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SYSTEMATIC REVIEW OF RESEARCH AND DEVELOPMENT EXPENDITURES AND SUSTAINABLE ECONOMIC DEVELOPMENT IN ASEAN COUNTRIES

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Abstract

Although numerous researches about the importance of research and development (R & D) for sustainable economic development have been carried out among ASEAN countries, it is challenging to say with certainty that what level of interest is being put on R&D expenditures and sustainable economic development among these countries. The objective of this study is to conduct the systematic review of R & D expenditures and sustainable economic development in ASEAN countries with theoretical and empirical review of the previous studies. This paper grouped previous studies considering economic development based on their results in Four (4) stages i.e. 1) review of previous literature, 2) comparison of growth theories and, 3) developing a concept in light of previous models and at last, 4) the conclusive note related to R&D and economic development among ASEAN countries. Total 163 research articles were considered containing the terms economic development or economic growth and after applying a systematic review process, 14 papers considered as final sample specific to the objective of this study related to economic development among ASEAN countries. The review has shown that most of economist found that previous studies were lack of R&D expenditures in the economic development among ASEAN region countries. This study fills theoretical and empirical gap in the field of R&D-lead economic development among ASEAN and provides a meta-theoretical insight in the concept of sustainable economic development with respect to R&D expenditures.

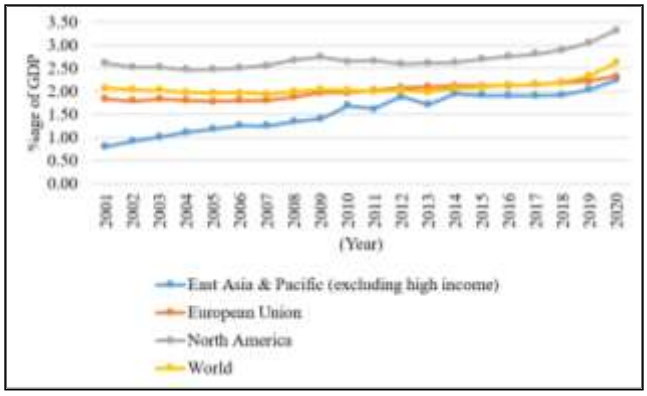
Keywords: R&D expenditure, sustainable economic development, ASEAN countries

Introduction

Sustainable development is demonstrated by the economic and social benefits that brings to individuals, firms and government in the form of innovated and modernized offerings. The interconnection between R&D and sustainable development can also be perceived when R&D intensive policies are instigated through prevailing economic and social structures that are important for sustainable development (Zafar et al., 2019; Nair et al., 2020). These economic and social structures provide the channels through which firms and government spend more on R&D for the sake of sustainable economic development (Zhang et al., 2021; Xu et al., 2020; Wei et al., 2023). Provided that this apparent interrelationship of the link between R&D expenditures and sustainable development provoke the need to investigate the factors affecting sustainable economic development among researchers, experts and policy makers (Yu et al., 2020; Cao et al., 2021).

On account of economic volatility, macroeconomic variables like inflation, exchange rate, inflation rate, employment rate, and many more have greater impact on economic development (Guru and Yadav, 2019; Mensi et al., 2020; Huy, 2021) but, in digitally impulsive background, the importance of R&D expenditure for sustainable economic growth has attracted widespread attention over the years as economists and politicians struggle to evaluate the impact of R&D expenditure on economic growth which is a sub-domain of economic development (King and Levin, 1994; Acemoglu, 2012; Spyros, 2020). Macroeconomic factors influentially effect sustainable Economists believe that economic growth is central to an economy's development (Nwosa, 2019; Chen et al., 2021; Niyazbekova et al., 2021). Such attention has also prompted calls for research (Dobrzański and Boboski, 2020; Shahbaz et al., 2022; Ahmad et al., 2022) and special issues devoted to economic development, with a resulting dramatic increase in academic publications pertaining to economic development across the globe.

Theoretically, there are Keynesians who argue that government spending has a positive effect on economic growth then Classicals and Neo-Clasiscals who resist that government involvement and spending have negative effect on economic growth (Romer, 1986; Lowenberg, 1990; Balsalobre-Lorente et al., 2021; Baruk, 2022). There are also those who have middle course and hypothesised that government expenditure has a favourable influence on economic growth up to an ideal threshold, after which it has a negative effect (Barro, 1989; Friedman, 1997) while some say that it the result of technology adoption in production process (Solow, 1956; Swan, 1956; Mankiew et al., 1992; Li et al., 1998; Li and Li, 2022).



Source: WDI, World Bank (2022)

Figure 1: Regional and world comparison of R&D expenditures to GDP

Figure 1 depicts a regional comparison of R&D expenditure at world level. The developed regions like Europe and North America are spending large among as compare to East Asia and Pacific region (excluding East Asian High Income countries). The figure clearly invites policy-makers of this region that if they want to be developed economies, they need to take serious steps towards R&D in order to gain sustainable economic development. As spending in R&D on behalf of the government, it is always controversial in the course of sustainable economic development. Hence, the author intends to examine existing literature to find identify the role and nature of R&D expenditures on economic development across ASEAN nations. This study employs the strategy outlined by Poole and de-Ven (1995) and Khraisha and Arthur (2018) to investigate various hypotheses in order to explain the variety of related theories. The authors go on to say that it would be more informative and helpful to take into account a pool of theories and models that can be combined and modified to understand R&D-led economic development rather than trying to establish one general theory as the best option to explain R&D and innovation for economic development.

This study seeks to develop a set of fundamental premises that reconcile dilemmas in the current economic development literature and provide integrative guideposts for future research in the field as well as the degree of compatibility in their underlying assumptions (Okhuysen and Bonardi 2011; Becker and Jaakkola, 2020). We pose three research questions to guide our efforts: (1) What is the nature of the economic development phenomenon and the underlying theoretical assumptions adopted in literature that addresses economic development? (2) What are the common factors of economic development that are applicable in literature fields across ASEAN region? (3) What is the current situation of research and development expenditure (R&D) in order to achieve economic development among ASEAN region in the era of industry 4.0? (4) What gaps are available for future contemporary academic and empirical work in the field of R&D expenditures lead economic development?

To address this proposition, this article starts off by going through what economic development means proving the summary of a number of concepts and categories in use. The distinctions between economic growth and economic development are then examined, and then typical characteristics of economic development are described. The previous literature on economic development are recognized, examined, and grouped under different theories in the following part, along with a diagram of the level of development. It is challenging for a single

theory of economic development to materialize the needs of changing economic scenarios because the current approach, which relies on isolated economic development study objects, is likely to lack several theoretical connections and complexities that are necessary to comprehend in order to manage R&D activities in a productive way. In the last section, four economic development theories have been defined before introducing the idea of a meta-theory of economic development. We give several examples of how this method leads to trickier and complex theories that more effectively explain the phenomenon of economic development in a rapidly changing technological environment that calls for future research to understand R&D for sustainable economic development.

Systematic Review of the Economic Development Paradigms

A systematic review is an indication on the basis of evidently formulated question which uses previous research to extract and analyse in an explicit method to identify, select and appraise the relevant research (Dinter et al., 2021; Garcia-Penalvo, 2022). As this study intends to investigate macroeconomics factors responsible for sustainable economic development among ASEAN countries considering R&D expenditures important among macroeconomics factors which is considered as the money an economy spent on improving products and service quality include idea development, making exiting goods better or offering new products. Hence, a literature review in development process can help to identify R&D expenditures need among the countries in ASEAN region.

Sustainable development is the "development without compromising the social, economic, and environmental dimensions for future generations (United Nations, 2022). As economic dimension is crucial for sustainable development, this study focuses on economic side of sustainable development. When we look at the history and evolution of economic development theories, it come forth that factors of production play important role in economic development. The main point is to consider an economy's social, economic, and technological aspect while talking about economic development. Each theory has its own strong and weak points in different state of economies like when we talk about Keynesian theory, it is about the output, inflation and unemployment which can be mitigated by active government interference (Wang and Zhang, 2021). The exogenous theory says that economic development is a result of collective working of labour and capital considering the technology as an exogenous variable. When we look the implacability of endogenous growth model, we come to know that economic development is a result of continuous promotion of human capital through R & D and innovation. Further, this theory considers the technology as an endogenous factor for economic development through GDP growth rate (Musibau et al., 2019; Simonova et al., 2021).

Paul Romer (1990) pioneered the role of R&D for long-run economic development (Celli et al., 2021). Since that time, a number of studies have been conducted to examine the role of R&D in economic growth. A profound scrutiny of existing literature reveals that research in R&D related to economic growth was trivial extent gained academician's attention after 2015 and most of the studies have been conducted among ASEAN region. The conceptual paper, most commonly, has no single way to articulate a conceptual paper but it enlightens relationship among the constructs rather than testing them empirically (Jaakkola, 2020).

For this purpose, the articles using economic development, economic growth, R&D expenditures and ASEAN have been hunted in databases include; science direct, emerald insights and web of science from 2001 till data. At first, authors read 17 papers related to R&D expenditures and economic growth and sustainable development to understand the concept. After that, total 146 research articles have been downloaded containing the terms economic development or economic growth as depicted by Figure-2. At this stage, 31 articles were excluded as they were downloaded from non-peer reviewed journals. After this stage, further 87 articles were excluded as they were not related to ASEAN region. There were 14 papers considered as final sample which were more specific to the objective of this study for the systematics review process of evaluation of various theories related to economic development among ASEAN countries (Figure-2).

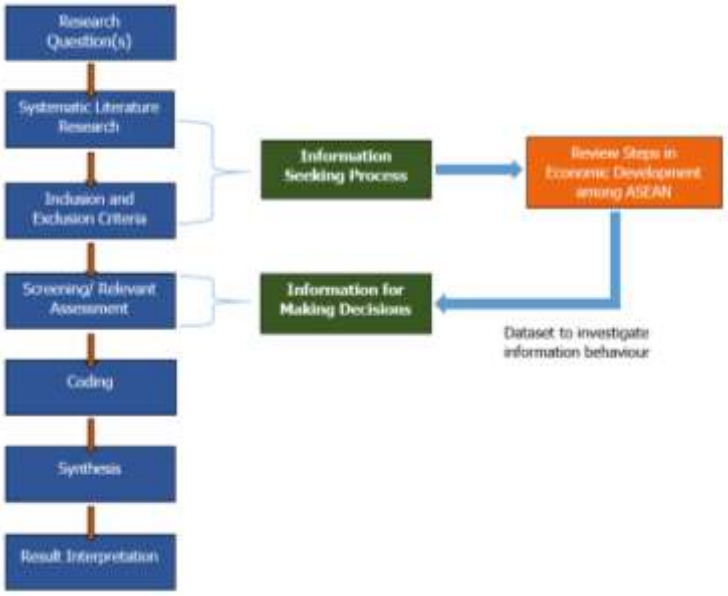
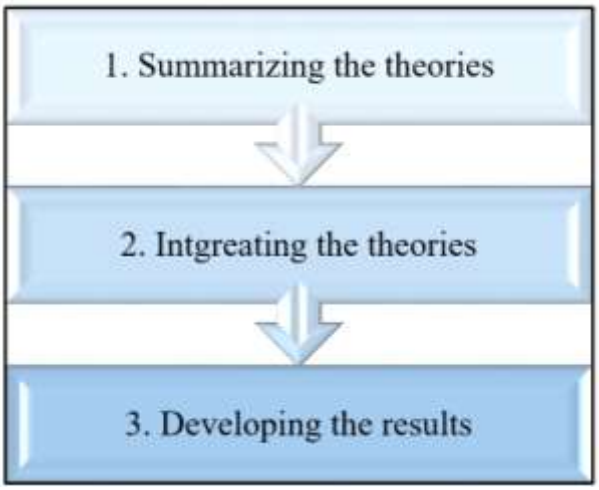


Figure 2: Systematic Review Process (own development)

Synthesized Theoretical Review

In theory synthesis, a researcher realize various theories related to a specific concept in order to summarise in a meaningful way followed by seeing a concept in a best way considering the previous literature (MacInnis (2011). In the conclusion section, researcher tries to extract an expressive finding in light of chronological and contemporary consideration.



Source: adapted from MacInnis (2011)

Figure 3: Synthesized Theoretical Review Process for Research Methods

The modern economy has been considered a global economy which changes the needs and ways to respond in specific situation (Manion and Evan, 2001; Dorsser et al., 2020; Matyushok et al., 2021). The role of technology, as trigged by Romer and subsequently Easterly and Levine, is crucial to meet modern economical needs. For evaluation of economic progress among ASEAN region, researchers used many theories to test their applicability which is shown in Table-1.

Theoretical Review of the Metamorphosis of Economic Development

Economic growth is the rise in total output within an economy, which typically takes the form of an increase in national income or in any growth related economic indicator (Law, 2016; Spyros, 2020). The concept of economic growth is narrower than the economic development as it deals with the quantitative factors of growth whereas, the economic development also considers the qualitative aspects of growth as well (King and Levine, 1994; IMF, 2022). The economic development highly depends on the economic growth as gains in overall production frequently, but not always, correlate with higher average marginal productivity. As a result, there is an increase in income, which encourages people to spend more money and buy more goods, raising the level of living and quality of life in tangible terms which are the crucial elements for economic development. In light of the general discussion, it is believed that;

> *"The route through which a country, a region, or the world as a whole progress to a new level of economic performance. It is usually associated explicitly with economic growth, but there are other measures of development such as happiness, security of the means to a good life, and the execution of human potential, more specifically, economic well-being of inhabitants of the economy."*

According to Henry (1987) and IMF (2022) the economic development model can be seen in the following Equation (1).

Economic development = Economic growth + standard of living (Equation 1)

Extending the concept of economic development, it reveals that this concept serves multiple goals as;

- Economic development is the quantitative and qualitative change in an economy.
- Economic development refers to the reduction and elimination of poverty, unemployment and disparity with the context of growing economy.
- Economic development includes process and policies by which a country improves the social, economic and political well-being of its people.
- Economic development focuses on distribution of resources.
- Economic development is multi-dimensional in nature as it focuses on both income and improvement of living standards of the people.
- It is a continuous and long-term process as it does not have specific time period to measure.
- Economic development requires intervention from the government as all the developmental policies are formed by the government
- It is relevant to increase in productivity.
- It is concerned with structural changes in the economy.
- Achieving economic development is linked with end of poverty and inequality in the income.

Table 1: Summary of Theories Used for Economic Growth among ASEAN (2001-2022)

Author(s)	Theory Used	Inferences
Yanyun and Mingqain, 2004	Cobb-Douglas Production function	Discusses the technological relationship among input for production
Hill and Hill, 2005; Chung et al., 2016; Dobrzanski and Bobowski, 2020; Charutawephonnukoon et al., 2021; Ho et al., 2022	Endogenous growth theory	Focuses on internal factors of production in order to increase production level. More focus on R&D and innovation
Almasaied et al., 2008	Borensztein cost theory	Focuses on alternative for maximizing the production function
Srinivasan et al., 2010	Dependency theory	Assumed that resources flow from poor to rich economies
Moudatsou and Kyrkilis, 2011	Transition cost theory	It focuses on net result of government transactions with other economies

Delpachitra and Van-Dal, 2012; Haini, 2019; Sriyakul, 2022	Exogenous growth theory	Relies on basic factors of production for economic growth
Muhamad et al., 2018	Theory of Value	It focuses on exchange value of goods and services
An et al, 2020	Purchase power disparity theory	Considers purchase power and exchange rates between economies

Source: Own development

The Asian Financial Crisis 1997-98 severely hit ASEAN countries which creates a needs of finding the ways towards growth and development. Keeping in view the post-crises dilemma of development, this study uses the data from 2001 to 2022. Table-1 shows that maximum number of researchers (5) used endogenous growth theory for evaluation of economic growth among the region. The major focus of this study is on exogenous growth theory, endogenous growth theory as they likely to consider capital (endogenous) and technology (exogenous) as production and growth function (Schumpeter, 1942; Romer, 1986; Aghion and Saint-Paul, 1991; Habib et al., 2019).

Empirical Review of Economic Development among ASEAN

Previous studies considered a number of factors which influence economic growth but Table-2 is showing the factors which were used by previous studies related to economic growth/ economic development among ASEAN region only.

Table 2: Empirical Review of Economic Development Concept among ASEAN Countries (2001-2023)

Author(s)	Objective	Theory Used	Results
Yanyun and Mingqain, 2004	To analyzed the effect of R&D expenditures on TFP lead economic growth	Cobb-Douglas Production function	R&D expenditures have more positive contribution toward EG
Hill and Hill, 2005	GDP growth through trade openness, foreign exchange rate and inflation	Endogenous growth theory	EG is not adequately determined in Singapore and Thailand, but in Indonesia, Malaysia and the Philippines are quite large and persistent through the endogenous variables

Almasaied et al., 2008	To examine the role of GDI, FDI and financial intermediaries on GDP	Borensztein cost theory	Investments and exports have positive impact growth to encourage domestic as well as foreign capital for economic growth
Srinivasan et al., 2010	GDP growth evaluation through FDI	Dependency theory	The results reveals one way causality between FDI and GDP for economic growth among Myanmar and Thailand
Moudatsou and Kyrkilis, 2011	To evaluate EG through GDP using FDI, FCF as endogenous variables	Transition cost theory	There is a two-way causality between GDP per capita and FDI among Indonesia and Thailand while in Singapore and the Philippines FDI is prompted by host country.
Delpachitra and Van-Dai, 2012	To evaluate TFP lead economic growth through FDI, Trade and HC	Exogenous growth theory	Trade has positive while FDI and HC have invisible impact on GDP
Chung et al., 2016	To measure GDP as economic output using R&D activity, financial liberation and financial development	Endogenous growth theory	Financial liberalization and deregulating have positive impact while financial openness has negative impact on EG
Muhamad et al., 2018	To evaluate impact of HC, patent application, and high-tech exports on EG through GDP	Theory of Value	There is significant long-run relationship between human capital and innovation capacity for the economic growth in Indonesia and Thailand while no relationship between human capital and innovation capacity for the economic growth in Malaysia
Haini, 2019	To evaluate the relationship of EG, trade openness, internet penetration and HCI	Romer's growth model	Human capital formation and internet penetration is positive and significant towards economic growth providing support for the absorptive ability of human capital
An et al, 2020	To evaluate the impact of FDI and macroeconomic variables on EG among ASEAN countries	Purchase power disparity theory	FDI has a positive impact, inflation rate and trade openness rate have a negative impact and the economic savings rate variables is not statistically significant to the economic growth.

Dobrzanski and Bobowski, 2020	To evaluate R&D expenditures among ASEAN through patent application, trade mark, high-tech export and ICT exports	Endogenous growth theory	R&D spending is gaining popularity among Indonesia, Singapore, Hong Kong, Philippines and Thailand
Charutawe-phonnukoon et al., 2021	To evaluate the impact of high-tech exports, R&D expenditures, patent application on EG	Schumpeter and Keynes Model of Economic Development	The impact of high technology exports as well as R&D expenditures has been found as significant on economic growth
Ho et al., 2022	To observe the EG, trade openness and financial depth among ASEAN countries	Schumpeter Development model	Trade openness and financial depth has strong association with EG among ASEAN countries
Sriyakul, 2022	To examine the impact of renewable energy and industrialization on EG	Solow's growth theory	The EG of ASEAN countries has a significant positive association with industrialization, renewable energy output, its consumption, energy import, and inflation

Source: Own development

Note: Table 2 is showing the detail of studies conducting after 2001 among ASEAN countries,

TFP=Total factor production, EG=Economic growth, HCI=Human development index, GDI=Gross domestic income, FCF=Fixed capital formation, and ICT=Information & communication technology

Table -2 shows that 1st study, after 2001, considered R&D as indicator to measure the TFP using Cobb-Douglas production function in 2005. The table show that the concept of economic growth gained popularity after 2015 but the researchers sill used economic growth using GDP, HC, renewable energy as proxies to economic growth. The word 'economic development' was first used by Hill and Hill (2005) then by Kwon and Kang (2011) followed by Chung et al., (2016). It is point to ponder that they used trade openness, foreign exchange rate, inflation, financial liberation and financial development as proxy to evaluate economic growth. The table depicts that previous researchers used R&D expenditures in the course of economic growth, TFP, and for technology adoption (Yanyun and Mingqain, 2004; Dobrzanski and Bobowski, 2020; Charutawephonnukoon et al., 2021) which shows a wide gap in the field of economic development.

J.M. Keynes and his followers thought gave the idea of development through increasing output level through spending, consumption, investment, and increasing government expenditures (Keynes, 1937; Friedman, 1983; Popelo et al., 2021). Later, exogenous growth theory tells that it is the result of efficiently employing factors of production while investment in human and physical capital in the way of economic development (Solow, 1956; Swan, 1956; Mankiew, 1992; Li et al., 1998; Li and Li, 2022). In the third phase, endogenous growth theory highlighted human capital and R&D as they are major estimator to improve technological

elements of production which are crucial for sustainable economic development (Romer, 1986; Habib et al., 2019). Later, Barro (1996) and Easterly and Levine (2001) highlighted the importance of technology for sustainable long-term economic growth.

In sequence, economists agree that technology play important role in the course of economic growth but, on the other hand, growth lead to development which is crucial for economic well-being. As technology is the main turning factors of this theory hence it is observed that technology needs investment which termed as R&D expenditure as a source of productivity and growth (Caminati and Sordi, 2019) which not only enhances modernization but also result in technology transfer to the developing countries (Haseeb et al., 2019).

Theoretically, from Malthus (1798) to Romer (1986), the economic development has been considered alternative to economic growth. Malthus used mathematical model for economic growth considering growth proportionate to population. Keynes (1936) developed an idea of total spending in the economy to gain maximum output and its result on economic development (Mankiw (1995; Mansoor et al., 2018; Popelo eta al., 2021). Neo-Classical growth theory, also called exogenous growth model, conceptualized that capital and output are important factor of economic development and labour is crucial for production in order to achieve economic development (Solow, 1956; Swan, 1956; Saidu et al., 2018; Alekhina and Yoshino, 2019; Chugunov et al., 2021). Technology is the main turning factors of this theory hence it is observed that technology needs investment as a source of productivity and growth (Caminati and Sordi, 2019). Some economists, Harrod (1939), Domer (1946), Anoruo and Ahmad (2001) and Misztal (2011), say that economic growth is proportionate to the rate of saving.

Schumpeter (1946) creative-destruction theory, concentrated on innovations that leads to improved quality of the product. This model works on three assumptions: (1) Innovations are the source of long-term growth; (2) Innovations are the concerns of business investments that are themselves driven by the possibility of monopoly rents; and (3) New innovations take place getting out old technologies. This theory was advocated by many economists who testified that R&D activities, output level, human capital are the primary sources of economic development which are controllable and internal forces for economic development (Romer, 1986; Aghion, 1991; Helpman, 1997).

The statistics show that Singapore is spending a large amount to R&D resultantly it provides economy a competitive edge as a developed nation (ASEAN Development Outlook, 2021) followed by Malaysia and Thailand considered as emerging economies. The case is different for Myanmar, Vietnam and Cambodia because of concerns about R&D spending. Although, researches are being carried on related to economic growth but there is a need to conduct empirical research in the field of economic development as this phenomenon is different from the later one. economic development (Henry, 1987; Law, 2016; Spyros, 2020). Unfortunately, a profound assessment of the region's existing literature was unable to locate any initiatives to establish a shared framework for R&D spending and economic development. In the former scenario, at least some of the schools of thought would finally have meaning, whereas in the former scenario, all of them would continue to exist independently.

Conclusion

This paper discussed the meta-theoretical premises of sustainable economic development and R&D expenditures after examining the previous researches among ASEAN countries. The study found that economic development and economic growth mostly based on the same ideology, while need of R&D-lead economic development built in accordance to SDGs is rare. Instead of building bridges between technology and development, studies are going to used traditional macroeconomic variables while assessing the growth which ignores the economic well-being of the region.

The importance of R&D is uncluttered for economies as R&D expenditure is directly associated with economic development. The economic side of SDGs like no poverty; decent work and economic growth; industry, innovation and infrastructure can lead to economic well-being for peoples. Hence, this study suggests to combine R&D and economic growth in order to achieve sustainable economic development for academician as well as for policy-makers. This collaboration will endorse the sustainable economic development considering the technology part of economic development in further studies as it is an integral part of economic well-being in modern era.

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