

University of Pardubice
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New determinants of Economic growth in the context of Knowledge

Economy

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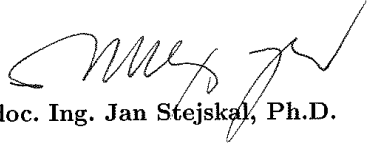
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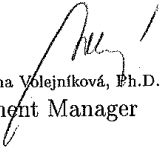
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ABSTRACT

The thesis deals with a correlation analysis to verify the relationship between selected determinants of knowledge economy and economic growth. The concept of economic growth and knowledge economy are defined in the first and second chapters. Knowledge economy is generalized as using human intelligence to create value. Three research questions were establishing to find the relationship between the Input Variables and GDP in those countries (Sweden, Netherlands and United Kingdom). To establish this relationship, Pearson's product moment correlation analysis was performed. It was revealed from the analysis that; all the five inputs variables have strong positive relationship with GDP in Sweden. That is, Patent, HRST, Int.Exp., R&D personnel and Tertiary education graduates are all a good determinants of knowledge economy. It shows that, the more these inputs variables increase the more advanced Sweden would be and vice versa. Surprisingly, in the United Kingdom, there was a negative relationship existing between HRST, Tertiary education graduates and GDP. Also, there was another surprise in Netherlands. It was revealed that; tertiary education graduates and patent had a negative relationship with GDP growth. This holds that if much attention is given to these inputs variables (determinates of knowledge economy), there would be a positive influence on the economic performance of the nation. Because they have proven to be a very good determinants of knowledge economy and economic growth.

KEY WORDS

Economic Growth, Knowledge, Knowledge Economy, Knowledge Creation, Knowledge Spillover.

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LIST OF THE ABBREVIATIONS

R&D	Research and Development
GDP	Gross Domestic Product per Euro Inhabitant
Int. Exp	Intramural Research and Development expenditure (GERD) by sectors of performance
HRST	Human Resource science and Technology
Patent	Patents applications to the European Patent Office (EPO) per mil inhabitant
GII	Global Innovation Index
R&D personnel and Researchers	Research and Development personnel and researchers by sectors of performance, educational attainment level

INTRODUCTION

The concept of knowledge and knowledge economy has gained much attention in recent years, especially since individual economies are forced to find new sources of competitive advantage in an environment of an open globalized economy, with which knowledge is no doubt a vital factor of growth. The creation, dissemination and the ability to use different kinds of knowledge, combined with innovation, is a key activity that enables many nations especially developed nations to add value, increase their own competitiveness and contribute to long-term economic growth. Thus, the success and the competitiveness of every economy depends on how well they are able to capitalize and utilize knowledge in full capacity. The European countries competitiveness is based on the advancement in technology and quality. The advancement in technology and quality depends on how well a country is able to access and utilize more knowledge and information. Thus, the growth of an economy depends upon the accessible knowledge creation and its capacity to duplicate.

Economic growth is an imperative macroeconomic class, which is a sign of supreme increment in social creation, as well as the capacity of the economic framework to meet the developing needs and enhance life quality. Current phase of worldwide economic improvement is described by progressive increment in the level of intellectualization and the progress to an economy that dwells much on knowledge.

Growth resulting from knowledge and innovation has been a major discussion of interest among public policy makers and researchers. There is always a debate as to why nations (like Sweden, Netherlands, Switzerland, United States, United Kingdom) develops faster than others. What makes some economies achieve higher growth than others? Why some countries are most innovative than the others? Why Switzerland and Sweden etc. has been the world's most innovative countries?

It is because of this contemplations that the researcher deems it necessary to find out the determinants of economic growth in the context of knowledge economy. Thus, the researcher wants to know the factors that influence the growth of nations within the European union countries. Sweden, Netherlands and United Kingdom were chosen to serve as a benchmark for other European economies.

Based on the aim of the study, the thesis was organized under five chapters. The first chapter highlighted the theoretical review of the concept of economic growth, importance and determinants of economic growth, economic growth theories both old and new, stages, benefits and barriers of economic growth. The second chapter dealt with the review of literature on the concept of knowledge economy, determinants of knowledge economy. The third chapter gives description on the research methodology. Results and discussion were done in chapter four. Then the conclusion was done in the fifth chapter.

1 THE CONCEPT OF ECONOMY GROWTH

The performance of every economy is highly measured using the rate of growth of GDP. The rate of growth of GDP is the main indicator of assessing the economic health of nations. In the reality that economic growth or the growth of gross domestic product or gross national product(GNP) assumes a noteworthy part in governments 'policy-making and thinking in developed nations currently is a typical conclusion. Ovaska and Takashima (2006) sated that, economic growth is very vital and instrumental in today's standard reasoning and that government seldomly overlook higher economic growth as one of the principle focus of public policies. All countries around the globe have placed much emphasis on economic growth and governments in recent economy focus on the national income or GDP or GNP. (Easterlin, 2005; Layard, 2005). Therefore, it is important to clearly know what economic growth is; the stages of growth; the underlying theories behind it; benefits of economic growth and determinants or factors that determine or have great influence on this concept of economic growth. This part of the study gives responses to the above-mentioned items.

1.1 Economic Growth

Economic activity is concerned with production, distribution, exchange and consumption of goods and services needed to satisfy human needs individual or collective (Kuznets, 2016). Growth is a long-term expansion of productive capacity or potential of a firm or a nation. Therefore, economic growth of a country, firm or a region, means a persistent increase in the output capacity of a nation, firm or region compared from one period to another (Kuznets, 2016; Jorgenson et al., 2016).

Economic growth is the increase in the productive capacity of a given economy in a particular period of time. All things being equal, it means if all the production factors (land, labour and capital) are utilized to their maximum, the economy would be expected to grow. It is the basic yardstick of macroeconomic performance (Fyfe, 2013; Lewis, 2013). Though productive capacity measurement is difficult, a lot of the economist dwell on more accessible measure of economic growth as the percentage change in Gross Domestic Product (Lewis, 2013; McCombie

and Thirlwall, 2016; Jorgenson et al., 2016). Gross Domestic Product measures a nation's production and consumption of goods and services. Precisely, gross domestic product is estimation of goods and services that a country produces in a specific year, where the black market is incorporated (to the degree that it is conceivable) however not production in home. Home production may appear as a minor part to GDP yet can be vital particularly while examining economic growth. It is a proven fact that in many less developed countries a significant portion of the entire populace produce for own consumption. This home production does not enter the national accounts. Along these lines, when the nation is industrialized, and more individuals are utilized in the formal sector, at that point the labour force and gross domestic product will increase due to this accounting practice more than because of the expansion underway (Panayotou, 2016). Apart from GDP per capita, there are other indicators of economic growth like the human development index (HDI) which measures a nation's accomplishment in terms of life expectancy, adjusted real income and educational attainment. Nations can score contrastingly if they are positioned by HDI or GDP per capita.

Growth has a quantitative significance. Growth indicate a percentage increase in the quantity or volume of something (it shows an increase in a country's population, national income). Moreover, an increase in per capita income, consumption, saving, investment, foreign trade over a period also imply growth (Coale, 2015). According to Maddison (2014), the raising of income levels in rich countries could also be termed as economic growth.

Economic growth in the restricted sense is an expansion of the nation's income per capita, and it includes the investigation, particularly in quantitative terms, of this procedure, with an emphasis on the useful relations between the endogenous factors; in a more extensive sense, it includes the expansion of the gross domestic product, gross national product and national income, consequently of the wealth of the nation, including the production capacity, expressed in both absolute and relative size, per capita, encompassing also the structural modifications of economy (Haller, 2012).

Economic growth is a process of quantitative, qualitative and structural changes, with a positive impact on economy and on the population's standard of life, whose tendency follows a

continuously ascendant trajectory. Economic growth triggered a rising or a good standard of living for majority of citizens in a country (Balcerowicz et al., 2013).

Phimphanthavong (2013) defines economic growth as an increase in the average rate of output produced per person, usually measured on a per annum basis. The growth shows how much more the economy could produce in the current year as compared to the previous years.

The above definitions all talks about economic growth occurring when there is an increase in the output of a nation compared from one year to another or an increase in aggregate productivity of a nation over a period. They are of the view that economic growth means an increase in real GDP. That is, when there is a positive change of a nation's total output produced over a certain period. One vital feature of economic growth is that it is never uniform or same in all segments of an economy. For instance, in a specific year, the mining area of a nation has denoted a noteworthy commitment in economic growth while the agriculture part has not performed well the extent that the economic growth of the nation is concerned.

Historically nothing has worked better than economic growth in enabling societies to improve the life chances of their members, including those at the very bottom (Rodrik, 2007).

According to Heller (2012), economic growth can be positive, negative or zero. She stated that, a positive economic growth is recorded when the annual average rhythms of the macro-indicators are higher than the average rhythms of growth of the population. On the other hand, negative economic growth appears when the rhythms of population growth are higher than those of the macro-economic indicators. She also stated that zero economic growth is when the annual average rhythms of growth of the macro-economic indicators, particularly GDP, are equal to those of the population growth.

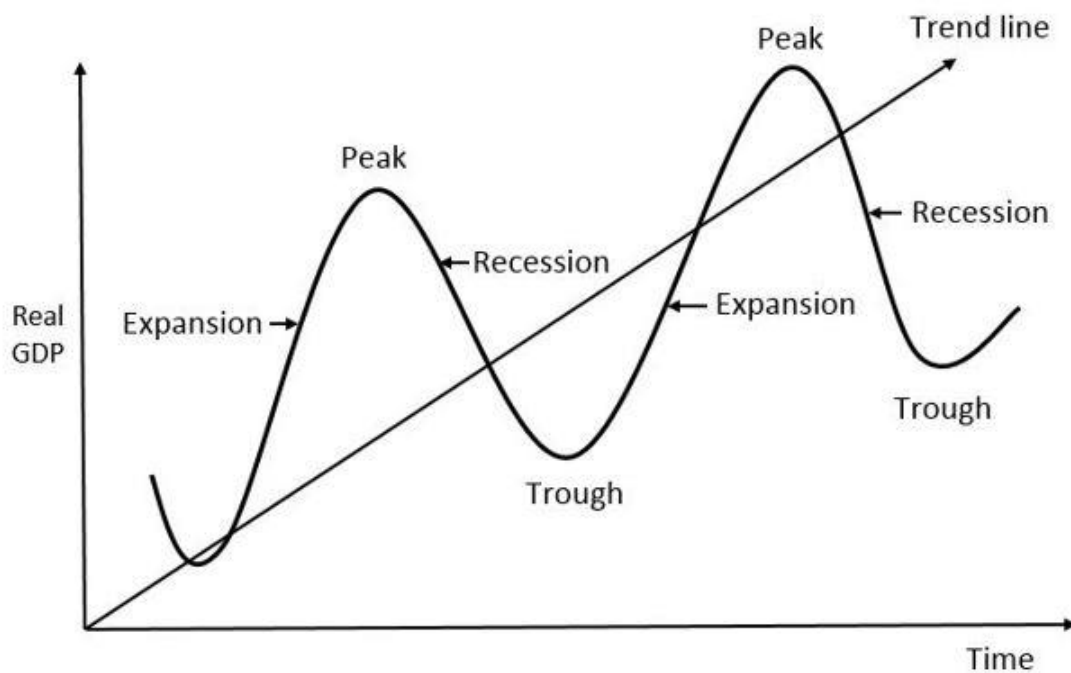
Economic growth estimates the additional output the economy generates than it did in the previous period. On the off chance that the economy is producing more, organisations are more productive and stock prices rise. This gives companies funding to invest and employ more employees. As more jobs are created, income rise. Consumers as well have more money to spend on extra items and services. Purchases by the consumers speed up economic growth. For this reason, all nations want positive economic growth. This makes economic growth the most

viewed economic indicator. Gross Domestic Product is the most ideal approach to gauge economic growth. This is because it considers the nation's whole economic yield (it corporates all goods and services that businesses in the country generates). Gross domestic products consider final production. It encompasses exports since they are produced in the country. Import on the other hand are subtracted from economic growth (Hartwell, 2017).

1.2 Phases of Economic growth

Economic cycle is the intermittent however unpredictable upward and downward development in economic activity estimated by changes in real GDP and other macroeconomic factors such as rate of consumption and employment. It is the real changes in economic activity and GDP over a time period. The cycle is a valuable tool for assessing the economy. The cycle has four phases namely; expansion, peak, contraction and trough. That is, the phases include the growth period and a decline period, as well the point that mark the shift from one period to another as shown in the figure 1 below.

Figure 1: Economic Cycle



Source : López-Salido, et al., (2017)

Analysts watch the pattern of the economic growth to discover the phase of the business cycle the economy of a nation is in. The expansion phase is the desirable phase. It is the best phase within the business cycle. The expansion phase reflects the point at which the economy is progressing in a sustainable manner. That is when GDP, which estimates the total economic output, keeps increasing. In the event that the growth goes beyond the healthy growth rate (the solid GDP rate that is more sustainable, so the economy remains in the expansion phase of the business cycle as long as possible), it overheats causing an asset bubble. Baker and Wurgler (2006, 2007) and Nofsinger (2012) in their research concluded that there is a link between business cycle and investor sentiment.

In an economic expansion period, investors are mostly presented with uplifting news. Over an extended period, investors' 'extrapolation inclination drives them to become confident and they see good news as a norm because it was expected. Around this time, any bad news becomes an element of surprise to the investors because it is an unexpected norm (Lewis, 2013; Cox et al., 2017).

The peak is the second phase in a business cycle. The peak being the highest point of the business cycle happens when the economic growth has achieved a point where it will stabilize for a brief timeframe and afterwards switch bearing. That is, where the growth rate of the business cycle reaches its maximum limit. During the peak phase, the economic factors (sales, production, employment, profit) reach their highest level without any further increase. During this period, the demand for various products starts declining because of input price increases. The period of inflation kicks in, as more money chases fewer goods. Sooner or later, confidence in the economic growth scatters. At the point where a larger number of individuals offer than purchase, the economy contracts (Hartwell, 2017). In the period of economic contraction, investors mostly hear bad news. Their sentiment now changes, and they become more unhopeful. During this contraction time, any bad news is of less surprise to them, as it was expected (Cox et al., 2017). At that point when that period of the business cycle continues, it turns into a recession. The economic growth around this point weakens. The trough phase is when the economy is at its lowest level.

1.3 Stages of Economic Growth

Economies all over the world evolved and developed over a period of time and there had been numerous speculations created throughout the years that have endeavoured to give predictive and illustrative clarifications. One of the more generally acknowledged theories was Rostow's linear stages of growth model.

In 1960, Rostow proposed a theory of economic history. Before Rostow, theories to development had been founded on the assumption that "modernization" was described by the Western world (richer nations and powerful countries), which could progress from the underlying phases of underdevelopment. Other nations likewise, were to model themselves after the west in becoming a modern state of capitalism and a liberal democracy (Costa et al., 2017). Based on these ideas, Rostow in 1960 proposed his classic theory of economic growth, where countries must pass through five stages to become developed; the traditional society, the pre-conditions of take-off, the take-off, the drive to maturity, and the age of mass consumption (Costa et al., 2017).

1. **Traditional society:** The economy is almost or wholly a primary sector economy. It is characterized by subsistence agriculture, hunting, mining, hunting and gathering, fishing. There is limited technology; the population lacks scientific perspective on world and technology. There is no economic mobility. There is rigidity in the society.
2. **Preconditions to Take off:** Economic Transition is triggered by external demand for raw. The economy is characterized by development of more productive and commercial agriculture. Exportation of cash crops not consumed by producers. There is increasing investment in physical environment to boost production. There is an advancement of existing technology. Social mobility begins. Shared economic interests and national identity are developed.
3. **Take off:** There is an increase in urbanization. Industrialization proceeds to occur, employees and institutions become settled around new industries. Breakthrough in Technological occurs. There is an expansion in the secondary sector of the economy. The economy moved quickly towards secondary sector (The secondary sector constitute a

significant part of gross domestic product, it add value and it is an engine of economic growth).

4. **Drive to Maturity:** Economic activities in the economy are characterized by modern technologies. According to Rostow, some ten to twenty percent of the national income of such economy is steadily invested, making output move faster than the population increase. The composition of the economy changes persistently as system enhances, new industries accelerate and older industries as well level off. There is a manufacturing change in the economy from investment-driven (capital goods) towards consumer durables and domestic consumption. Goods formerly imported are manufactured at home. There is massive investment in transportation and social infrastructure (large-scale investment in social (railways, airports, roads and highways, schools, universities, hospitals, etc.).
5. **Age of Mass consumption:** At this stage, the level of output in the economy goes up resulting in an increase in consumer expenditure. The taste and preferences of consumers goes up as there is more disposal income for high-value consumer goods (like automobiles). The economy at this stage is mainly dominated by industries; the primary sector tends to diminish it weigh on the economy. People desire to move from rural countryside to urban cities goes high.

According to Rostow, the most vital stage of the economic growth transition was from stage one through stage two, through stage three and then into the sustained growth and finally to the stage of high mass production (Rostow 1959; Cox et al., 2017).

Kehoe et al. (2016) in their research had a different classification of the stages of economic growth of a nation. According to them, countries go under four stages of economic growth. The countries start from the Malthusian trap to the taking off into growth then begin to trend to the economic leader stage and finally join the economic leader(s) as shown below:

0. **Malthusian trap:** In this stage, the economic growth is roughly matched by the population (Early growth in Great Britain and the United States was based on mobility of

population from rural to urban centres and movement of labour from agriculture to manufacturing).

1. **Taking off into growth:** This stage categorically refers to nations that have achieved one percent annual growth for the past 25 years. A nation could only be seen as taking off after it completes twenty-five years of one percent average annual growth in income per capita.
2. **Catching up to the economic leader:** Per capita income of the country goes beyond thirty-five percent of that of the economic leader for at least fifteen years (example, Mexico in the 19th century, beginning of the 20th century and later during 1970 and 1980's achieved that stage).
3. **Joining the economic leader:** Per capita income of the country is above sixty-five percent of the economic leader for at least fifteen years (example, Hong kong, Singapore).

Kehoe et al. (2016), did not use Rostow's 'sustained growth' considering the fact that the frequent growth, although prolonged, it is never maintained. The take off stage in Rostow's classification is very difficult and requires much effort. On the other hand, Kehoe et al. (2016) classification concludes that once the international economic leader becomes wealthy, it makes it less difficult for poorer nations to achieve economic take off stage. It is a heavy task for countries to progress from stage one to stage two then to stage three in Rostow's theory due to the extensive preparation requirement at each stage.

1.4 Benefits of Economic Growth

Verifiable, nothing has worked superior than economic growth in empowering social orders to improve the life of members in a society, including the deprived ones (Rodrik, 2007).

Economic growth enables individuals to move out of destitution. Research that thinks about the encounters of an extensive variety of developing countries finds reliably solid proof that quick and managed growth is the absolute most essential approach to diminish destitution. For instance, a lead investigation of 14 nations in the 1990s found that throughout the decade, neediness fell in the 11 nations that accomplished critical growth and rose in the three nations

with low or stale growth (Arndt et al., 2016; Shepherd et al., 2016).

Below are other benefits of economic growth:

- Economic growth transforms society. Economic growth is obtained by using all the available resources in an efficient manner and by increasing the production potentials of a nation. It helps facilitates redistribution of income between society and population. The positive impact of growth on poverty reduction is clear. Initial levels of wage imbalance are essential in deciding how intense growth has in lessening neediness. For instance, it has been assessed that a one percent increment in pay levels could bring about a 4.3 percent decrease in destitution in nations with low disparity or as meagre as a 0.6 percent decrease in neediness in exceedingly unequal nations (Ravallion, 2007).
- Economic growth creates openings for work and subsequently more grounded interest for work, the fundamental and frequently the sole resource of poor people. Thus, expanding business has been urgent in conveying higher development. Solid development in the worldwide economy over the past 10 years implies that most of the world's working-age populace is presently in work (World Bank, 2007).
- Economic growth drives human improvement. Economic growth is not recently connected with lessening neediness. There is likewise a clear prove for a positive connection between economic growth and more extensive measures of human improvement. Economic growth is not in a general sense about realism. Nobel laureate Amartya Sen has depicted it as a vital means for growing the substantive flexibilities that individuals esteem. These opportunities are emphatically connected with changes by and large expectations for everyday comforts, for example, more noteworthy open doors for individuals to wind up noticeably more beneficial, eat better and live longer (Jorgenson, 2015).

A quick growth in Gross Domestic Product extends the general size of the economy and fortifies fiscal conditions. Extensively shared growth in per capita GDP rises the standard of living of people. In any case, GDP is not intended to be a measure of economic welfare, and different contemplations are essential in completely surveying the expenses and advantages of strategy changes (stone et al., 2015).

In 2017, appraisals from both the Office of Management and Budget and Congressional Budget

Office (CBO) revealed that quicker economic growth would enhance the monetary viewpoint. They find that a 0.1 rate point increment in yearly economic growth would decrease deficits by generally \$300 billion over 10 years, for the most part through higher revenues. Despite the boosting that economic growth reduces future spending deficits, *ceteris paribus*, making farfetched development guarantees for one's arrangements as an approach to balance their cost will downplay the antagonistic effect of those strategies on actual deficits of the future (stone et al., 2015).

In conclusion, a full evaluation of the advantages of economic growth requires thought of how broadly peoples share in that economic growth. There is a major contrast between growth like that was encountered near 1948 and 1973 in United States of America, which multiplied expectations for everyday comforts all over the pay circulation, and the growth joined by extending salary imbalance the people encountered since.

1.5 Barriers to Economic Growth

Economic growth is the thing that each nation need for their riches, yet by one means or another it is very unthinkable for a few nations particularly Least Developed Countries (LEDC) like Afghanistan, Angola, Bangladesh, Benin, Bhutan., Burkina Faso etc. to increase economic growth, since there are numerous hindrances to growth that keep down developing countries. Basic cases of the obstructions are Poverty cycle, Ineffective Taxation Structure, Lack of Property Right, Political instability, Poor Infrastructure, Poor Governance, Capital Flight and Indebtedness as shown in table 6 below;

Table 1: Barriers to Economic Growth

BARRIERS	FINDINGS	AUTHORS
Poverty Cycle	Poverty and inequality are major factors that impede economic growth of less developed nations. Inequality apparent within these nations would trigger resentment leading to ethnic violence, hatred, corruption and undermine democratic process. As a result, potential	Morrison (2007), Sachs (2008), Dauda (2017), Nyasha et al., (2017).

	<p>investors would be unwilling to invest in such nations. Therefore, there would be lack of funds for investment because of low savings. Low level of income of a nation will lead to low savings, which in turn leads to low investment and this low investment would lead to low productivity.</p>	
Ineffective Taxation structure	<p>There is a negative relation between personal income tax, corporate taxation, social security contributions and economic growth. To stimulate economic growth, countries should lower the taxation rate (personal income tax, corporate taxation, social security contributions).</p>	<p>Macek (2014), Arnold (2008), Dackehag and Hansson (2012).</p>
Lack of Property Right	<p>Institutional structure is one of the vital indicators of proper rights and it interacts with economic growth. As needs be, better guaranteeing the security of property rights keeps the misuse of resources, makes it conceivable to dispose of market mutilations and creating positive externalities gives a positive commitment to economic growth. Also, the presence of ensured successful property rights decreases vulnerability in economic life and cost of transaction, facilitates the bringing together of financial resources, speeds technological knowledge flows and finally, results in economic growth in the long-term by encouraging entrepreneurs. An increase in property rights has been found to increase economic growth. So, in those economies where the guarantee of property rights is lower, studies have confirmed that there is a negative effect on economic growth.</p>	<p>Brunt (2011), Ceyhun (2015)</p>
Political	<p>Political instability reduces growth by lowering the rates of productivity growth and, to a smaller degree, physical and</p>	<p>Aisen and Veiga</p>

Instability	human capital accumulation. Instability in the government scares investors and hinders investment.	(2013)
Poor Infrastructure	Infrastructure creates economic value. Investment increase in physical capital, for example, plants, machinery, and roads will bring down the cost of economic activity. Infrastructure gaps limit economic growth and human development. It makes a nation less attractive to inward foreign direct investment. It makes an economy vulnerable to climate change or natural disasters.	Ansar et al. (2016)
Poor Governance	There is a positive effect of government effectiveness on economic growth. Positively, there is a lot of proof to propose that disparities in the level of development between nations are identified with level of governance and that poor level of governance is an impediment to growth.	Kurtz and Schrank (2007), AlBassam (2013), Alam et al., (2017), Dadgar and Nazari (2018).
Capital Flight	Capital flight has a negative impact on GDP growth. That is, illegal conveyances of capital abroad which stays unrecorded in the national accounts affect GDP of the nation.	Gusarova (2009), Ndikumana et al. (2014), Weeks (2015).
Indebtedness	A high government debt-to-GDP ratio has a negative impact on long-term growth.	Checherita-Westphal and Rother (2012), Panizza and Presbitero (2014), Mencinger et al.

		(2014).
Quality and Quantity of Human Capital	The quantity and competence level of the human capital of a nation directly affect the economic growth of that nation. A low competence level of the human capital impedes economic growth.	Lutz et al. (2017), 80) Li et al. (2017).

Source: Own compilation

Economic Growth is the expectation of every nation, yet by one means or another it is very inconceivable for a few nations (particularly Least Developed Countries) to increase economic growth, since there are numerous hindrances to growth that keep down developing nations. Regular cases of the obstructions are Poverty cycle, Institutional and Political variables, poor governance, ineffective taxation structure. These are fundamentally boundaries preventing growth in an economy. Numerous nations in Africa and Asia are known to have a poor institutional and political framework and through this they are confronting numerous boundaries to growth. One of the vital hindrances to institutional obstructions is poor infrastructure. It is realized that most developing nations are deficient with regards to framework even though it is imperative to economic growth.

1.6 Approaches to Economic Growth

The Theory of Economic Growth compares the primary speculations of growth from Adam Smith to the present day with a specific end goal to detach their logical structures, hypothetical spaces and methodological underpinnings. There are several growth theories that have been proposed by economists over some time.

Table 2: Approaches to economic growth

Theory	Date	Features	Authors
Mercantilism	16th to 18th century	Wealth of a nation determined by accumulation of gold and running trade surplus. The wealth of Nations should be increased through	Bibi et al., (2014), Heckscher

		trade.	(2013), Vaggi (2016).
Classical theory		Increasing returns to scale. The growth of the population and accumulation of capital are the necessary conditions of growth. The forces of diminishing returns and technological advancements determine the pace of economic growth.	Lewis (2013), Keynes (2016).
Neo-classical-theory	1950's and 1960's	Growth based on supply-side factors such as: labour productivity, size of the workforce, factor inputs. Development is a gradual and continuous process of change in an economy. Invention and new set of techniques are also gradual and continuous.	Meade, (2013), McKinnon, (2010), Penrose (2009).
Endogenous growth theories	1960's, 1986,1988	Rate of economic growth strongly influenced by human capital and rate of technological innovation. Productivity increment is linked directly to high pace of growth in innovations and additional investment in human capital. Knowledge accumulation as determinant of growth.	Checherita-Westphal, and Rothe (2012), Braunerhjelm et al., (2010), Michalopoulos et al., (2009).
Keynesian	1963	Keynes argued that aggregate demand could play a role in influencing economic growth in the short and medium-term. Though most growth theories ignore the role of aggregate demand, some economists argue recessions can cause hysteresis effects and lower long-term economic growth.	Keynes (2016), McCombie and Thirlwall (2016)

Source: Own compilation

Economic growth theories endeavour to clarify the conditions that are vital for growth to happen and weigh up the relative significance of specific conditions. The concentration on the olden

theories was to discover an understanding of economic growth and general determinants of growth that could be connected to any instances under any thought. By having a reflection on the growth pattern, the expectation was to find a portion of the principles that oversee growth always and in every nation.

1.7 Determinants of economic growth

The determinants of economic growth refer to factors that have an influence in the economic growth of a nation. According to Boldeanu and Constantinescu (2015), there are six inter-related factors that determine the rate of growth in an economy. These six factors are grouped under two namely:

- Supply determinants (Natural resources, human resources, technology and capital goods). These four factors have a direct impact on the total production of goods supplied
- Efficiency and Demand determinants: Efficiency factor implies achieving a high output to input ratio in service or production. Moreover, the persistent rise in the supply of goods in an economy because of the supply factors must be sustained by equivalent increase in demand for goods and services. Achieving high efficiency leads to a higher growth rate when full employment is achieved. To maximise the rate of growth in an economy, the available resources of the economy must be efficiently utilized in the production of optimum mix of goods and services (Boldeanu and Constantinescu, 2015).

The growth of economy measured by GDP implies the expansion of the growth rate of GDP, however what decides the increment of every segment is altogether different. Economic growth is additionally affected by indirect factors including institutions, aggregate demand size, saving and investment rates, financial system’s efficiency, budgetary and fiscal policies, movement of labour and capital and the effectiveness of the legislature.

Table 3: Determinants of economic growth

Determinants	Findings	Authors
Public Expenditure	Public spending on education has a great impact on productivity thereby increasing the economic growth	Ghosh et al., (2008), Arpaia et al., (2008),

	of a nation. Infrastructural spending by government not only increases the production of goods but also the supply of health and education services. As good health services contribute to productivity, spending in such areas of the economy would have a positive influence on economic growth.	Szarowska (2012), Pieroni (2009), McDonald and Eger (2010), Hou and Chen (2014), Marglin (2014), Boldeanu and Tache (2015), Navarro (2016), Ali et al., (2018).
Capital Formation	Infrastructure and human capital had a significant effect on long-run growth for a group of 14 European Union member countries.	Benos (2009), Osoba (2017). Jorgenson et al., (2016).
Education	Education is a key estimation device and intermediary for the quality of human capital. Skilled workers can have a vital impact to total production and growth. Education in an economy can speed up the human capital in the work force, which builds work efficiency, and this leads to a higher equilibrium level of output. It builds the innovative capacity of an economy; knowledge of new technologies, products, and processes promotes growth. It can also speed up the diffusion and transmission of knowledge expected to comprehend and process new information and to actualize new technologies formulated by others, again advancing growth. it can encourage the dissemination what's more, transmission of learning expected to comprehend and process new data what's more, to actualize new advances formulated by others, again advancing growth.	Mankiw et al., (1992), Hanushek and Wößmann (2007), Hanushek and Woessmann (2015).
Private and	Both private and public investment have an impact	Bose et al., (2007), Ponce

Public Investment	on economic growth of countries. Government investment especially on education has long-lasting effects on economic prosperity. Also, government investment in agricultural, non-agricultural, industry and service sector have a positive correlation to economic growth.	and Navarro (2016).
Trade components and Foreign Direct Investment (Export, imports openness, trade restrictions)	Theory has made it clear that there is a openness to trade speed up the transfer of technology and the sharing of knowledge, and, by increasing exposure to competition, contributes to exploitation of comparative advantage.	Barro (2003), Liu et al., (2009) Tekin (2012), Ramona (2014), Sultan and Haque (2011), AL-Raimony (2011), Abu-Eideh (2014), Malešević-Perović et al., (2014), Belloumi (2014), Mihuş and Luţaş (2014).
Foreign Aid	Foreign aid has a positive impact on economic growth. Countries coupled with trade deficit like Laos has enjoyed a positive impact on foreign aid.	Phimphanthavong (2013), Nwaogu, (2015).
Real Interest Rate	Real interest rate (RIR) is one of the essential determinants of growth. A rise in interest rate increases borrowing cost and creates incentive to save more money resulting in a reduction of the expenditures which in turn decreases the aggregate demand. Subsequently, it influences the economy adversely.	Islam and Mumtaz (2016), Jelilov (2016).
Real Exchange Rate	A high real exchange rate stimulates economic growth especially in developing countries. Keeping the real exchange rate at competitive levels can be critical for jump-starting growth.	Gala (2007), Eichengreen (2007), Rodrik (2008).

Consumer Confidence	Customer confidence index characterizes the level of positive thinking on the present condition of the economy that consumers are expressing through their exercises of savings and spending which prompt economic growth of the nation. Positive changes in consumer confidence should prompt the economic growth while negative changes hinder the economic growth of the nations.	Mazurek and Mielcová (2017), Islam and Mumtaz, (2016).
Role of Governance	Nations with high governance grow faster than those with weak governance	Arusha (2009), Chiu, (2016), Wilson (2016), Huang (2017).
Institutional framework	Corruption had statistical significance and a negative influence on economic growth.	Lewis (1955), Rodrik (2000), Acemoglu et al., (2002), Shera et al., (2014)
Political Instability	The propensity of the collapse of government affects economic growth. The economic growth of countries with a high propensity of the collapse of government is significantly lower than those without or with least propensity of collapse of government.	Aisen and Jose Veiga (2013)
Socio-cultural factors	Ethnic diversity and fragmentation, language, religion, civic norms, beliefs have effect on economic growth. The behaviour of people with aspects related to output growth: investment, consumption, savings and expectations all have impact on economic growth of a nation.	Harrison and Huntington (2000), Acemoglu (2009), Popa (2012).
Geography	Geography has effect on economic growth. For example, the quality of soil would influence total produce. Climate has a direct impact on production and attitudes regarding consumption.	Naudé (2004), Rodrik (2003). Acemoglu (2009),

Source: Own compilation

One of the main objective of any government is to maintain a sustainable growth in the economy. The available evidence suggested that the real per capita of gross domestic product is highly influenced by governments policies including the public expenditure, spending on education, real interest rate and real exchange rate. Other empirical evidence also concluded that political instability, consumer confidence, a country's openness to trade, geographical location of a country, capital formation and institutional framework of a country tend to correlate with economic growth of a nation.

1.8 Transition from the original factors to Knowledge Economy

The difference between the traditional Economy and Knowledge Economy (KE) is that, there is abundance in the knowledge economy as compared to the scarcity nature of the traditional economy. Historically, if resources used to be diminished, in the knowledge economy; information and knowledge do not diminish. Contrary, by their application they can be increased and shared (Edvinsson, 2002; Dalkir, 2005; Ricceri, 2008).

Even though human capital skills add value to industries, evaluations of competencies are not reflected in industries yearly statements (Stewart, 1998; Ricceri, 2008; Tocan, 2012).

There are other differences enumerated by Brinkley (2006):

- KE is “a soft discontinuity from the past”.
- KE encompasses all other sectors of the economy.
- Information Communication and Technology plays a vital role in Knowledge Economy, together with skilled labour force.
- Innovation is a key concept in Knowledge economy
- The traditional economy is of the view that capital can only be explained in financial and physical terms. On the other hand, in the knowledge economy, the traditional capital having financial and physical description converts into intangible capital. The new economy records that more than half of total national output in developed economies, in view of the knowledge-based economy. This is because of the scholarly capital and the polished methodology of the staff
- Knowledge management is needed in knowledge economy to handle, store and share

information.

The growth of an economy is the concerns of nations around the world. Each nation seeks to achieve growth in their economic activities. Therefore, investigations that seeks answers to factors that influence growth has been of concern to researchers. Factors like openness to trade, real interest rate and education have been concluded to have a positive correlation to growth. Moreover, factors like poor governance, lack of infrastructure, poverty cycle, political instability have been realized to be hindrances to growth. Inside the concept of economic growth theory, there have been two vital theories that have initiated a great part of the current lectures on economic growth. These incorporate neoclassical theory and endogenous growth theory. Their primary spotlight has been on the significance of state factors, for example, the amassing of physical capital and human capital (Solow 1956; Romer 1986; Lucas 1988). Therefore, the following chapter focussed on describing knowledge, and the term knowledge economy, characteristics of knowledge economy and other knowledge related concepts.

2. THE CONCEPT OF KNOWLEDGE ECONOMY

The capacity to control knowledge is turning into a more and more essential in recent knowledge economy. The advent and the spreading of knowledge have emerged as ever more vital elements in competitiveness. Increasingly, knowledge is being regarded as a valuable commodity that is incorporated in products especially high-technical products and within the tacit knowledge of highly mobile personnel. Even though knowledge is more and more being considered as intellectual asset or a commodity, it possesses some contradictory features that are noticeably special from other valuable commodities or assets (Nonaka, 2006). Knowledge is one of the most vital assets for an industry to generate value and for that reason, sustainable competitive advantage (Khan, 2014). Knowledge has been regarded as the only significant resource today (Drucker, 1993).

2.1 Knowledge in the Modern Economy

The term knowledge has been defined as a dynamic process of substantiating individual belief towards the truth (Nonaka, 2006). Knowledge is information that is depending upon a set of circumstances, material and actionable (Turban et al., 2011). Possessing knowledge means that it can be used to resolve a problem. Though data, information and knowledge are all assets of an organization, knowledge provides higher level of meaning (Khan, 2012). Knowledge is being seen as a liquid blend of confined understanding, values, logical data, and expert insight that gives a structure to assessing and joining new-experiences and information. It starts and is used in the brains of knowers (Amine, 2012; Campeanu-Sonea, 2014; Webb, 2017). Unlike data and information, knowledge leads to decisions and actions which increase an organization's ability for effective action (Davenport and Prusak, 1998; Dalkir and Beaulieu, 2017). It is suggested that the knowledge is a construct shaped by interlinking a range of scholarly segments, the most straightforward being information. Information is made out of yet a less difficult frame, named 'data' which are probably situated at the limit of knowledge strata (Spuzic et al., 2008).

Knowledge is a built-up arrangement of relations, which makes due by being imparted to more than one individual, normally countless number of humans. Knowledge can keep on existing

over a noteworthy timespan with extensive unwavering quality. At a more elevated amount, knowledge is put away efficiently as a benefit inside the scientific disciplines and it is gotten to and utilized for various purposes by an individual or by the broadest society (Abhary, 2009). Characteristics of knowledge according to Dalkir and Beaulieu (2017) are as follows:

- use of knowledge does not consume it.
- transferal of knowledge does not result in losing the knowledge.
- knowledge is abundant, but the ability to use it is scarce.
- much of an organization's valuable knowledge walks out the door at the end of the day.

Knowledge can be characterized as a dynamic system or structure from which information can be put away, handled and caught on. Knowledge, hence, has a social trademark, including a 'knowing self' and an occasion or a substance (Howells, 2002).

2.2 Types of Knowledge

There have been different endeavours to distinguish and characterize diverse kinds of knowledge, yet an early and original qualification has been made by Michael Polanyi who recognized tacit knowledge and codified (explicit) knowledge (Paswan 2009; Broudy, 2017).

The distinction between these two wide kinds of knowledge is connected to the level of formalization and the prerequisite of quality in the formation of knowledge.

2.2.1 Tacit Knowledge

Tacit knowledge is an individual knowledge inserted in singular experience and includes immaterial factors, for example, individual conviction, point of view and esteem framework (Nonaka and Krogh, 2009). It is some of the time alluded to as know-how and alludes to instinctive, difficult to characterize knowledge that is encounter based (Nonaka et al., 2018). Along these lines, it is frequently context independent and individual in nature. It is difficult to impart and profoundly established in real life, responsibility, and association (Nonaka and Krogh, 2009).

Tacit Knowledge is fixed to the senses, material encounters, development abilities, instinct, unarticulated mental models, or certain dependable guidelines Thus, tacit Knowledge can be

characterized as abilities, thoughts and encounters that individuals have in their psyches and are, along these lines, hard to get to since it is regularly not systematized and may not really be effortlessly communicated (Chugh, 2015). The most remarkable feature of the tacit knowledge is the fundamental conviction that knowledge is basically individual in nature and is along these lines hard to extricate from the heads of people (Sanchez, 2005).

2.2.2 Codified Knowledge

Explicit or Codified Knowledge is knowledge that can be promptly enunciated, systematized or codified, gotten to and verbalized (Hélie and Sun, 2010). Explicit knowledge includes know-how that is transmittable in formal, orderly dialect and does not require coordinate understanding of the knowledge that is being procured and it can be moved in such arrangements as an outline or working manual (Howells, 2002). This sort of Knowledge is formalized and arranged and is occasionally alluded to as know-what. It is subsequently genuinely simple to distinguish, store, and recover (Wellman, 2009). This is the kind of knowledge most effortlessly dealt with by Knowledge Management Systems, which are extremely compelling at encouraging the capacity, recovery, and change of records and messages.

As opposed to the perspectives held by the tacit knowledge approach, the explicit knowledge approach holds that knowledge is something that can be clarified by people, even though some exertion and even a few types of help may occasionally be required to enable people to verbalize what they know. Accordingly, the explicit knowledge approach accepts that the valuable knowledge of people in an association can be verbalized and explicitly made (Sanchez, 2005).

Knowledge codification is how much the collected experience is examined, disconnected, and consolidated under control records, manuals, outlines, computer programs, and so forth., that give the substance ("know-what"), the procedure ("know-how"), and in the long run the method of reasoning ("know-why") for the execution of a specific errand (Lundvall, 2012).

Keeping in mind the end goal to speed up economic examination, distinctions can be made between various types of knowledge which are essential in the knowledge economy. These are the know-what, know-why, knowhow and know-who. Knowledge is a substantially more

extensive idea than information, which is for the most part the "know-what" and "know-why" segments of knowledge. These are additionally the kinds of knowledge which come nearest to being market items or economic assets to be fitted into economic creation capacities. The other kinds of knowledge especially the know-how and know-who are tacit knowledge and are harder to systematize and measure (Johnson et al., 2002; Jensen et al., 2007). Individual knowledge comprises of these four kinds of knowledge: 'know-what', 'know-why', 'know-how' and 'know-who' (Johnson et al., 2002; Lundvall, 2012). With respect to the level in organizations, these classifications relate to shared information databases, shared routines, networks and shared models of understanding including organization's stories (Lundvall, 2012; Johnson et al., 2002).

- Know-what alludes to unequivocal comprehension about a theme that can be effortlessly transmitted to colleagues. For instance, confirmations or certifications exhibit that you have some particular knowledge, and in certainty have met some base prerequisites to work in a space with least knowledge. While accreditations can be essential, accomplishing one is not in actuality a capability beyond exhibiting that you have taken or learned in a watchful group of knowledge about a specific point.
- Know-why alludes to logical knowledge of the standards and laws of nature. This sort of Knowledge underlies innovative improvement and industries' advancements in products and processes. To gain admittance to this sort of knowledge, firms need to cooperate with these industries either through employing scientifically-trained personnel or through joint ventures.
- Know-how alludes to abilities or the capacity to accomplish something. Know-how is the capacity to tackle issues proficiently construct principally with respect to internally generated knowledge, experience, and aptitudes. Specialists judging market prospects for another item or a work force director choosing and preparing staff need to utilize their know-how. The same is valid for the gifted specialist operating complex machine devices. Know-how is regularly a sort of knowledge created and kept inside the outskirts of an individual firm. A standout amongst the most critical purposes behind the arrangement of organization networks is the requirement for firms to have the capacity to share and join components of know-how.
- Know-who is the capacity to gain, change, and apply that know-how. Know-who based

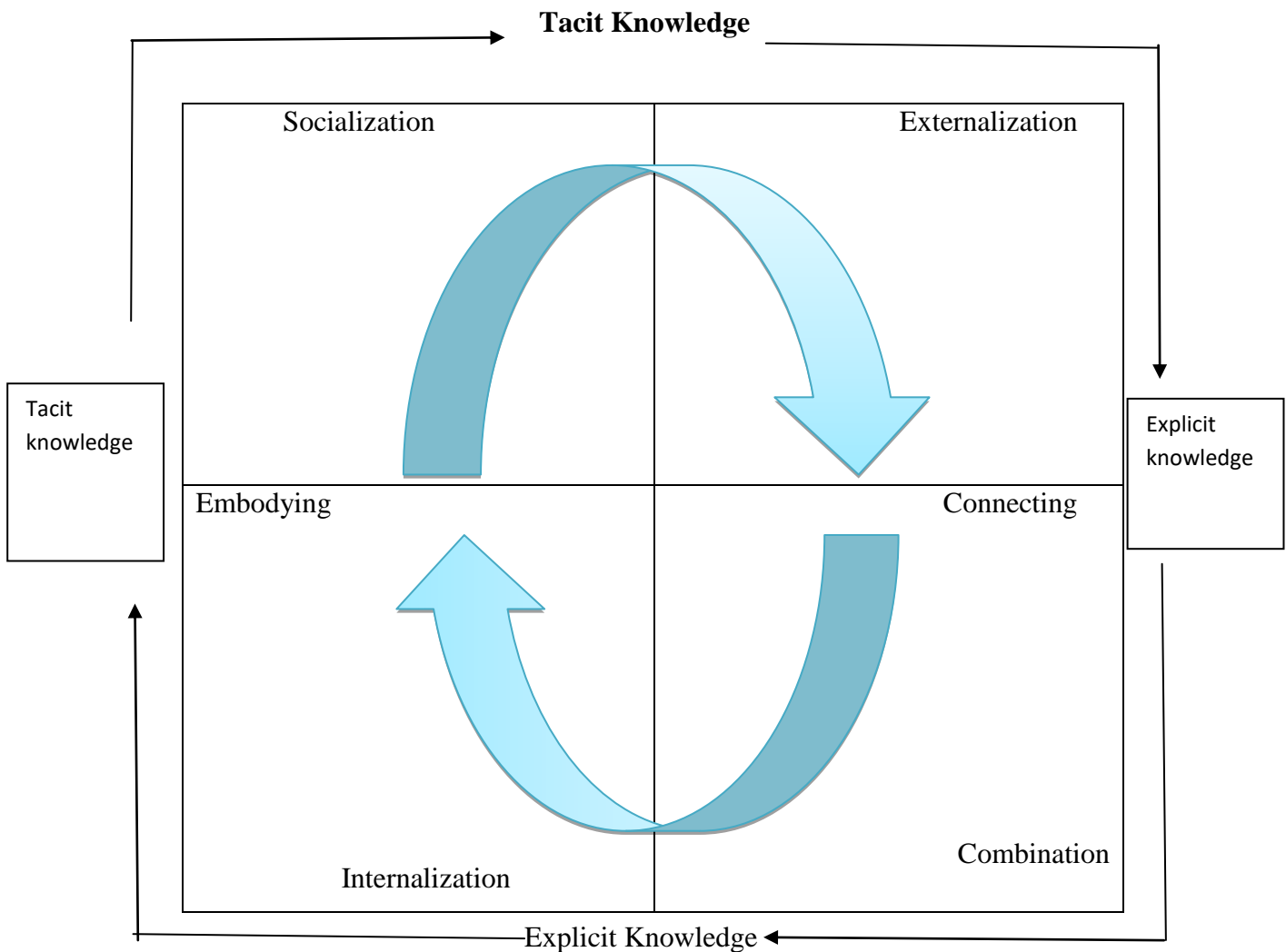
organizations know who has the know-how; have the dynamic empathy to quickly set up the trustful relationship required to obtain that know-how; and have the various abilities required to change and apply it in another setting with the goal that advancement can happen. It is important in economies where aptitudes are broadly scattered considering a very created division of labour among industries and specialists.

Whereas know-what and know-why type of knowledge can be acquired through attending lecture, conferences, and getting to databases, the other two sorts of knowledge are established essentially in practical experience. Know-what sort of knowledge will commonly be learned in circumstances where an apprentice understudies his master and depend upon him as the expert. One of the major rational behind why firms participate in fundamental research is to obtain access to systems of scholarly specialists urgent for their inventive capacity. Know-who is socially inserted knowledge which is difficult to exchange through formal channels of information (Lundvall, 2012).

2.3 Knowledge Creation

In an economy where the main sureness is vulnerability, the one wellspring of enduring upper hand is knowledge. At the point when markets move, innovations multiply, market competition increase, and products end up out of date overnight. Fruitful organizations are those that reliably make new knowledge, scatter it generally all through the organization, and rapidly exemplify it in new products and technologies (Nonaka and Krogh, 2009). Academic research that do incorporate a meaning of knowledge creation exhibit a boundless reasonable scope, delineating knowledge creation as a progression of exercises or process, as the yield of such processes, or value-adding outcome, for example, new product exploitation, process or service. At the point when characterized as a process, knowledge creation alludes to the activities and initiatives undertaken to create new thoughts or products. Knowledge creation as a process is characterized regarding the strategy or means through which knowledge is made and can be separated from the final product or yield (Mitchell and Boyle, 2010).

Figure 2: The SECI Model Knowledge Creation Spiral



Source: Nonaka and Takeuchi 1995

Knowledge creation is the arrangement of thoughts through association among tacit knowledge and explicit knowledge in human mind. According to Khodakarami & Chan (2014) knowledge creation comprises of four phases namely; socialization, externalization combination and internalization. Socialization relates to tacit knowledge to tacit knowledge. Here, the knowledge is transmitted through practice, imitation, observation and guidance. Externalization implies tacit knowledge to explicit knowledge. This is considered as difficult and most of the time important transformation instrument. The tacit knowledge is codified into manuals, documents and so forth with the goal that it can spread more effectively through the organization. The term combination refers to explicit knowledge to explicit knowledge. This is the least complex frame. Codified

knowledge references are joined to generate new knowledge. Internalization is the transfer of explicit knowledge to tacit knowledge. As explicit sources are used and learned, the knowledge is disguised, changing the user's current tacit knowledge (Nonaka and Krogh, 2009).

The creation and transfer of knowledge is one of the key exercises that most economic actors in recent years should address. There are various manners by which it is possible to create and spread new and existing knowledge. According to Frenz and Ietto-Gillies (2009), there are four different sources of knowledge that can be utilized:

- the own generation of knowledge;
- bought-in knowledge;
- intra company resources (transfer of knowledge within a single company);
- collaboration (joint).

The collaboration as the fourth source has turned out to be progressively vital as of late (González-Benito et al., 2016; Miozzo et al., 2016). It can be said that collaboration is at present essential if firms need to grow and compete on the global market. Firms that share knowledge can generate superior returns and stand high in market competition (Holmquist, 2009). Non-collaborative organizations center around their own assets and the improvement of key skills, knowledge is being refreshed at an ever-speedier pace and technologies are outdated, bringing about the vital increment in cost of investment and a rising cost of knowledge generation. Because of these variables, it is relatively unimaginable for an organization to make and gather all the knowledge required for its survival and success independently. Collaboration as a result, is very vital for the knowledge to spread outside and within the organizations (Moreira, 2009). Coordinated effort can join partners towards positive results that could not be accomplished in isolation (Holmquist, 2009). The making of a common vision between companies or partners can produce the vital sense of duty regarding shared growth. As a result, "exchange" between the partners is obligatory with a specific end goal to change tacit knowledge into explicit, both inside and remotely (Nonaka and Krogh, 2009).

2.4 Knowledge Transmission

Alongside the improvement of intellectual capital during the time spent in value creation,

knowledge is turning into the key component of firms' growth rather than customary productive factors, for example, labour, capital and land. With a specific end goal to keep upper hand, firms must transfer their knowledge, and the technology innovation alliance has given a decent chance to knowledge transfers, knowledge acquisition and knowledge learning (Mazloomi and Jolly, 2008).

The dissemination of knowledge shows that knowledge transfers in different ways among different organizations (Bloodgood and Salisbury, 2001). Technology and Innovation is basically the procedures of knowledge transfers, knowledge creation and learning application (Gil and Passino, 2006). Consequently, knowledge transfer forms have become the focus for consideration (Nielsen, 2005), and the procedures are fundamentally influenced by the learning expectation of partners, the transfer capacity of knowledge sources and the acknowledgment capacity of knowledge beneficiaries (Jiang et al., 2008; Narteh 2008). Research has proven that, firms improves their performance by collaborating with and tapping knowledge from other firms from pairing to network level (Ahuja, 2000; Möller et al., 2005).

In a developing group of research, researchers contend that firms exchanging knowledge successfully from one specialty unit then onto the next are more gainful than firms less ready to play out this exchange (Gupta and Govindarajan, 2000; Hansen, 2002; Kostova and Roth, 2003) As a result of these exchanges, units within an organisation learn and gain from each other through new knowledge that has been created by other units. The transfer of knowledge among departments in an organisation gives chances to mutual learning and inter-departmental participation that invigorate the creation of new knowledge and additionally, contribute to the departments or unit's capacity to innovate (Walter et al., 2007).

2.5 Knowledge Spillovers

While explicit knowledge can be disseminated at an individual, corporate or international level, tacit knowledge can only be acquired at the lowest, i.e. individual level. The transfer of explicit knowledge can then take place through technologies, documents, products and processes (company level) or multilateral agreements on technology transfer, education and training, direct

export and import of products (international level). On the other hand, the exchange of tacit knowledge on an individual level can take place through deliberate transfer or transfer knowledge or through unintended spillover effects (Aghion and Jaravel, 2015).

Knowledge Spillovers are the inadvertent transmission of knowledge to others past the expected limit. At each conceivable cooperation, there is a potential for knowledge exchange. On the off chance that knowledge is traded with the proposed individuals or associations, it is "Knowledge transfer", any knowledge that is traded outside the proposed limit is spillover. The unintended use of traded knowledge is called is what is termed as knowledge Externality (Fallah and Ibrahim, 2004). At the point when a person settles on the choice to share his or her tacit knowledge there is normally an inspiration driving this sharing. Individuals share information for various reasons, for instance, to get input from other individuals, or to get affirmation of one's thoughts, this affirmation could be materialistic or essentially acknowledgment between peers for the work done.

When this knowledge is out there it can be utilized as a part of any approach to profit other people groups' work and could prompt different revelations (Rodríguez-Gulías, 2018). Thus, sharing knowledge could bring about spillovers and other knowledge externalities. Reverse engineering (the reproduction of another manufacturer's product following detailed examination of its construction or composition) is a decent case of knowledge externality. At the point when an organization puts resources into innovative work to acquaint another imaginative item with the market, the inspiration driving that demonstration is to benefit from the innovation. In any case, there is a related hazard that a contender may figure out that item and make utilization of the externalized knowledge emerged in the creative item. Organizations prepare for spillovers and unintended use for a timeframe by protecting their inventions (Fallah and Ibrahim, 2004; Aghion and Jaravel 2015; Rodríguez-Gulías, 2018).

2.5.1 Levels of Knowledge Spillovers

According to Fallah and Ibrahim 2004, there are three levels of spillover effects:

- Individual Level (among people): Knowledge is inadvertently exchanged among people.

Individuals have control over their tacit knowledge and can share them with anyone they want or need. The spill-over effect can most often occur as a result of ignorance or ignorance, or when tacit knowledge is externalized to use it. While individuals may use patents or copyrights to protect their knowledge, however, as soon as one becomes tacit knowledge, explicit knowledge will begin to spill over to others. While knowledge sharing, for example, within team members working together (within a company, or through business-to-business or customer-to-customer relationships, for example) is not considered as a spill, because in this case the team was created to share knowledge. On the contrary, unintentional sharing of knowledge that was not primarily intended for a given group, or sharing the group's knowledge with people outside the group (outside the organization) is considered to be a spill-over effect;

- Corporate Level (between companies): in this case, knowledge is exchanged between companies, both between neighbouring companies (often located in close proximity) and in the joint venture of companies involved. Just as in the previous case, if it is a deliberate exchange of knowledge, this process can be called sharing or knowledge transfer. Any information that is not deliberately shared then represents the spill effect;
- Global (between countries): the effects of knowledge spill-over occur in the unintentional sharing of knowledge across countries. This sharing can occur between neighbouring countries as well as between countries that trade together (e.g., the process of transferring technology).

Currently, there are other levels that may have the effects of spillover between companies and other entities. Among them are;

- University-Industry: in this case, cooperation between universities and firms is becoming increasingly important and is being studied by an increasing number of academic researchers (Siegel et al., 2003; Ponds et al., 2010; Maietta, 2015),
- University-Industry-Government collaboration: Similarly, as in the case of cooperation with universities, this kind of collaborations between universities, businesses and government is gaining importance and is being explored by a number of foreign authors (e.g. Etzkowitz and Leydesdorff, 2000; Leydesdorff, 2012; Zhang et al., 2014; Petersen et

al., 2016). In recent years, the original Triple Helix concept has been expanded to Quadruple - Helix by adding a fourth component - the human company as an innovation user.

The new growth theory was of the view that knowledge speed up advancement in technology and also has positive influence on productivity thereby increasing the economic growth of a country. Lucas (1988) and Romer (1986, 1990) defined economic growth through the build-up and spillover of knowledge that is based on technology. New Knowledge is a vital ingredient when it comes to innovation. It is a great input factor for innovation and it is highly distributed when it gets transformed into products, process and firms. Research and Development activities, in addition to generating innovations, bring with them many other options for instance, they increase the ability to identify; adapt and use externally generated knowledge and this results in the possibility of using a higher level of research and development activities, greater absorption capacity and a pool of knowledge. Industries are forced to decide whether to implement their research and development independently; in research alliances with other research institutions like universities or governmental laboratories; contractually through specific research and development projects; hiring researchers from other firms or research centres (Mueller, 2006).

Despite the obvious benefits that cooperation and the dissemination of knowledge bring, there are many companies that do not participate or who are unable to take full advantage of its benefits. According to Iammarino and McCann (2006), there are two different perspectives of knowledge spillover effects such as knowledge inflows and knowledge outflows. Knowledge tributaries evaluated by companies are positive. On the other hand, unscheduled knowledge flows can have both a positive and a negative impact on businesses. One of the main negatives of unintentional outflow of knowledge for the original firm is the escape of valuable intellectual capital and intangible assets (Iammarino and McCann 2006; Ferreira et al., 2017).

On the other hand, the potentially positive effect of unintentional knowledge leakage is seen in the nature of knowledge as a public good. This outflow would then be important if it helped to strengthen the local knowledge base and thereby make the area more attractive to other innovative companies, which would result in a greater inflow of knowledge in the future. In

particular, it depends on the individual assessment of the benefits of spillover effects for individual companies, i.e. the relative importance of these two effects. This reflection is currently quite complex because there is no one-size-fits-all method that would give companies the ability to measure the size of knowledge outflows and inflows and the associated effects (Ferreira et al., 2017).

2.6 Knowledge Economy

The term Knowledge economy has gained prominence in recent years. In some economies, knowledge has been added to the traditional production factors (land, labour and capital) and in some economies too it has totally been substituted the traditional factors of production which guaranteed growth of nations. Previous studies by some researchers (Kim, 2015; Verba, 2016 and Magnier-Watanabe, 2015) confirmed this shift from the traditional factors of production (labour, land and capital) towards knowledge. According to Heng et al., (2012), knowledge influences the economic growth of nations, represent a vital factor of production and also trigger disparities in the productivity of countries.

Verifiable improvement of economic theories working with sources of competitive advantage demonstrates that economic subjects have dependably needed to search for other better approaches to satisfy your corporate methodology and adapt to the pace of rapid change (Stejskal and Hajek, 2015). It is obvious that economic growth cannot be achieved in the same way as it used to be in the past, that is, by constantly hiring more workers representing inputs or increasing demand of consumers (Pulic, 1998; Chen et al., 2004). Most of the leading nations in recent decades have progressively advanced toward knowledge-based economies, depending less on conventional factors of production (labour and capital) for prosperity in economies and creation of wealth (Chen and Dahlman 2005; Chavula 2010; Chandra and Yokoyama 2011; Asongu 2017). Thus, knowledge is undoubtedly one of the new sources of economic growth, however, their use from an economic perspective is not a new issue (Snieška and Bruneckienė, 2009). It is broadly recognized that the creation of knowledge, development, and mechanical changes drive success in these nations. In like manner, economic motivating forces in view of new knowledge animate the progress of an economy, enhance the stepping stool of business openings, give

higher wages, and at last upgrade the nation's intensity inside the worldwide condition. The engaging economic patterns common in many developed nations emphatically rely upon interests in innovation, high talented work force and technology enterprises (Tchamyou, 2017). The above stream of accounts is reliable with the requirement for a more scientific research on concept of knowledge economy and the driving factors behind it.

2.6.1 Definition of Knowledge Economy

In the present academic research, it is extremely hard to locate a unified meaning of what a 'knowledge economy' is. There are several definitions by authors stemming from digital economy, to the information economy, to the internet economy. Though each author adds his own insight and meaning to this term they all express one economy administered by knowledge; where this last is the one predominant to improve things, and where the possibility of survival of the quickest overwhelms, and this to appear the welfare of society.

The OECD defined knowledge economy as a kind of economy based on production, distribution and use of knowledge. It has widely been known as an economy where production and use of knowledge play an essential and important role to achieve prosperity. The knowledge economy is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to these by the business and public sectors (OECD, 2005).

Brinkley (2006) in his attempt to find an all-inclusive definition of knowledge economy came up with these descriptions:

- Knowledge economy is an economy in which the creation and use of knowledge has a dominant role in wealth creation or prosperity. Such economy is based on the most effective use of all kinds of knowledge in economic activities.
- The rationale of the knowledge economy is centered on the description of new sources of competitive advantage that can be used by all companies (knowledge) in all regions and in every sector, from agriculture to biotechnology.
- The success of the Economy is highly based on the effective use of intangible assets such

as knowledge, experience and innovation potential. These assets are key elements for gaining a competitive advantage. The concept of the knowledge economy is then used to describe this emerging economic structure.

- The knowledge economy and the knowledge society are a bigger concept than just increased attention towards research and development. They include every aspect of the current economy in which knowledge represents the basis for added value, ranging from high-tech industries and ICT, through the knowledge intensive industry to the creative / creative industries such as the media and architecture.

The expression "knowledge economy" is ordinarily used to portray economic activity that depends not on natural resources (like land or minerals) but rather on scholarly assets, for example, know-how and expertise. A key idea of the knowledge economy is that human capital can be dealt with as a commercial resource or as an educational and intellectual products and services that can be traded for a high esteem return. Clearly the knowledge economy is somewhat more vital for those areas whose normal assets are rare (Commission of the European Communities, 2008).

The term Knowledge economy has been used in several cases but is rarely defined. Brinkley et al. (2009) came up that, the knowledge economy is about a transformed economy dominated by investments in knowledge-based assets (R&D, design, software, human and organizational capital) compared to investments in physical assets (machines, equipment, buildings and vehicles). Such economy captures the gradually altered industrial structure, ways of work, and the basis on which organizations compete.

Moreover, Knowledge economy is subspecialty of economy mainly concerned with knowledge. It is a modern economic phenomenon characterized by the change of economies course; in terms of growth and regulation of economic activity (Dominique Foray, 2005). Economists depict this economy because of the advancement of private enterprise, a motivation behind why it is additionally called "post-capitalist economy (Hachimi and Al-Azzawi, 2007).

Parken and Rees (2009) characterizes the knowledge economy as the examination and

comprehension of the aggregation procedure; and the motivating forces of people to find and pick up knowledge and access to what the others know. With supported utilization and production of knowledge at the focal point of the economic development process, an economy basically turns into a Knowledge Economy. A Knowledge Economy (KE) is one that uses knowledge as a spring board for economic growth. It is an economy where knowledge is procured, made, dispersed and utilized adequately to upgrade economic advancement in a nation (Chung-Hae and Chen, 2007).

Hendarman and Tjakraatmadja (2012) proposed that the knowledge economy is an economy in view of the creation, assessment and exchanging of knowledge. In this manner, the knowledge economy speaks to production and services considering knowledge-intensive activities that add to the quickened pace of technological and scientific progress and in addition their rapid obsolescence. The key highlights of the knowledge economy are, in this manner, the more prominent reliance on intellectual capabilities than on natural resources or physical inputs, combined with endeavors to coordinate upgrades at each phase of the production process: from a research and development laboratory, through a factory to communication with customers and (Powel and Snellman, 2004).

All the above definitions lead to a conclusion that, knowledge economy is using human intelligence to create value.

Table 4: Theories of Knowledge Economy

Theory	Characteristics	Authors
Learning Regions	The idea of this theory is the claim that competitiveness is based on better learning and interregional skills, socio-cultural and institutional differences. Convergence (divergence) leads above all to the existence of positive feedback in the field of learning, adoption of new technologies and procedures and, where appropriate, exchange of	Florida (1995); Lundvall (2012).

	information (both on and off - market); the existence of technological infrastructure.	
Triple Helix	The creation of innovations, which is considered as the engine of regional development, is determined by mutual cooperation and the emergence of synergic relations between relevant actors (Industries, public sector, and academic institutions). The cause of interregional differences is the different quality of relationships within each of them three helices (actors) and among the main convergence mechanisms (divergence) includes thoughtful decisions of individuals and theirs groups, but also random phenomena.	Leydesdorff (2013), Etzkowitz and Leydesdorff (2014).
Regional Innovation System (RIS)	These systems are made up of two subsystems. The first subsystem is focused on knowledge production (R & D), and the second subsystem (firm) then uses this knowledge, while targeted support for RIS competitiveness and upgrading is a major complement to existing spontaneous (and random) synergic effects. Different qualities of research and development institutions, the different ability of companies to create and absorb innovations, but also the different quality of interconnection between the two subsystems is influenced by interregional differences. The main mechanism of convergence (divergence) is, in particular, the various levels of connectivity and trust between actors within and between the two subsystems	Cooke (2002); Cooke et al., (2007).

Clusters	<p>According to this theory, the success of business depends, among other things, on the quality of the environment, where localization of individual activities is a strategic issue. The main reasons for inter-regional differences are corporate strategies, the nature of competition between firms, the quality and cost of inputs, the demand for markets and the quality of the connected and supporting industries.</p> <p>Convergence (divergence) occurs through agglomeration savings, the creation of sufficient supply of skilled labour, and the establishment of a specialized infrastructure and the emergence of specialized suppliers.</p>	Porter (2000)
Theory of flexible specialization	<p>Inside this hypothesis, there is a withdraw from large scale manufacturing and the principle motor of interregional contrasts are the distinctions in the social structure for the organization of production and the conduct of ventures. For instance, external investment funds, agglomeration advantages or collaboration are thought to be reasons for difference. The fundamental performers in this hypothesis are little firms in less industrialized regions.</p>	Piore and Sabel (1986)
Open Innovation	<p>Open innovation has been characterized as the utilization of purposive inflows and outflows of knowledge to speed up internal innovation and extend the business sectors for outside utilization of innovation, respectively. When open innovation is adapted, the firm's limits turned out to be penetrable and that permits consolidating the organization resources with the outer co-administrators.</p>	Chesbrough, (2003)

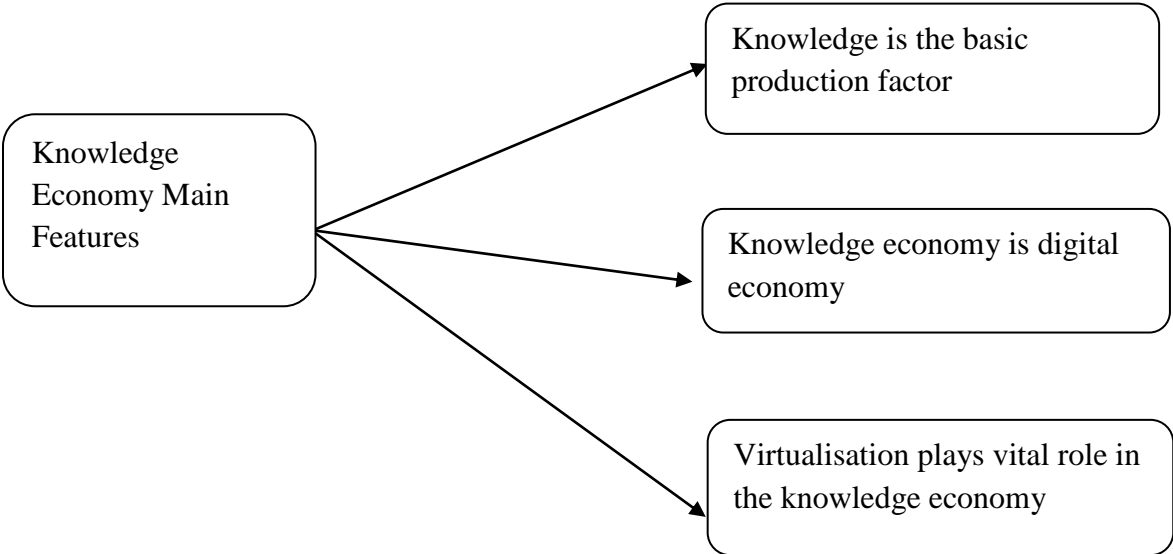
Global commodity (value) chains, global production networks.	The core of this theory is to understand the factors, ideas and processes that shape the current global economy, with companies' capabilities and behavior being influenced by their position and position within these chains and networks organized especially by large multinational firms. The main cause of inter-regional differences is the asymmetry in the power of leading companies and suppliers, with convergence (divergence)	Gereffi et al., (2005)
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Source: own compilations

2.6.2 Characteristics of Knowledge Economy

Numerous efforts have been made in the academia and worldwide gatherings to define knowledge economy by featuring different parts of investment in knowledge. In doing as such, Tapscott (2014) showed the highlights of the knowledge economy, as shown in figure 3.

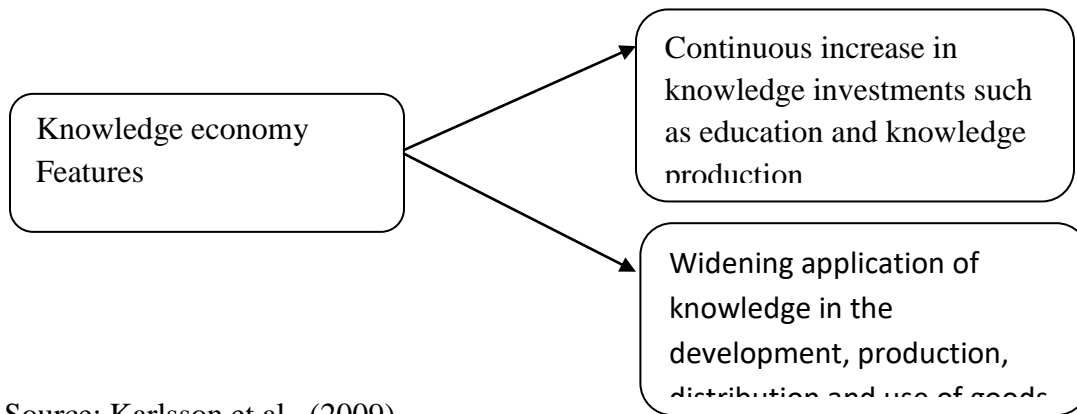
Figure 3: Main characteristics of Knowledge economy



Source: (Tapscott, 2014).

Characteristics of knowledge economy could include the creation of knowledge in terms of research and education, its utilization and dissemination, as well as growth in the macroeconomic and social sharing of knowledge. Figure 4 below shows the main features of knowledge economy according to according to Karlsson, Börje, and Stough (2009).

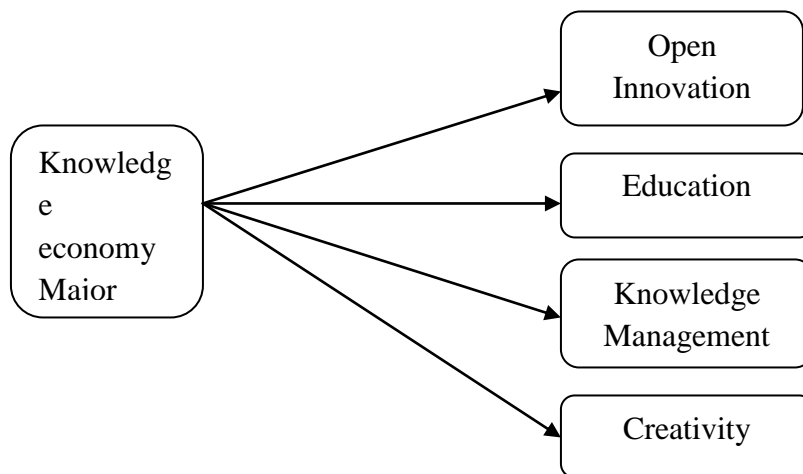
Figure 4: Main features of Knowledge Economy



Source: Karlsson et al., (2009).

White et al., (2012), enumerated the following as being a major feature of knowledge economy:

Figure 5: Knowledge Economy features



Source: White et al., (2012).

According to White et al., (2012), open innovation, education, knowledge management and creativity are structural components of knowledge economy.

2.6.2.1 Open Innovation

One of the most acknowledge and vital driver of the knowledge economy is innovation (Mention, 2011). There is the need for every organization to initiate innovation practices to remain relevant, keep and catch the interest of its customer base. To initiate these practices, there is the need for organizations to build innovation into their business model and decide whether to go by open or closed innovation practices. The choice of these two depends on the firm's willingness to share. Many firms have acknowledged success with open innovation (Chesbrough, 2003).

Open Innovation is characterized as the utilization of purposive inflows and surges of learning to quicken inside advancement and grow the business sectors for outer utilization of development, separately (Chesbrough, 2003). When open innovation is adopted, the firm's or the economy's limits turned out to be porous and that permits joining the nation's resources with the outside co-operators. Open innovation is that type of innovation that welcomes all stakeholders, clients and third parties (Wallin and Krogh, 2010).

2.6.2.2 Education

Human capital, as the major aspect of the intellectual capital comprised of knowledge, skills, individual dexterity, individual perspectives of employees and intuition. Human capital is highly movable, and it is not in ownership of the company and the staff takes it when leaving the company (Sharabati et al., 2010). At the end of the day, human capital depends on the individual limits of the workers with the reason to accomplish the objectives of the company. In the traditional economy, the human capital was spoken to by the way the employees formed a social collective group and were dynamic in the organization. But in the knowledge economy, workers' abilities are characterizing by their knowledge, intelligence, values and skills (Bratianu, 2008). In this modern economy and this world of business, special value is placed on workers who have the knowledge (Thai et al., 2011). Organizational value in addition to the physical stock comprises of intellectual capital and the knowledge of it staff (Bratianu and Orzea, 2013).

2.6.2.3 Knowledge Management

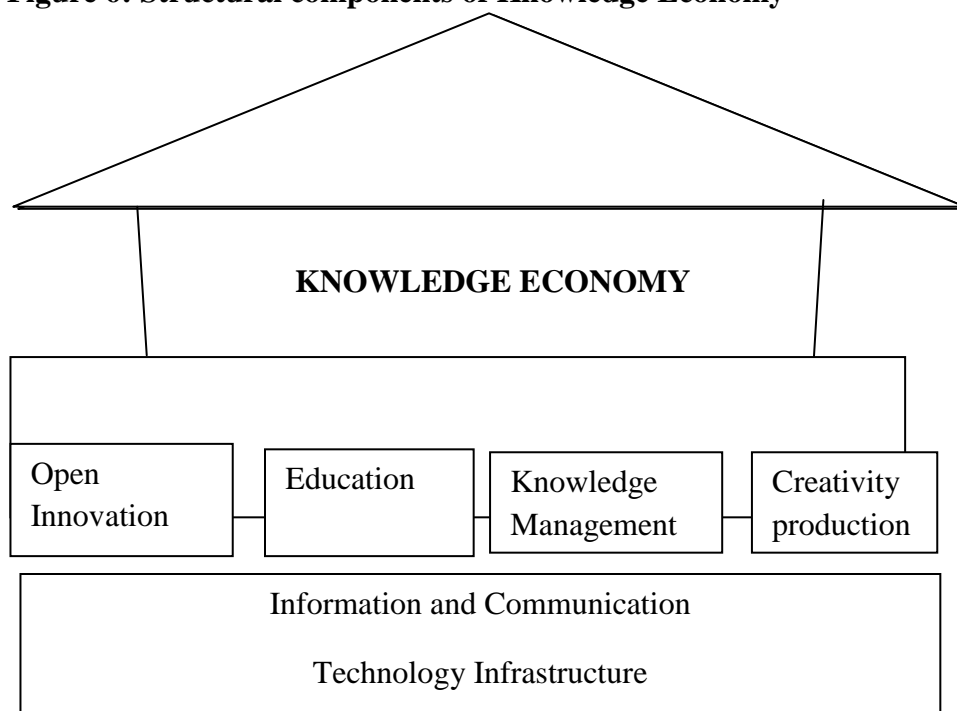
Knowledge management deals with the arrangement of a set of activities design to manage the human capital in an organization for creating value and achieving the strategic plans or requirement of the organization. It involves developing the skills and competence of employees through education and training (Becerra-Fernandez and Sabherwal, 2008)

2.6.2.4 Creativity

Creativity has become an important attribute of a knowledge economy. Creativity is measured on an individual's capacity to form new ideas or problems; their ability to learn, their ability to transfer the knowledge in several contexts and the capacity to achieve their goal. The dimension of creativity in an economic activity is to abandon the old fashionable way of doing things and focus on new ways backed by innovation, originality and diversity (Tapscott, 2014).

The foundation of the above features has Information Communication and Technology (ICT) as their common foundation. The structure of knowledge economies is grouped under five components (White et al., 2012). These structural components can be seen in figure 7 below:

Figure 6: Structural components of Knowledge Economy



Source: (adapted from Ramalingam, 2006)

The growth of Knowledge economy has triggered a change in employee's role (Bontis, 2004; Malhotra, 2000). Drucker (2001) revealed in the Economist that "the next society will be a knowledge society. The most vital resource in it is Knowledge and knowledge workers will be the overwhelming group in its workforce" (Lingenfelter, 2012).

2.7 Drivers of the Knowledge Economy

The transition to a knowledge economy requires several changes in the economic system. There are several knowledge economy structures which give a premise to knowledge economic evolution. Be that as it may, not these structures are appropriate for each nation and its specifics (Hadad, 2017). Considering encounters of numerous nations, World Bank Institute (WBI) presented pointers that give direction in estimating of knowledge economy development. The motivation behind knowledge economy estimation is to portray the progress of a nation being developed into a knowledge economy (World Bank, 2004). In view of exact investigations by the OECD also, WBI a system has been acquainted to help policymakers. According to WBI, there are four pillars needed to develop a knowledge economy. These four pillars are (Chen and Dahlman, 2005):

- *Effective government institutions and economic incentives* that create good economic policies and ensures and allows efficient allocation of resources and invigorate innovations and motivations for the proficient creation, dispersal and utilization of existing knowledge
- *Education and training*. Effective and productive educational system that can continually upgrade the knowledge-base of the labour force.
- *Information-communication technologies and infrastructure* that can speed up communication and processing of information and its dissemination.
- *Research and development (R&D) and innovation* system that can maintain the evolution of knowledge, take advantage of the developing supply of worldwide knowledge and acclimatize and adjust it to the local needs.

The Knowledge Economy Framework proposes that the measure of knowledge and how it is

utilized are key determinants of total factor productivity. Fortifying these pillars of the knowledge economy will prompt an expansion in the amount and nature of the pool of knowledge accessible for economic growth in any nation. As a result, productivity would increase leading to an increase in the rate of growth of the economy (Chen and Dahlman, 2004).

3 DATA AND RESEARCH METHODOLOGY

This chapter explains the methodology that was used to conduct the research. The research methods, sources of data and analytical tools used for data collection and analysis will be discussed in this section. The goal of the research is to find out the new determinants of economic growth in the context of Knowledge Economy. Therefore, the research is focused on performing a correlation analysis to verify the relationship between selected determinants of knowledge economy and economic growth for a 10-year period from 2005 to 2014 in selected world economies.

The analysis covers three selected world economies: Sweden, Netherlands and United Kingdom. These countries were selected based on the Global Innovation Index rankings (GII) of 2017 and European Innovation Scoreboard (EIS) of 2017. Today, innovation is seen as a central driver of economic growth and development (Love and Roper, 2015). The GII is a yearly ranking of the innovative capacities of nations by Cornell University, INSEAD and the World Intellectual Property Organisation. These organisation ranks countries based on their capacity for, and success in innovation. The eighth Secretary-General of the United Nation, Ban Ki-moon stated that *'GII is a unique tool for refining innovation policies . . . for providing an accurate picture on the role of science, technology and innovation in sustainable development'* (UN Economic and Social Council, 2013). The GII addresses innovations in developed and developing market.

The 2017 GII rankings displayed broad measurements about the innovation performance of 127 nations and economies around the globe. In 2017 report of the GII, out of the top 10 global economies, 8 of them were in Europe. Europe has been found to be particularly strong when it comes to human capital, infrastructure, business sophistication. European economies ranked first down the middle the pointers forming the GII, and incorporate knowledge-intensive jobs, industry or universities explore coordinated effort, patent applications, quality of scientific publications and logical and specialized articles.

In the same line, the European Innovation Scoreboard is the tool that the European Commission initiated under the Lisbon strategy to provide a comparative analysis of the innovative

performance of European Union (EU) member states. It is an annual assessment of the relative weakness and strength of innovation systems in European Union member states and other leading innovation countries (Hollanders and Cruysen, 2008). Per the 2017 rankings, Sweden, Netherlands and United Kingdom were ranked as part of innovation leaders.

Table 5: Top 10 Global Economies (GII, 2017)

Countries	2017 Global Rank	2016 Global Rank
Switzerland	1	1
Sweden	2	2
Netherlands	3	9
United States	4	4
United Kingdom	5	3
Denmark	6	8
Singapore	7	6
Finland	8	5
Germany	9	10
Ireland	13	13

Source: Own Compilation from GII Ranking (2017).

The GII report 2017 revealed that, the three leading economies were all occupied by small European countries- Switzerland, Sweden and Netherlands (Larisa et al., 2018). These three countries are the world's most innovative countries. Therefore, the researcher deems it necessary to find out the factors that influence their growth. This would help the least performing innovation countries to restructure government policies and public funding on these areas of the economy. Global Innovation Index 2017 report also ranked United Kingdom as being part of the first five countries that have high innovation capacities. It is because of this rankings that is why

I chose these three countries; Sweden, Netherlands and the United Kingdom. That is, I based on the first five most innovative countries in the world. Among these five most innovative countries, four of them were within the catchment of the European zone.

Table also shows that, Germany in 2017 did better as compared to 2016. They were 10th in 2016 and came 9th in 2017. Finland on the other hand, was 5th per the global rankings in 2016 but dropped to 8th in 2017 rankings. France per the rankings of GII 2016 report was 18th but in 2017 rankings was 15th in the global rankings. This shows that there an improvement in their innovations activities within the European zone.

Academic researchers like Prokop and Stejskal (2017) did a study on the effectiveness of knowledge economy determinants and came out with the conclusion that nine (9) countries within the European Union 28 were effective and efficient in using determinants of knowledge economy variables. United Kingdom was part of these nine (9) countries that were classified by them as being effective and efficient. Even though Sweden and Netherlands did not reach the rate of effectiveness (1.00000) in that research, their mark was quite strong (0,83305 and 0,78135 respectively). Therefore, the researcher deemed it fit to conduct a study to verify the relationship existing between the dependent variable and independent variables classified in table 6 of these three European countries. The selected time (2005-2014) was constrained by the availability of data. It was because of the availability of data that is why Switzerland was neglected in the chosen countries.

3.1 Research Questions

To achieve the stated aim of the thesis, the following research questions were used:

RQ1: What determinants of the Knowledge Economy influence the growth of GDP in Sweden?

RQ2: What determinants of the Knowledge Economy influence the growth of GDP in Netherlands?

RQ3: What determinants of the Knowledge Economy influence the growth of GDP in United Kingdom?

3.2 Data Source

As the three selected economies (Sweden, Netherlands and United Kingdom) are within the European Zone, European Commission's website, Eurostat Database, 2018 (<http://ec.europa.eu/eurostat/data/database>) was resorted for information on these selected countries.

The research was based on the first five most innovative countries in the world and selected those within the European zone. The rationale behind this selection was to provide a benchmark for other European countries e.g., V4 countries or Central and Eastern European Countries.

As useful as it may analytical, it is thought to be vulnerable by manipulation by the researcher because the sample size selection may be motivated by known and unknown bias on the side of the researcher. It was because of this that the researcher resorted to a more reliable and credible source. The source of the data was retrieved from Eurostat Database, 2018 (<http://ec.europa.eu/eurostat/data/database>).

The selected determinants and their description are shown in Table 6. The determinants involve five independent variables (determinants of knowledge economy) and one dependent variable represented by GDP (retrieved from Eurostat 2018).

The researcher will perform correlation analysis for each independent determinant and verify its relationship with the growth variable (GDP). That is, these input or independent variables will individually be mapped against the growth variable (GDP) to verify the relationship that they have on GDP.

3.3 Selected Determinants

Input independent variables are shown in Table 6, as output variable, GDP euro per inhabitant was used. GDP per capita which is "positively correlated with the ability of a country to develop a knowledge society" (UN, 2005). Therefore, GDP was used as a measurement of a Knowledge economy. The Gross domestic product (GDP) is the commonest used indicator for measuring economic growth. It is one of the most widely used measure of economic success of nations

(Chen and Dahlman, 2005; Buesa et al., 2011). An indicator that is mostly used to gauge the progress of an economy is economic growth and, an increased in the economic growth stipulates the change in gross domestic product. Also, the change in GDP depicts the turnover of the sectors in the economy (Apergis and Danuletiu, 2014).

Table 6: The selected input variables (determinants of Knowledge Economy)

Determinants	Description
Intramural R&D Euro per inhabitant	Intramural Research and Development expenditures are all expenditures for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds (OECD, 2015). It is believed that effective use of intramural R&D expenditures can influence GDP growth (Di Cagno et al, 2014; Boroush, 2016)
Human Resource Science and Technology (HRST)	Employed people in the areas of science and technology are very vital and the utilization of their competence can create and lead to a great dissemination of knowledge and synergies and in addition, bring more innovative output which would speed up economic growth (Yanadori & Cui, 2013; Gelec and Wagner, 2014)
Patents applications to the European Patent Office (EPO) per mil inhabitant	Patents gives a reflection of a country's inventive activity. It also reflects the capacity of a nation to exploit knowledge and translate it into potential economic gains. This indicator measures the requests for protection of an invention directed either directly to the European Patent Office (EPO) or filed under the Patent Cooperation Treaty and designating the EPO (Euro-PCT), regardless of whether they are granted or not. The data shows the total number of applications per inhabitants (Eurostat 2018). In the research work of Buessa et. al (2010), patent was used as the basic measurement of innovation capacity of a nation.
R&D personnel and researchers	This refers to all persons employed directly on research and development activities, as well as those providing direct services such as research and

	development managers, administrators and clerical staff. The expenditures on R&D personnel and researcher helps improve productivity and efficiency (OECD, 2008). It leads to pure creation of new knowledge. That is, it directly supports the development of knowledge and technology. Therefore, when much is invested in R&D personnel and researchers the sponsor gets a huge mix of knowledge (Zúñiga-Vicente et al.,2014).
Tertiary Students: The number of people with tertiary education (15-74)	This explains those having the highest level of education. The number of tertiary education allows the creation of new knowledge and strengthens the capacity and capabilities of individual countries and companies (Barro, 2013)

Source: own source based on Eurostat Database

3.4 Methods

The gathered data was quantitative in nature and was analysed with the aid of a statistical software STATISTICA. To verify there is a statistically significant relationship existing between the growth variable (GDP) and the independent variables, the Pearson Product Moment Correlation Coefficient (PPMCC) or (Pearson’s Correlation Coefficient) was employed.

Pearson Correlation Coefficients was used to measure the strength between the selected determinants to verify the relationship existing between the selected determinants of knowledge economy and economic growth. It is one of the statistical tool that is commonly used to obtain an index of the relations existing between two variables when the relationship between the variables is linear and when the correlation is continuous (Tharenou et al., 2007).

Pearson Product Moment Correlation Coefficient(r) is shown below:

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2} \sqrt{\sum(Y - \bar{Y})^2}}$$

Explanation of the variables:

X= Dependent variable

Y= Independent variable

The interpretation of the correlation coefficient will be based on the work of Cramer and Howitt (2004). They described -1 as a perfect negative correlation and +1 as a perfect positive correlation. The ranges per Cramer and Howitt (2004) classification are showed below.

Table 7: Interpretation of correlation coefficient

Coefficient Value	Sign	Interpretation
0.80 – 1.00	Positive	Strong
0.60 – 0.80	Positive	Substantial
0.40 – 0.60	Positive	Medium
0.20 – 0.40	Positive	Low
-0.20 – 0.20	–	Very Low
-0.40 to -0.20	Negative	Low
-0.60 to -0.40	Negative	Medium
-0.80 to -0.60	Negative	Substantial
-1.00 to -0.80	Negative	Strong

Source: Compiled from Cramer and Howitt (2004).

4 RESULTS AND DISCUSSION

This part deals with the analytical research in finding the new determinants of economic growth in the context of knowledge economy. Here, Pearson's correlation test was conducted to find the relationship existing between the input Variables in table 6 (determinants of knowledge economy) and GDP. That is a correlation analysis test was conducted to find out the significance of the relationship existing between the input variables and GDP. Here, a correlation test of each input variable (determinant of Knowledge) on GDP was conducted. For the interpretation to be easily understandable, Cramer and Howitt (2004) interpretation of correlation coefficient was used. This interpretation could be found in table 7.

4.1 The Analysis in Sweden

The table 8 will show the correlation coefficient analysis conducted between the inputs variable (determinants of knowledge Economy) and GDP.

Table 8: Correlation analysis of Sweden

GDP		
Determinants	Correlations Coefficient Value	Correlations Coefficient Percentage
Patent	0.890701	89%
HRST	0.910251	91%
Int. Exp.	0.932113	93%
R&D personnel	0.728860	73%
Tertiary education graduates	0.426923	43%

Legend: ** Correlation significant at 0.01 level; * Correlation significant at 0.05 level

Source: Own computation

The analysis of table 8 shows that, there is a strong and positive relationship between patents and GDP. This shows that when patents acquisitions increase, it can have a positive influence on GDP growth in Sweden. This revelation supports other studies by (Hu and Png, 2013; Sinha, 2008; SM, 2013; Josheski et al., (2011). Additionally, it can be seen that, HRST also has a strong and positive relationship with GDP such that an increase in either HRST will result in an increase in GDP. This revelation really confirms that, HRST is an important determinant of knowledge economy (Prokop et al., 2014). Intramural expenditure showed the highest relationship at 93% implying that there exists a stronger correlation between the amount expenditures devoted to Intramural research and this causes GDP to increase (Sokolov-Mladenović et al., 2016). Also, table 8 shows that the number of graduates from Tertiary Education does not have a strong relationship with GDP even though it showed a direct relationship at 42%. This shows that, these determinants are very important in the determination of knowledge economy and economic growth.

Figure 7: GDP VS Patent in Sweden

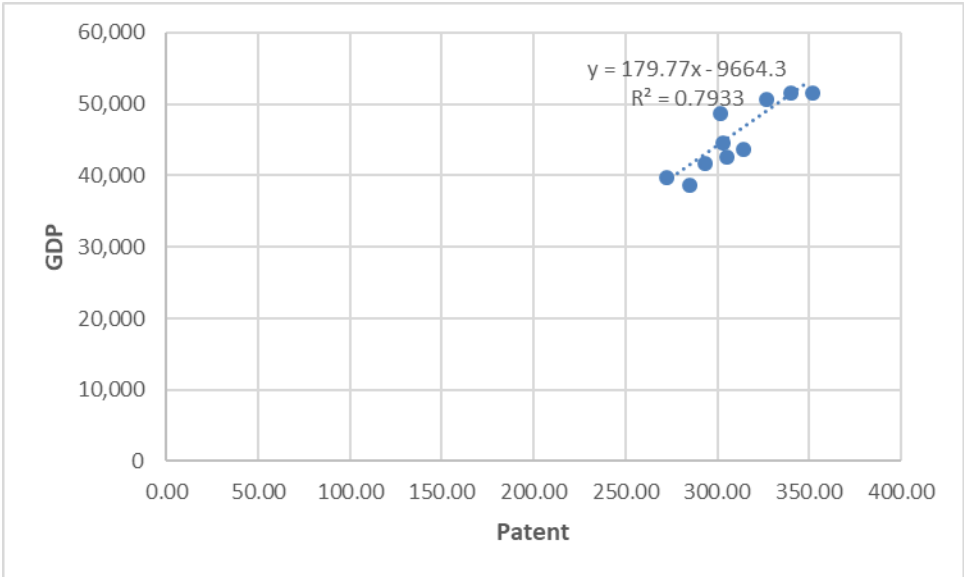


Figure 8: GDP VS Patent

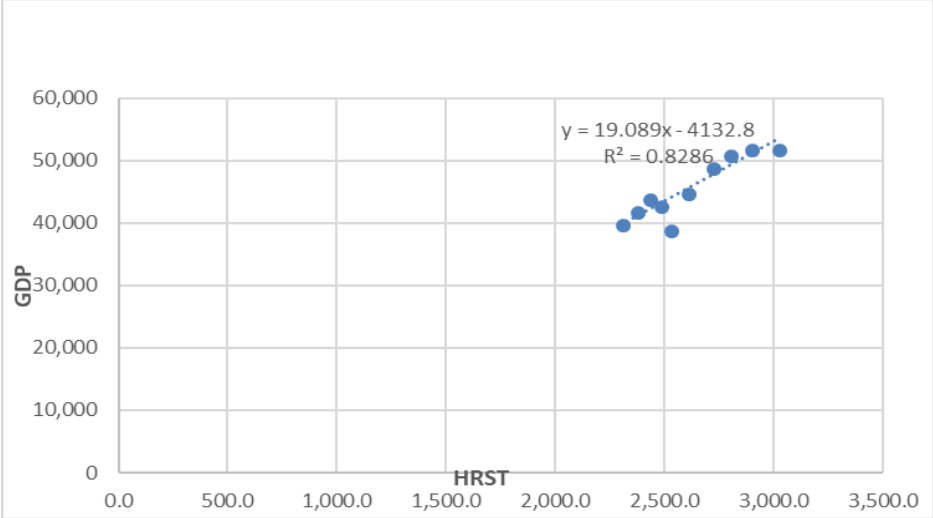


Figure 9: GDP VS R&D Personnel in Sweden

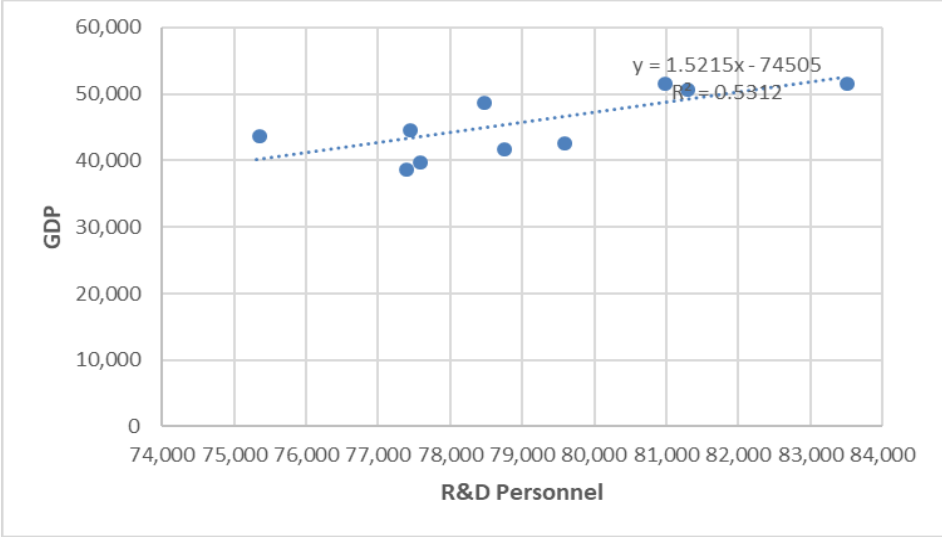


Figure 10: GDP VS Int. Exp. in Sweden

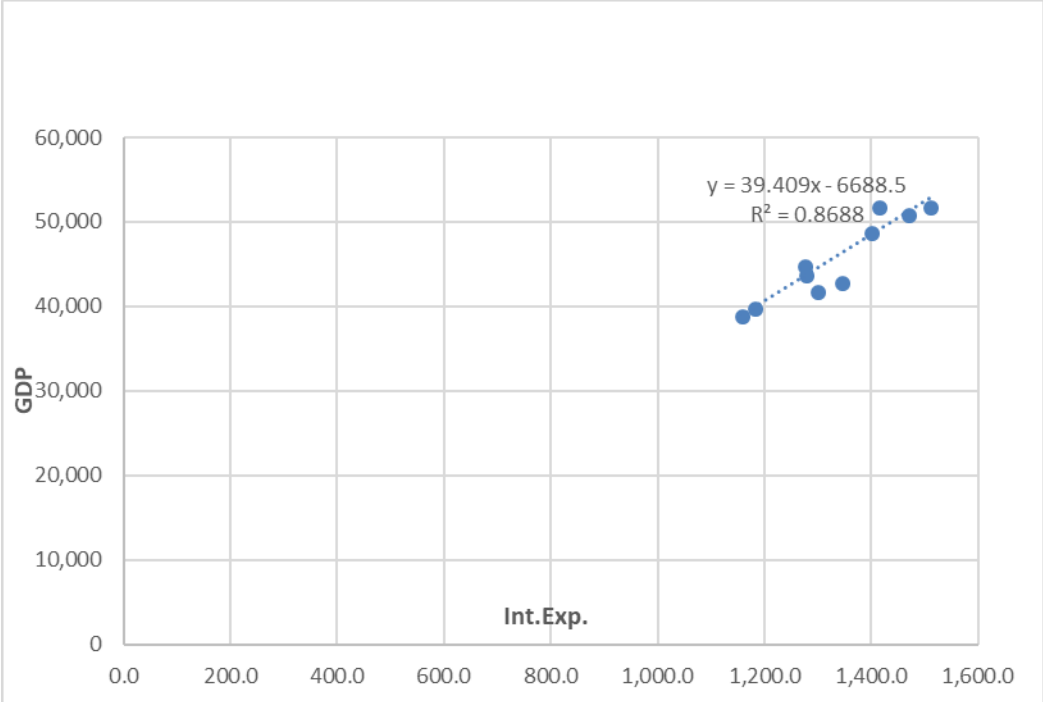
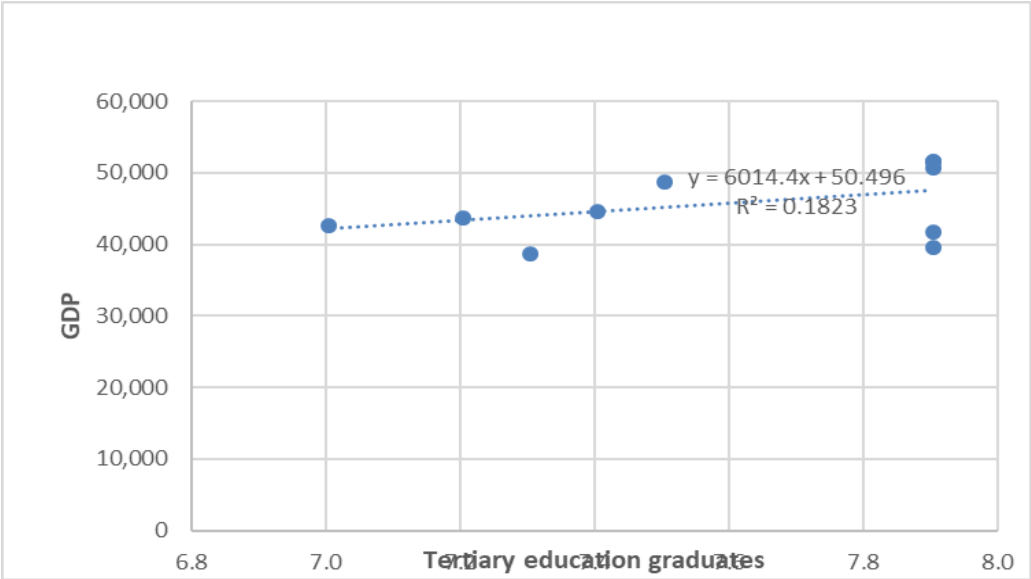


Figure 11: GDP VS Tertiary education graduates in Sweden



For Sweden, the findings confirmed that tertiary educational graduate imparted less on GDP growth. This supports other findings by (Hanushek,2016; Pritchett, 2001). The studies also revealed that Intramural R&D exp., the human resource base, Number of Patents and R&D personnel have a strong and positive relationship with the GDP growth. This also supports other studies by (McCombie and Thirlwall, 2016; Hu, 2015; Pelinescu, 2015).

4.2 The Analysis in Netherlands

The table 9 will show the correlation coefficient analysis conducted between the inputs variable (determinants of knowledge Economy) and GDP.

Table 9: Correlation analysis of Netherlands

GDP		
Determinants	Correlations Coefficient Value	Correlations Coefficient Percentage
Patent	-0.487353	49%
HRST	0.882497	88%
Int. Exp.	0.750790	75%
R&D personnel	0.582741	58%
Tertiary graduates	-0.834229	83%

Legend: ** Correlation significant at 0.01 level; * Correlation significant at 0.05 level

Source: Own computation

The results of the correlation analysis in table 10 shows that, patent has a negative (-43%) relationship with GDP. This supports the findings of Wang (2013). Meaning that if patent acquisition increases, it will have an inverse relationship with GDP. Similarly, the total number of Tertiary graduates in the Netherlands did not have a positive influence on GDP growth, as can

be seen with the inverse relationship between the two (-83%). If Tertiary education graduate's increases, it rather decreases GDP by 83%. That is, the impact of tertiary education on GDP growth is negative (Hanushek and

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Woessmann, 2012; Soto, 2009; Jamison et al., 2007; Castelló and Hidalgo, 2012). This raises questions on the quality of education. That is, the level of educational system's quality may not be high. Conversely, HRST and Int. Exp. Had a positive and significant relationship with GDP. If HRST increases, then it will have a corresponding 88% increase in GDP growth. Also, an increase in intramural expenditures also increased GDP growth by 75% (Sokolov-Mladenović et al., 2016). Lastly, there was a substantial relationship between R&D personnel and GDP. An increase in R&D personnel corresponded to a 58% increase in GDP.

Figure 12: GDP VS Patent in Netherlands

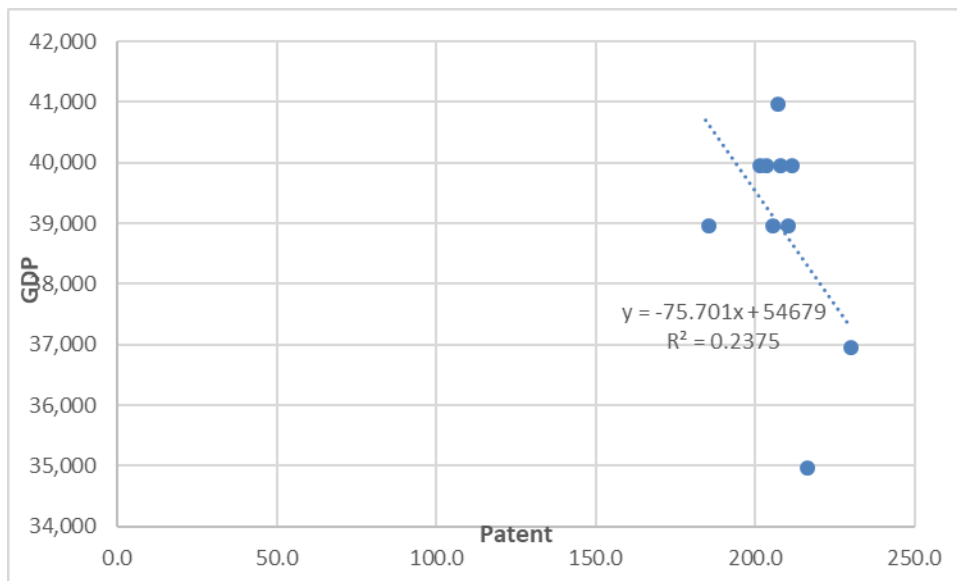


Figure 13: GDP VS HRT in Netherlands

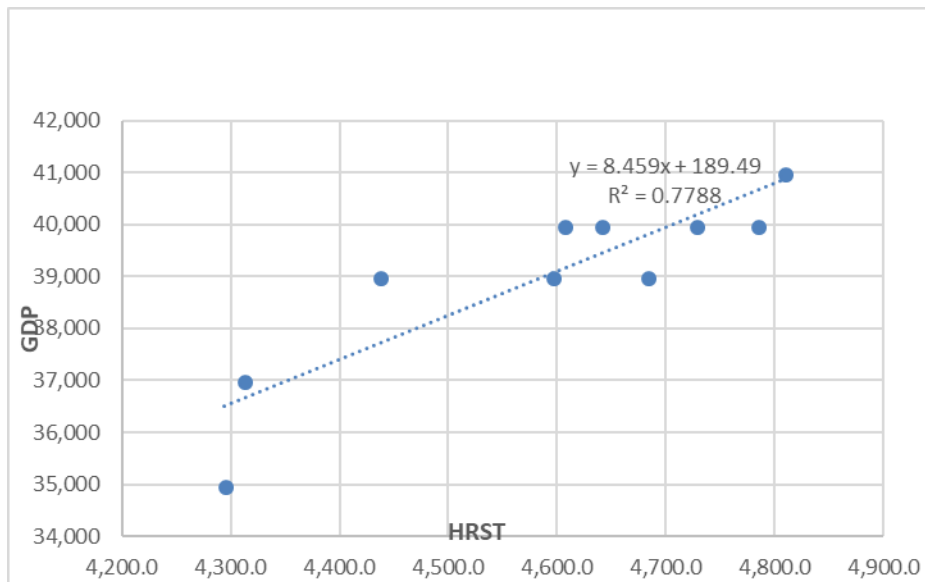


Figure 14: GDP VS R&D Personnel in Netherlands

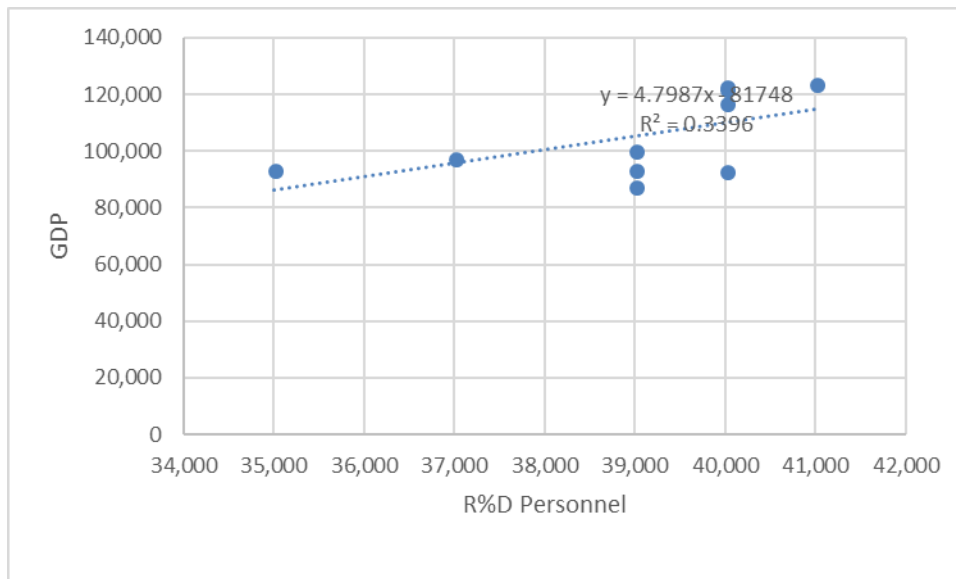


Figure 15: GDP VS Int. Exp. in Netherlands

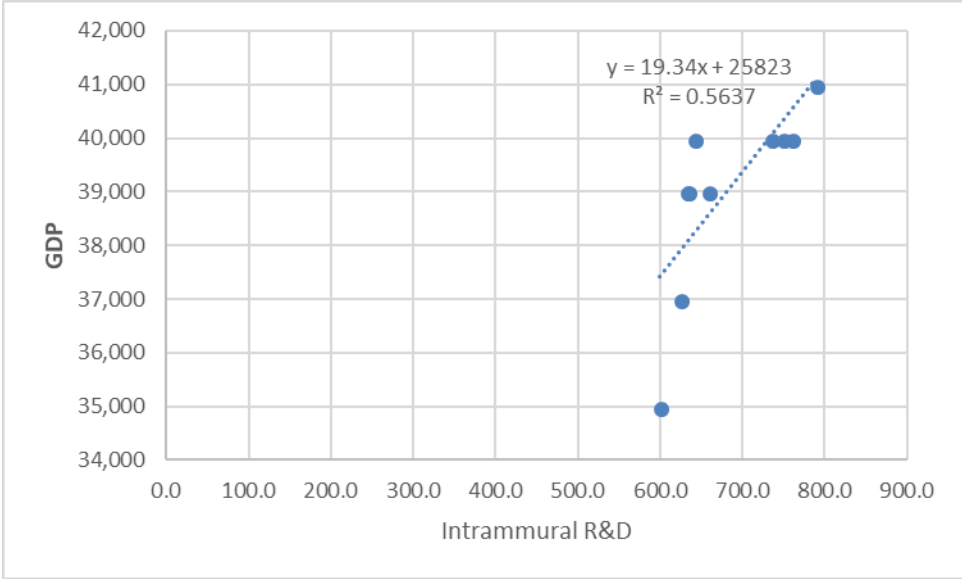
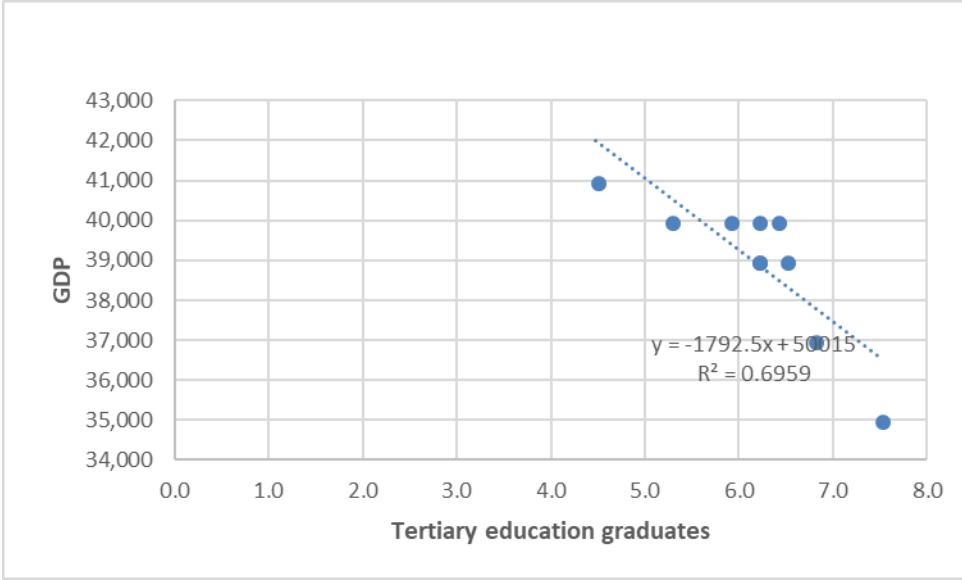


Figure 16: GDP VS Tertiary education graduates in Netherlands



4.3 The Analysis in United Kingdom

The table 10 will show the correlation coefficient analysis conducted between the inputs variable (determinants of knowledge Economy) and GDP.

Table 10: Correlation analysis of United Kingdom

GDP		
Determinants	Correlations Coefficient Value	Correlations Coefficient Percentage
Patent	0.3300180	33%
HRST	-0.064303	6%
Int. Exp.	0.9780159	98%
R&D personnel	0.1300867	13%
Tertiary education graduates	-0.183913	-18%

Legend: ** Correlation significant at 0.01 level; * Correlation significant at 0.05 level

Source: Own computation

The results in table 12 shows that, even though the number of patent acquisition has a positive correlation, its influence on GDP is low. Meaning that if patent acquisition increases the resultant effect on GDP will increase at a low pace. Similarly, an increase in R&D personnel will have a very low influence on the growth of GDP. That is, an increase in R&D personnel will have a corresponding 13% increase in the GDP growth. Though the number of patents acquisition and R&D personnel in United Kingdom have a positive influence, they do not have a strong relationship to GDP growth (33% and 13% respectively). Conversely, HRST and Tertiary graduates in United Kingdom have a strong negative relationship with GDP growth. If HRST and Tertiary graduates in United Kingdom increases, its effect would rather decrease the growth of GDP by 6% and 18% respectively. Finally, Intramural expenditure showed the highest relationship at 98% implying that there exists a stronger correlation between the amount

expenditures devoted to Intramural research and this causes GDP to increase in the United Kingdom.

For the UK, intramural research influences GDP growth. This supports other studies by (Alston et al., 2011; Fournier, 2016).

Figure 17: GDP VS Patent in United Kingdom

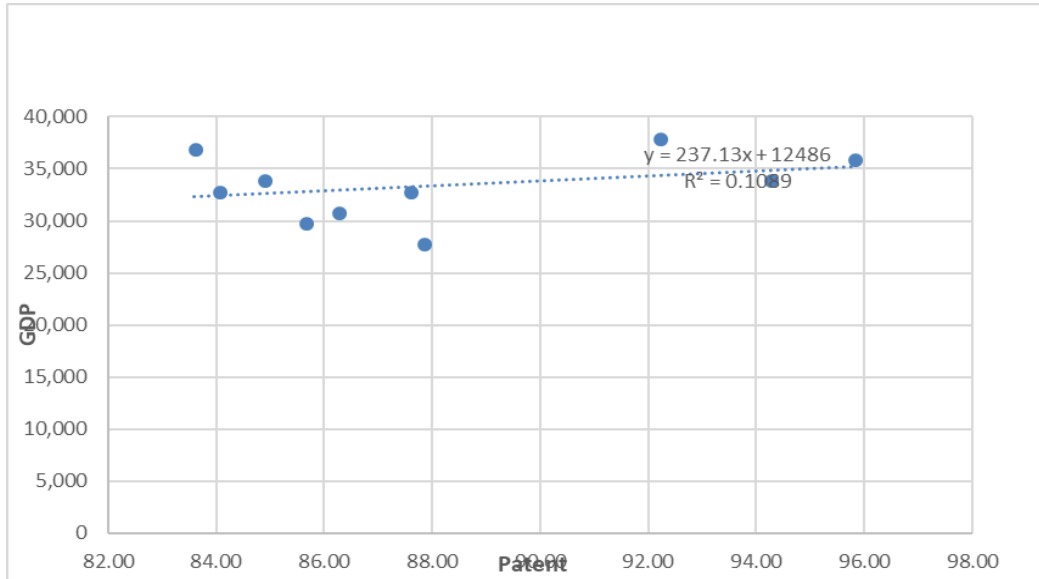


Figure 18: GDP VS HRST in United Kingdom

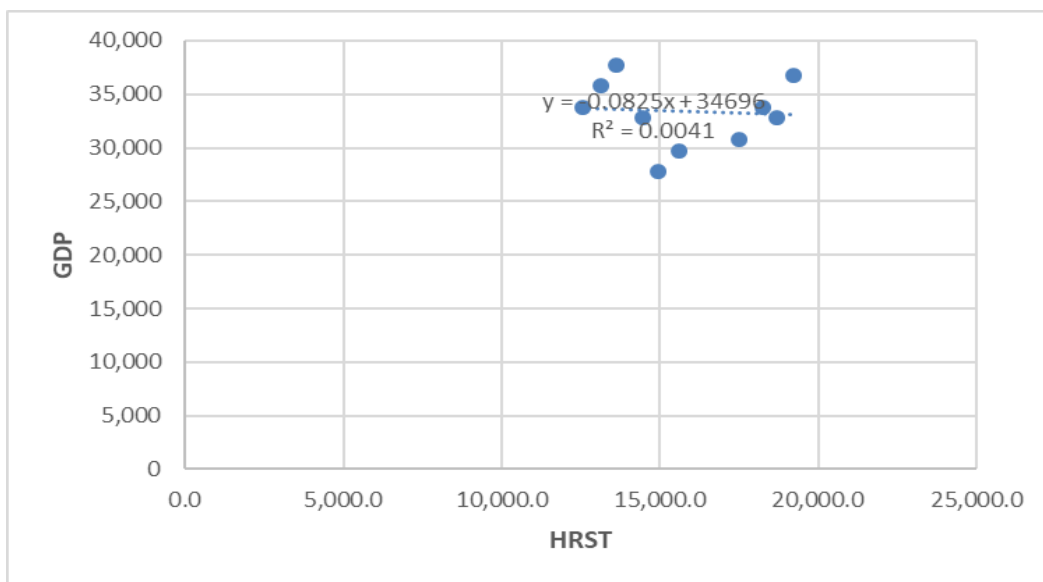


Figure 19: GDP VS Int. Exp. in United Kingdom

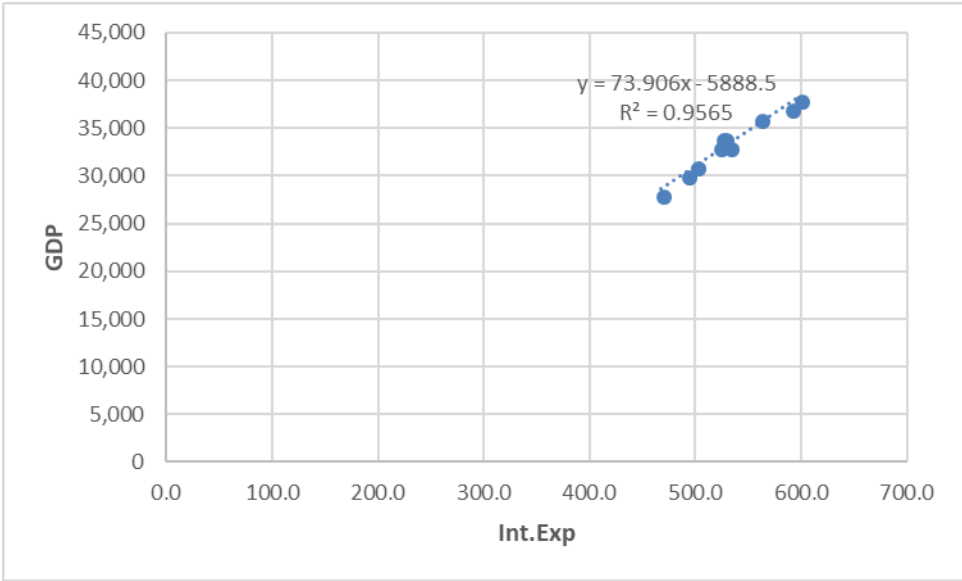


Figure 20: GDP VS R&D personnel in United Kingdom

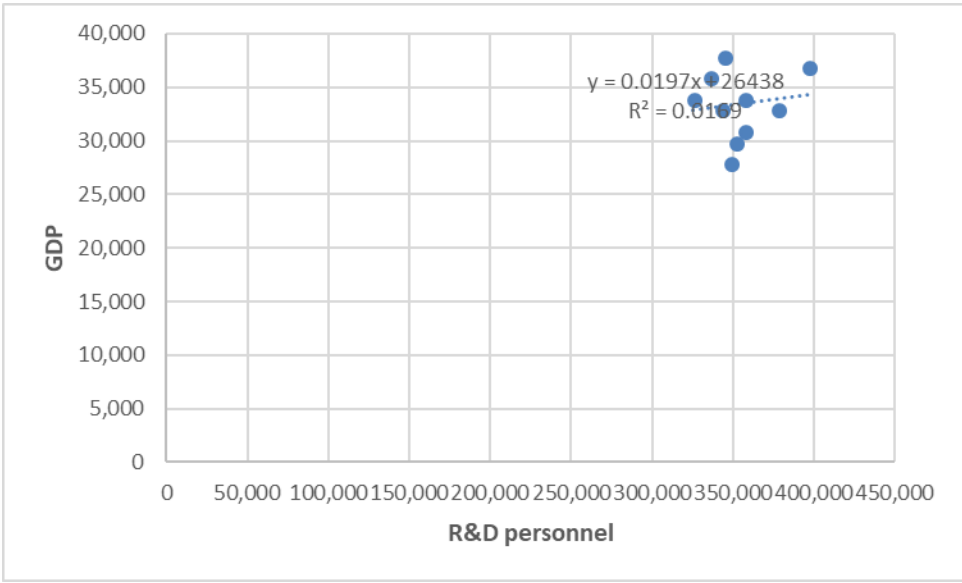
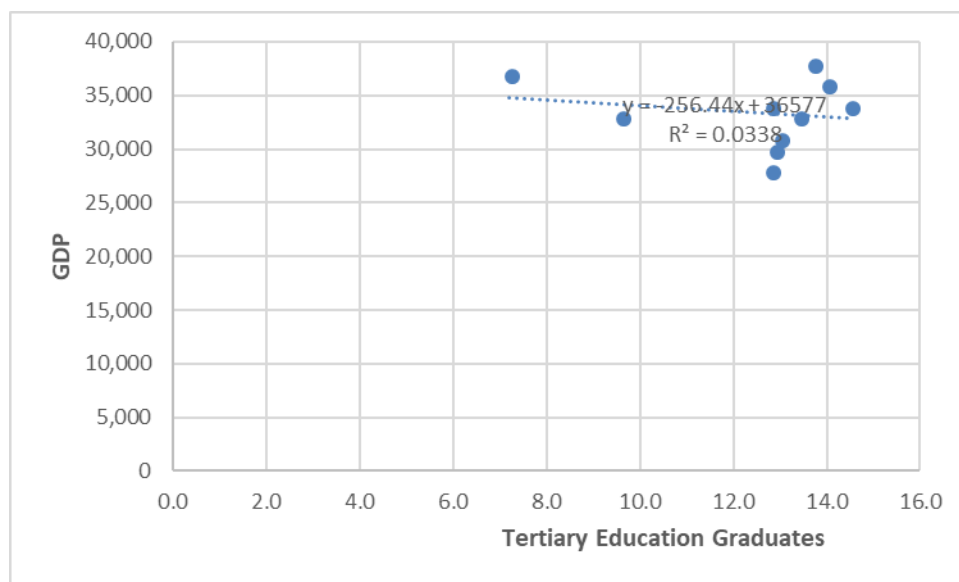


Figure 21: GDP VS Tertiary education graduates in United Kingdom



4.4 Discussion

This thesis had thrown more light on the importance of Intramural R&D expenditure, human resource science and technology, number of patents acquisition and R&D personnel in ensuring economic growth in terms of GDP in Sweden. The calculations revealed a strong positive relationship, statistically significant existing between GDP and intramural R&D expenditure, human resource science and technology, number of patent acquisition and R&D personnel. The high level of the score of the number of patents lead to the conclusion that, the investment in R&D personnel might have influenced the number of patents acquisition in the country. These inputs variables are very vital in the GDP growth in Sweden

Conversely, the situation was different in the United Kingdom. Only intramural R&D expenditure had a strong and positive relationship with GDP. The calculations revealed negative relationship existing between GDP and HRST and Tertiary education graduates. This lead to the conclusion that in some jurisdictions, education had provided intellectual abilities and these competences are in high demand but are being geared towards doing wrong things. The negative relationship with GDP and tertiary education graduates and HRST raises questions on the quality of the school curricula in United Kingdom. Looking at the results, it shows that the curricula is

not responding to the needed objective of enhancing growth. Therefore, I suggest that UK government should restructure their educational policies to upgrade the quality of tertiary education in the system. The educational structure should be structured based on the need. What is needed should be thought. The educational curricula should match the pace of technological development in the modern world. Therefore, the government should implement policies that would modify the existing policies of public funding on human resource, science and technology, expenditures on R&D personnel and researchers to speed up the growth.

Finally, there was also a shocking revelation in Netherlands. The number of tertiary education graduates and patent acquisitions all proved to be negatively related to GDP. Therefore, government must revitalize the education system in the country. Also, there should be much public funding on R&D personnel and researcher. R&D personnel and researcher has a greater influence on patents (Li and Hu, 2010).

Table 11: Comparison of the results of the input variables (determinants of Knowledge economy) on GDP

GDP	Patent	HRST	Int. Exp.	R&D personnel	Tertiary education graduates
<i>Sweden</i>	Positive strong determinants	Positive strong determinants	Positive strong determinants	Positive determinants	Positive determinants
<i>Netherlands</i>	Negative determinants	Positive strong determinants	Positive determinants	Positive determinants	Negative strong determinants
<i>United Kingdom</i>	Positive determinants	Negative determinants	Strong Positive determinants	Very low determinants	Strong negative determinants

Source: own

Based on these findings, there is the need for policy makers to place much attention on these determinants as they have a higher tendency of changing the economic spheres of nations. They

have proven to be a very good determinants of knowledge economy and economic growth as indicated in table 11. These findings would serve as a benchmark for other countries for example, to follow Sweden innovation systems.

5 CONCLUSIONS

The aim of this study was to find out the determinants of economic growth in the context of knowledge economy. Three countries were selected (Sweden, Netherlands and United Kingdom) based on the GII rankings of 2017 and European Innovation Scoreboard. For achieving this purpose, a correlation analysis was conducted to verify the relationship existing between the selected determinants of knowledge economy (table 6) and economy growth in the selected world economies in the last 10 years. The Gross domestic product (GDP) is the commonest used indicator for measuring economic growth (Chen and Dahlman, 2005; Buesa et al., 2011). For that matter, GDP was used as a measurement of a Knowledge economy.

From the results it was realized that, the inputs variables were a good determinants of knowledge economy. The results showed that they have a high tendency of influencing the economic growth of these nations; Sweden, Netherlands and United Kingdom.

A conclusion from the result is that, a determinant of a Knowledge Economy may not have a static influence or relationship or a particular pattern of relationship on GDP growth in all countries. It has been realized that a particular determinant could have a positive influence on GDP in one country and has a negative influence on GDP in another country. Therefore, policy makers must give much attention to these variables as their influence varies per country to country.

The results of the studies (table 11) revealed that the number of Patent acquisitions which had a positive relationship or influence on GDP in both Sweden and United Kingdom showed a negative relationship or influence on GDP in Netherlands. The HRST which had a positive influence on GDP in both Sweden and Netherlands showed a negative relation with GDP in United Kingdom. In addition, Tertiary education graduates which had a positive relationship on GDP in Sweden showed a negative relationship on GDP in both Netherlands and the United Kingdom. On the other hand, only Int.Exp. and R&D personnel showed a positive relationship with GDP across the selected countries (Sweden, Netherlands and United Kingdom).

Based on the above revelations in table 11, a conclusion can be made that the kind of relationship that a determinant of a knowledge economy would have may depend on the particular country

that the variable is being studied. There might not be a particular trend of relationship that a determinant variable would have. The question of why a determinant would have a positive relationship with GDP in one country and have a negative relationship in another country is a matter to be discussed in detailed in the near future.

In conclusion, Intramural Research and Development expenditure (GERD) by sectors of performance, Human Resource Science and Technology, Research and Development personnel and researchers by sectors of performance and educational attainment level, Tertiary education graduates and Patents applications to the European Patent Office (EPO) per mil inhabitant have all proved to be a good determinants of knowledge economy. Therefore, policy makers must factor these determinants in their public policy decisions to achieve better growth and also improve the knowledge economy.

For the future research, I plan to concentrate on the determinants of knowledge economy and economic growth outside the European countries and find out if the results are same in other European countries.

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