TAM is a very prevalent framework for examining mobile intentions adoption. However, previous studies assert that the original TAM is not sufficient in explaining the impact on the consumer's Internet banking (IB) towards today's technological innovations such as M-banking. This is because it ignores economic factors, trust, demographic factors, and social settings in which technology is being adopted (Shaikh and Karjaluoto, 2014; Chitungo and Munongo, 2013; Venkatesh and Davis, 2000; Shin, 2009). Also, the results of Chukwumah's (2017) study highlights the constraint of the primary TAM; in addition, Davis (1986) investigates M-banking adoption in a largely unbanked population. Hence, many M-banking adoption studies combined TAM with other information systems (IS) adoption theories to investigate M-banking adoption. These include Luarn and Lin, (2005) who combine TAM and TPB; Dineshwar and Steven (2013), who blend TAM and IDT; Ahad (2014) who fuses DOI, TPB, and TAM; Sidek (2015) who uses TAM and the Technology Readiness Index) studies. Other scholars extended it by adding some other factors to facilitate the understanding of the information system adoption. For instance, Teo et al. (2012) modified TAM via the inclusion of four demographic factors to evaluate M-banking adoption intentions in Malaysia. The TAM constructs have been used by Tobbin (2012) as a guiding theme to pursue M-banking adoption intentions in Nigeria. Moreover, to overcome the original TAM disadvantages, TAM has been extended to TAM2 and TAM3.

On the other hand, the literature review showed that the UTAUT model portrays around 70% of the variance in IB (Venkatesh et al., 2002, 2008; Williams et al., 2015; Yu, 2012; Al Mashagba and Nassar, 2012; Rilling , 2015; Al-Qeisi, 2009). Aldhaban (2012) postulates that key constructs from prevailing ICT adoption models successfully integrated into the modified UTAUT model can explain 70% of the variance in intention to use a system, as compared to 40% by TAM. In addition, results from Yu (2012) and Al-Qeisi et al. (2015) demonstrate solid proof for the legitimacy of the UTAUT model, information system adoption research stream.

The literature reviews also sustained that to obtain a better understanding of the clients' adoption of M-banking, and to fill the gaps in theories mentioned above, researchers often integrate/extend theories, resulting in two general approaches and/or extended models to study customers' M-banking adoption, such as the studies undertaken by Nisha et al. (2015), Witeepanich et al. (2013) and Yu (2012). As explained by Soong et al. (2020), it should be mentioned that Saxena (2018) added perceived risk in the study for mobile government application, and concluded that the middle age male group had no doubt in using m-government applications in India.

In this respect, this study thought to add factors such as banking needs, perceived self-efficacy, awareness, perceived credibility, and perceived financial cost to UTAUT to enrich the model. In addition, the moderating effect of age, education, gender, income, and previous experience are also included. Therefore, this contributes to the body of knowledge by filling the gaps in UTAUT and modifying it to accommodate the aforementioned new variables. Figure 4 below demonstrates the modified framework employed to examine SME consumers' technology adoption.

M-banking has great potential to offer financial services to the SME sector, and the area has received inadequate attention from M-banking researchers. Consequently, the lack of comprehensive M-banking and other digital technology applications research on the SME sector is one of the main gaps globally in general, and in IsDB MCs in particular. To date, no research that attempts to provide a comprehensive M-banking and other digital technology applications framework for the SME sector that includes all possible customers, human, social, and business perspective factors has been made. This is important as M-banking and other digital technology applications adoption in SMEs greatly depends on the digital technology contextual and social perspectives.

Technology Organisation Environment Theoretical Framework

The present study takes a close look into the factors influencing mobile banking and other digital technology applications adoption in IsDB MCs SMEs. It is proposed that a TOE framework be employed to investigate the factors that influence the adoption of mobile banking and other digital technology applications in IsDB MCs SMEs. In this respect, the factors related to mobile banking adoption were extended to the TOE framework (Tornatzky and Fleischer, 1990) among the organisational and environmental contexts such as market and products, business model, and partners' collaboration. A detailed framework of mobile banking adoption and other digital technology applications would be needed. To develop the study's theoretical framework, this study employed an SME factors framework, as depicted in Figure 5 below. The framework shows that the major factors for the IsDB MCs SMEs are a regulatory enabling environment, mobile banking business model, and stakeholder's collaboration. The proposed framework of this study blends the extended TOE model to investigate factors influencing the adoption of mobile banking and other digital technology applications by SMEs in IsDB MCs. The framework also included the moderating variables, including the SMEs size, type and age.

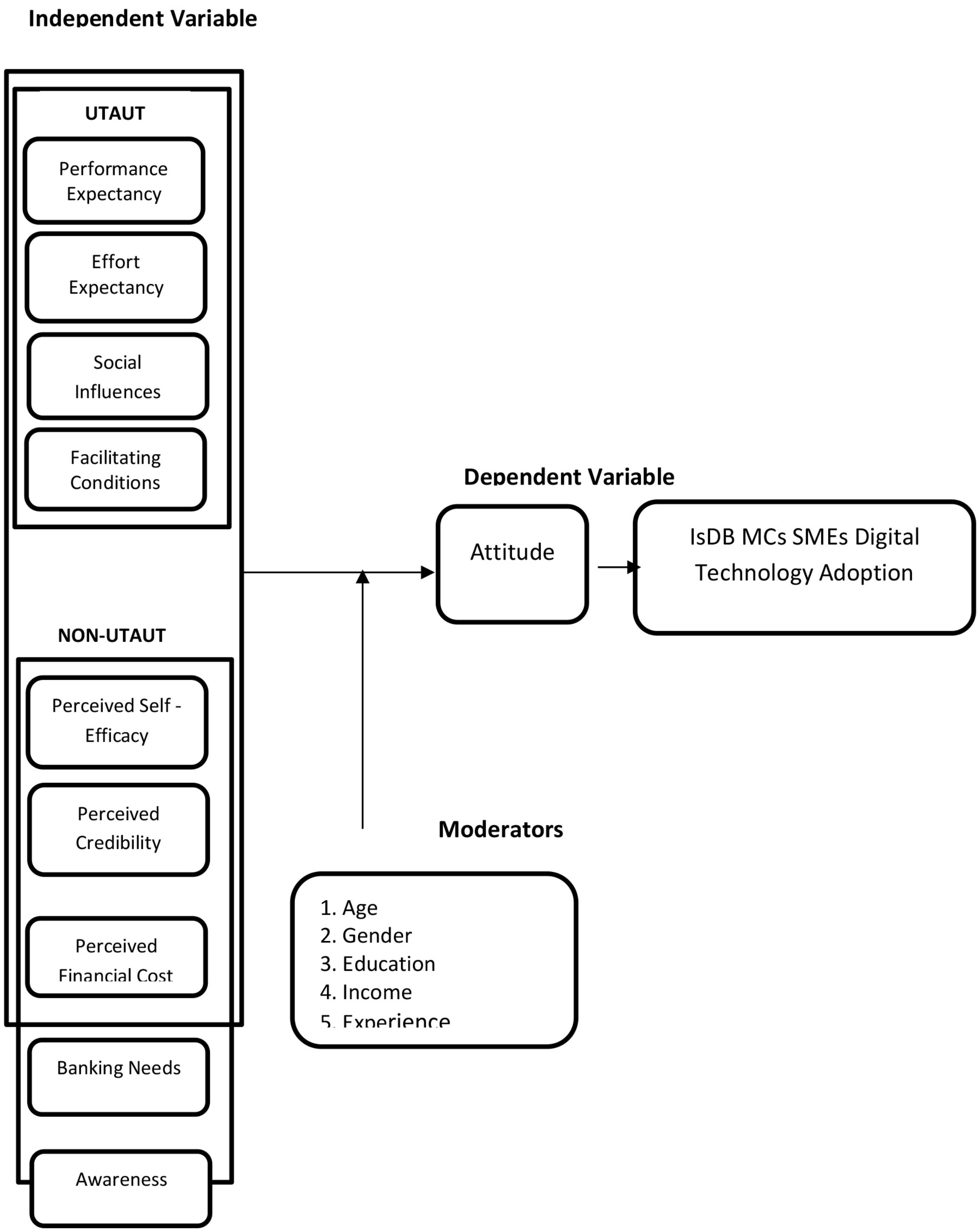


Figure 4: Theoretical Framework

Source: Modified from Ammar and Ahmed, 2016

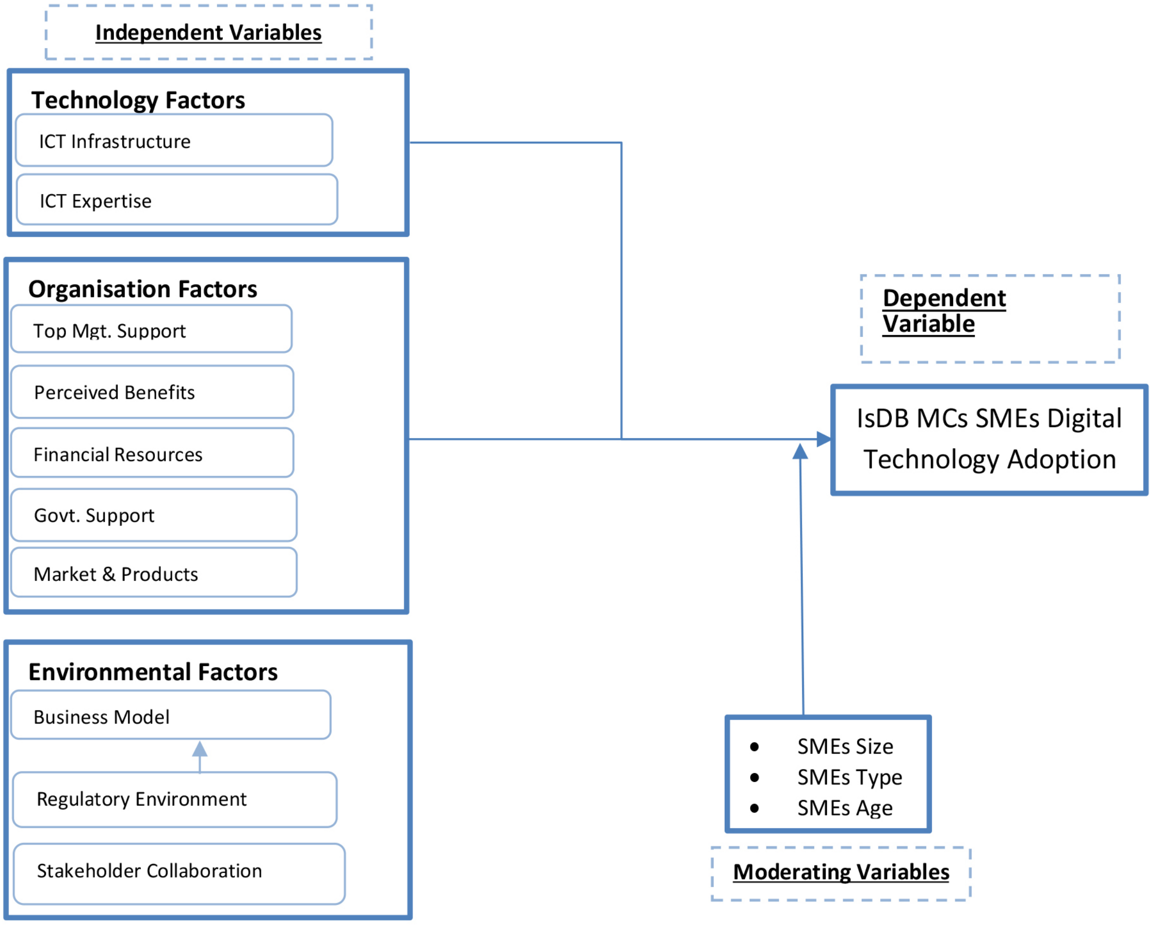


Figure 5: Theoretical Framework

Source: Modified from Ahmed et al., 2016

Qualitative Approach

It is important to conduct a qualitative approach as there is some information (for example, obtaining data through open-ended and conversational communication) regarding a particular topic that cannot be gathered through a quantitative approach. The qualitative approach has several research approaches ranging from in-depth interviews, focus groups, ethnography to the observation that includes the interview and case studies, and other forms to collect the information needed. The case study emphasises a specific case, counting its contextual and respondents, through which the extra detailed features of the case itself can be identified (Khalfalla and Ahmed 2017, 2018).

According to Al Ghammari and Ahmed (2017) and Saunders et al. (2020), "the use of the interviews can help to gather valid and reliable data that are relevant to the research questions and objectives" (Al Ghammari and Ahmed, 2017). In addition, these authors further stated that the nature of any interview should be consistent with the research questions, objectives, purpose, and strategy. They also categorised three types of interviews: structured interviews, semi-structured interviews, and unstructured interviews.

This study will employ a mixed-method approach of quantitative and qualitative approaches at the IsDB MCs macro and micro levels. The quantitative approach consists of a combination of an econometric approach and primary data survey research, while the qualitative approach will be conducted through interviews with IsDB focus groups. These will include experts as fund providers that implement the IsDB MCs digital transformation, as well as experts from the IsDB MCs' relevant departments concerning their digital economies' transformation and those concerning with achieving digital inclusion in general and digital financial inclusion in particular.

Conclusions and Policy Implications

The crucial fact is that with proper public policies, technological advances develop the wellbeing that is considered a positive externalities of digital technology and has shaped the digital economy around the globe. However; there are negative externalities associated with the advance of this technology, including cybersecurity and the mismatch of human skills in optimising the digital dividends generated in terms of economic growth.

This study explains that with the integration of innovation and climate change with economic growth, the SDG sustainability issues will be examined to achieve long-term economic growth based on a digital economy transformation that will allow IsDB MCs to technologically progress. This progression is required to sustain long-term economic growth and protect the environment via innovation and the spillover effects brought about by the implementation of the SDG agenda.

Three frameworks and models were employed to analyse data via econometric estimation, and the calculation of productivity indicators for the secondary data at the IsDB MCs Macro level. At the IsDB micro level, a questionnaire survey to collect the primary data will be designed and distributed. Also, a qualitative approach will be conducted via interviews with experts to capture the data and information that could not be captured via a quantitative approach.

The research ideas and output are expected to contribute to and fill the knowledge gaps in the form of modified models and frameworks that examine the digital economy and digital inclusion at the IsDB MCs macro and micro levels; these aim to achieve digital transformation in IsDB MCs and non-IsDB MCs. The empirical findings will be put in a form of recommendations and policy implications to be used by policymakers, industry, and academics in the IsDB MCs under study. They could also be used by international organisations and other concerned institutions around the globe as a platform to implement the SDGs.

To ensure enhanced coherence, IsDB MCs need to utilise these study frameworks and models to empirically examine the SDG sustainability issues in general and digital technologies in particular. In doing so, they could achieve long-term economic growth based on a digital economy transformation that will allow them to be transformed into the technological base required to sustain long-term economic growth. They would also protect the environment through the innovation and spillover effect brought by the implementation of the SDG agenda related to the digital inclusion in general and financial inclusion in particular. This study's outcomes will provide a digital economy framework and policy implications and recommendations to enhance cooperation, collaboration and smart partnership within IsDB MCs and non-IsDB MCs in the fields of knowledge transfer, technological progress, digital assets and the development of intellectual property. Adopting the suggested frameworks could help sustain IsDB MCs' long-term economic growth to overcome the impact of COVID-19 and possible future pandemics. Through digital technology applications, IsDB MCs can facilitate the economic activities needed to fight hunger and achieve food security, provide good health and well-being, quality education, clean water and sanitation, affordable and clean energy, industry, innovation, and infrastructure.

It will provide recommendations, policy implications, and solutions to the problems facing IsDB MCs in implementing the digital technology applications to transform their economies into digital economies, and to implement the new technologies in the future to achieve the SDGs.

The aggregate economy, economic sectors, industries, and companies will be provided with solutions and guidelines to implement digital technology applications to transform IsDB MCs into digital economies. The proposed frameworks and models will be empirically examined in the MCs' economies, sectors, and companies to provide practical solutions to sustain the economic development via the digital solutions needed to overcome the problems and lessons learned in the post-COVID-19 era, and to develop policies to be implemented by IsDB MCs' public and private sectors to achieve sustainable development.

This study proposed ideas based on frameworks and models that will be useful for digital technology policy construction in IsDB MCs as a foundation for the establishment and growth of a digital economy based on IsDB MCs' digital economy level. In this setting, a contrast of digital technology's contributions to productivity growth in each of the IsDB MCs would provide guidelines for policymakers to frame suitable national and IsDB MCs and non-IsDB MCs digital transformation policies in line with the IsDB transformation programme. The findings from this study will likewise support the construction of a digital technology investment policy and help the development of the human capital and infrastructure needed to support the effective use of the IsDB MCs digital technology.

It should be noted that IsDB MCs can capitalise on their synergy within both IsDB MCs and non-IsDB MCs to fully practice the competitive advantages within IsDB MCs and non-IsDB MCs to overhaul their digital asset deficiencies. In that circumstance, IsDB MCs will be able to accelerate the movement towards a digital technology-savvy nation that is accomplished by the members of the Organisation for Economic Cooperation and Development (OECD), such as Europe, USA, Canada, Australia, Japan, and South Korea, and non-OECD countries such as China.

Following the IsDB transformation programme initiative, this study proposed that a digital transformation programme should be taken by IsDB to narrow the digital divide and improve digital technology dividends. This would contribute to the transformation of IsDB MCs' digital economies and make a difference for their nations to enjoy high living standards and wellbeing, like their OECD counterparts. In addition, classifying the IsDB MCs lagging concerning the adoption of digital technology and human capital development, delivers a standard to improve cooperation and a smart partnership within IsDB MCs and non-IsDB MCs. In this respect, the first phase of IsDB MCs to transfer to digital economies is an emerging IsDB digital economy master plan to identify the policies and strategies to develop digital economy flagships and pillars for IsDB MCs and improve the IsDB MCs existing digital economy flagships and pillars for the countries like Malaysia among others including digital economy institutions.

A report will be produced to serve as guidelines for developing a digital economy blueprint and policy implications for digitising IsDB MCs whole economies in general and SMEs and Micro level in particular. A framework for IsDB MCs digital transformation and developing IsDB MCs digital economies will be produced.

IsDB

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