NEAR EAST UNIVERSITY

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PHD THESIS

KNOWLEDGE BASED ECONOMY and INTELLECTUAL CAPITAL

'The Impact of National Intellectual Capital on Economic Growth in North Cyprus'

Behiye Çavuşoğlu

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PREPARED BY

Behiye Çavuşoğlu

20134786

SUPERVISOR

ASSOC.PROF.DR. MUSTAFA SAĞSAN

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Prepared By

Behiye Çavuşoğlu

Examining Committee in charge

Prof.Dr. Mete Yıldız	**Hacettepe University** **Department of Political Science and Public Administration**
Assoc.Prof.Dr. Şerife Eyüpoğlu	**Near East University** **Department of Business Administration**
Assoc.Prof.Dr. Hüseyin Özdeşer	**Near East University** **Department of Economics**
Asst. Prof. Dr. M. Tayfun Gülle	**Ministry of Economy, Turkey** **Directorate of Export**
Assoc.Prof.Dr. Mustafa Sağsan	**Near East University** **Department of Innovation and Knowledge Management**

Approval of the Graduate School of Social Sciences

Assoc.Prof.Dr. Mustafa Sağsan

Acting Director

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Behiye Cavusoglu

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Declaration

I declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person and has not been submitted for any other degree or purposes.

Behiye Cavusoglu

2016

Abstract

In today's globalized world, the importance of knowledge and intellectual capital has been raised. It is very well known in the knowledge management literature that knowledge has become an engine of social, economic and cultural development in last decades.

This thesis examines the relationship between the national intellectual capital and economic growth, emphasizes the importance of knowledge economy for economic growth and creates both public and government awareness particularly for North Cyprus and for other small economies as well.

The key question examined in this dissertation is to what extent national intellectual capital has effect economic growth of North Cyprus? The main aim of the study is to understand the knowledge based economy and intellectual capital and find out the relationship between the national intellectual capital and economic growth in North Cyprus. The study also aimed to measure the overall level of preparedness of North Cyprus economy for the knowledge economy with calculating Knowledge Economy Index (KEI) and Knowledge Index (KI) of the country. Compare the index values of North Cyprus with South Cyprus and Turkey. Furthermore, the study investigate the sources of productivity in production process with imposing the extended Cobb-Douglas production function into the North Cyprus economy and measure the returns to scale.

The results of this thesis have interesting outcomes for development of North Cyprus. Four pillar of the knowledge economy index separately measured by the knowledge assessment method. The KEI is calculated based on the simple average of the normalized scores of all four pillars. KEI index value of North Cyprus computed as 4.61 with rank score of 78 within the 146 countries. KI index value of North Cyprus is 5.63, which is above the world average but below the average value of Europe. The regression results of the study indicate that there is a positive correlation between the growth of capital, growth of National Intellectual Capital (NIC), growth of labor and GDP growth of North Cyprus. The capital growth has the highest impact, followed by the labor growth and national intellectual capital growth on GDP growth. The result also represents the economy's productivity level upgrading with increasing returns to scale. An overall outcome of the study concludes that the economy of North Cyprus has not been a

knowledge economy yet but has a great potential to be a knowledge economy with appropriate national policies.

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List of Acronyms

ANOVA: Analysis of Variance

APEC: Asian Pacific Economic Cooperation

BC: Before Christ

CEE: Capital Employed Efficiency

CEO: Chief Executive Officer

CIV: Calculated Intangible Value

CYP: Cyprus

EFA: Education for All

EIR: Economics and Institutional Regime

Enosis: Unification of Island with Greece: Megali Idea

EOKA: Brutal Attacks of Greek Cypriots

EU: European Union

EUR 1: European Union Movement certificate

EVA: Economic Value Added

E-views: easiest to use toll for forecasting

G7: Group of Seven

GDP: Gross Domestic Product

GES: gross Enrollment Ratio

GSER: General Secondary Scholl Enrollment Ratio

GTER: Gross Tertiary Enrollment Ratio

HCE: Human Capital Efficiency

IC: Intellectual Capital

ICT: Information and Communication Technology

ISCED: International Standard Classification of Education

K4D: Knowledge for Development

KAM: Knowledge Assessment Method

KCH: Knowledge Clearing House

KE: Knowledge Economy

KEI: Knowledge economy Index

KI: Knowledge Index

LEV: Leverage

MVA: Market Value Added

NIC: National Intellectual Capital

NOPAT: Net Operating profit after Tax

OECD: Organization of Economic Cooperation and Development

OLS: Ordinary Least Square

ORRO: Official Receiver and Registrar Office

PISA: Program for International Student Assessment

R&D: Research and Development

ROC: return on Capital

SCE: Structural Capital Efficiency

SESRIC: Statistical Economic and Social Research and Training Centre for Islamic Countries

SPO: State Planning Organization

SPSS: Software Package for Social Science

TL: Turkish Lira

TMT: Turkish Resistance Organization

TRNC: Turkish Republic of Northern Cyprus

UIS: Institute for statistics

UN: United Nations

UNESCO: United Nations Educational, Scientific and Cultural Organization

US$: US dollar

US: United States

USA: United States of America

USPTO: United States Patent and Trademark Office

VAIC: Value Added Intellectual Capital

WACC: Weighted Average Cost of debt and equity Capital

YAGA: Investment Development Agency

1. INTRODUCTION

The development of the modern economy depends directly on the formation of basic knowledge variables. The term ‘knowledge–based economy’ is used to define an economy in which knowledge and knowledge creation plays a crucial role for growth.

A knowledge-based economy is also defined as an economy that is capable of knowledge production, dissemination and use, where knowledge is a key factor for growth, wealth creation and employment and also where human capital is a driver of creativity, innovation and generation of new ideas, with reliance on information and communication technology (ICT) as an enabler (www.jeg.org.sa/data/modules/ contents/uploads/infopdf/1820.pdf).

According to Chavula (2010), knowledge is at the heart of economic growth, as it increases the ability to take advantage of existing technologies and innovations, enhanced competitiveness and productivity. Knowledge that is embodied in human capital and technology has always been an important contributor to economic development.

Many economies are now seeking to shift their economies towards a technology-based economy. To do this, a country’s knowledge and information abilities have to be able to produce technology. Knowledge-based economic activities allow countries to create value by increasing the productive capacities of the factors of production.

Economic growth is an increase in the capacity of an economy to produce goods and services from one period to another. The most important measure of economic growth is the real gross domestic product (GDP) per capita (Çavuşoğlu, 2014). Traditional assessment of national economic performance has relied on an understanding of the GDP in terms of the traditional factors of production: land, labour, and capital. National intellectual capital can be distinguished from the traditional factors of production in terms of the ‘law of increasing returns to scale’. In contrast to the traditional factors of production, which are governed by diminishing returns, every additional unit of national intellectual capital that is used effectively results in an increase in economic performance (S. Kim, Yoon, H. Kim, Lee, Kang, 2006).

In recent years, economists have accepted that technology is an endogenous growth factor, with increasing returns to scale instead of diminishing returns to scale. Romer (1990) was one of the famous economists who advocated that the production process itself produces technology automatically, while assuming that the technology is an endogenous factor.

Steward (1997) emphasized the significance of knowledge and intellectual capital with the increasing use of technology. The importance of knowledge is now leading to an increase in the importance of measuring this knowledge. Kaplan, Norton and Edvinsson are primary scholars in the study of measuring intellectual capital (IC) and knowledge. Some of their common findings were based on the theory that ‘you cannot manage IC if you cannot measure it’.

The World Bank Institute's Knowledge for Development Program (K4D) measures knowledge using the knowledge assessment method (KAM). This program helps build the capacity of client countries to access and use knowledge so that they can become more competitive and improve growth and welfare (www.worldbank.org/kam).

The World Bank's KAM is a useful tool that produces the Knowledge Economy Index (KEI), which represents a country or region's overall preparedness to compete in the Knowledge Economy (KE). The KEI is based on a simple average of four sub-indexes:

1. Economic Incentive and Institutional Regime (EIR)
2. Innovation and Technological Adaptation
3. Education and Training
4. Information and Communication Technologies (ICT) Infrastructure

The KAM has been widely used by government officials, policy makers, researchers, civil society representatives and the private sector because of its ease of use, transparency and accessibility.

The World Bank KAM also highlights the close relation between economic development and knowledge. The correlation between KEI and GDP per capita values also underlines the importance of knowledge in growth.

1.1 Fundamental Research Question

'To what extent does national intellectual capital (NIC) have an effect on economic growth in North Cyprus? '

Sub-questions:

- What is the rank of North Cyprus within the KEI list developed by the World Bank?
- Are the North and South sides of the island compatible based on the KEI?
- To what extent does the KEI provide a reasonable solution to the development problems of North Cyprus?

1.2 Aim of the Study

This study aims:

- To understand the knowledge-based economy and to determine the relationship between national intellectual capital and economic growth.
- To calculate the Knowledge Economy Index (KEI) by using the Knowledge Assessment Methodology and to draw a comparative statement between the North Cyprus and South Cyprus economies.
- To measure the overall level of preparedness of the North Cyprus economy for the Knowledge Economy, to create awareness of knowledge and to increase the understanding of the importance of technology in the knowledge economy.
- In the light of estimated information about macroeconomic data, to investigate the source of productivity growth in North Cyprus by the Ordinary Least Squares (OLS) estimation method with the extended Cobb-Douglas production equation.
- To analyse the present conditions and give recommendations for future policy purposes.

1.3 Importance of the Study

This research is important because of the following reasons:

- It is the first study to explore the potential of the knowledge economy in North Cyprus
- It is the first study to compute the KEI and KI index values and the ranking of North Cyprus
- It is the first study in which only the knowledge economy variables are used as indicators to measure the effects of national intellectual capital on the economic growth of the country. Furthermore, it will econometrically confirm the increasing returns to scale in knowledge variables.
- It is the first study to provide a framework for knowledge economy development empirically tested on a small developing island - North Cyprus.

1.4 Limitations of the Study

- This study is limited to analysis of the impact of intellectual capital on economic growth of North Cyprus.

- The study will use the KAM for determining the KEI of the country and for comparing the findings with South Cyprus.
- The study is also limited to the application of the extended Cobb-Douglas Growth model using econometric analysis with the help of the E-views software program and other necessary statistical techniques.
- While collecting data, the study will use the State Planning Organization, Economic and Social Indicators, Macroeconomic Data, Five year development program, YAGA Doing for Business program and other governmental offices to obtain the necessary statistics
- Because North Cyprus has limited statistical data for unknown knowledge variables, if necessary, the study will construct its own questionnaire and collect the required information from the public or government.
- The study is also limited to the period between 2000 and 2013.

2. LITERATURE REVIEW ON INTELLECTUAL CAPITAL

In business life, market value has always been an important topic to be discussed. As far as market value is concerned, there are many other topics that can contribute to successful business life, such as organizational commitment and other factors. It is seen that not only tangible assets

but also intangible assets are important for success in business life. In this sense, intellectual capital gains significance as it has many benefits such as the market value of firms. Intellectual capital can be described as the intangible assets of a firm that is necessary for the future profits and survival of the businesses (Cheng, et.al. 2008).

Of course, intellectual capital is also important for nations as well as businesses. This is because having intellectual capital has been a vital aspect for establishing knowledge economy in a country (Matos, 2013). Bearing this in mind, it must firstly be understood what intellectual capital actually is.

2.1. Intellectual Capital

Intellectual capital deals with the reasonable, articular and substantial fruits of people‘s minds. Intellectual capital may solely be seen as an intangible asset. However, it will be explained in the following pages that it is about both the tangible and intangible gains of firms. Tangible and intangible assets generally complete each other. When thinking about intellectual capital, it can be said that it is about the transformation of knowledge into valuable gain (Kok, 2007).

Nowadays, intellectual capital has a greater impact on economic growth compared with the past. After the industrial revolution, businesses found themselves in severely competitive markets. In order to gain competitive advantage and survive, it became a necessity for firms to perform better. At those times, performing better was equated with producing more when compared with your competitors. Today, on the other hand, there are other indicators of success. Producing more with less cost does not necessarily guarantee competitive advantage, whereas motivation, values, skills, culture and many other intangible values/aspects have become determinants of success. Nowadays, intangible assets have been major interest areas for firms in terms of their survival. All firms and businesspersons are aware of the importance of intangible assets. However, there are also some problems related to intellectual capital to be solved by academicians and businesspersons. For example, it is nearly impossible to measure intellectual capital in a correct manner, as there are not accepted credible metrics for measuring intangible assets. There is a need for talent in order to understand what the intellectual capital is exactly for a given firm, manage it and use it as a tool for gaining competitive advantage (Matos, 2013).

Reviewing the literature, it is apparent that there are several different ideas about intellectual capital and this is why it has not been studied in depth. Intellectual capital is related to the difference between the cost of replacing assets and the market value of a firm. An important aspect of intellectual capital that is generally accepted is that it is nearly impossible to put a price on it. That is because one cannot measure knowledge or the learning capabilities of a firm. Intellectual capital can also be defined as the sum of market value and book value. However, it must be admitted that book value is just the tip of the iceberg of wealth. Intellectual capital cannot be seen just in the copyrights, patents or other valuable papers of firms. Market presence, discoveries, processes, relationships, community influence, experience and knowledge of a company are among the aspects of intellectual capital (Akpınar and Akdemir, 1999).

As one can see, there is a difference between intellectual capital and tangible assets. For economic growth, intangible assets may be more beneficial than tangible assets. To this end, it will be beneficial to understand the differences between tangible assets and intellectual capital. A literature review shows many differences among tangible assets and intellectual capital. For example, Talukdar (2008) points out six aspects that make intellectual capital and tangible assets different from each other. According to the author, those topics can be listed as follows:

- Intellectual assets are not rival assets. Tangible assets are the assets used for doing a certain duty at a certain time. On the other hand, it is possible to multiply intellectual assets. There may be several examples for this situation. For example, a person can deal with a single customer at a certain time. However, a consumer service system can deal with thousands of consumers at a time. This is a good example of how intellectual assets may be more important than tangible assets at a certain time.

- Tangible assets generally belong to a certain person in a firm. On the other hand, intellectual capital can be shared by other people working within the firm or can be shared by partners, suppliers etc.

- There is a point that makes tangible assets more important than intangible assets. It is that people and suppliers are generally interested in using and seeing materials. Moreover, getting in touch with tangible assets is more important than systems for customers and

suppliers. For example, getting in touch with a consumer representative is more desirable than getting in touch with an automated system for customers calling a firm.

- There is a need for space such as storage for many tangible assets and this can be an ongoing problem. On the other hand, there are no costs for the storage and transportation of intangible assets as they are used directly.

- Using knowledge has become more profitable compared with mass production in today‘s business life.

- Intellectual capital has a significant importance. There is a need for investing in people, systems and customers at the same time (Talukdar, 2008).

Intellectual capital may not be seen as an asset in the traditional manner. Modern economies accept the significance of making non-material assets better. Intellectual capital is used for many aims in modern business life, such as competition for the future and better management. The sphere of intellectual capital is formed via those targets (Bakarov, 2010). Competition and better management activities are key elements for economic growth.

As has been observed, having and developing intellectual capital has become a compulsory aspect of modern business life. This is why managers have to focus on that particular topic. According to Akpınar and Akdemir (1999), there are some steps to be taken by managers in order to develop the intellectual capital capability of their firms. These steps are as follows:

- All people working in a firm must be aware of the importance of intellectual capital. Managers must set personal goals around the topic and each person must be evaluated in some manner. For example, people working in the firm have to learn something about the business.
- The role of knowledge must be defined by managers. The role of knowledge must be about industry and business.
- Managers must be able to have knowledge (monitoring) capabilities including the strategies of competitors in the market.

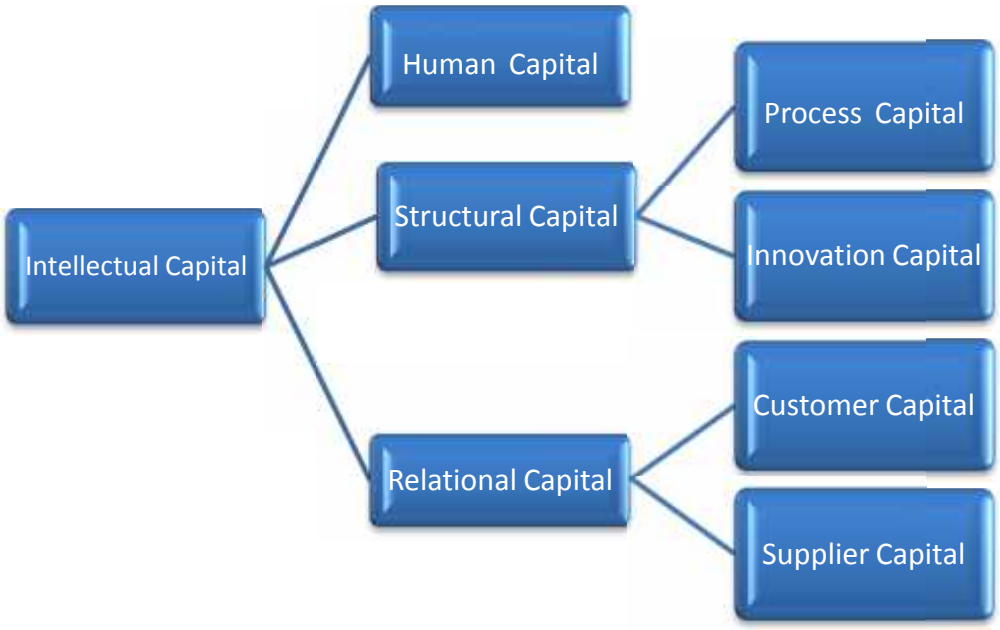
- Managers must take support from government institutions[1] and other institutions in the sector.
- Managers must be aware of the amount of support that can be obtained from government institutions and other institutions in the sector.
- A knowledge map must be prepared within the firm.
- An intellectual portfolio must be produced.
- The worth of intellectual capital must be evaluated.
- Monetary sources may be used in order to support the intellectual capital capacity of the firm.
- Managers must be aware of the weaknesses of their intellectual capital, comparing the firm with competitors.
- Strategies must be prepared taking consumers, suppliers and competitors into account.
- Development of intellectual capital must be reported annually (Akpınar and Akdemir, 1999).

All these steps are necessary to be taken in order to gain competitive advantage and economic growth. It must not be forgotten that intangible assets are as important as tangible assets for gaining competitive advantage. In particular, regional growth needs intangible assets such as intellectual capital (Bronizs et.al. 2010)

Intellectual capital has three sub-dimensions. These dimensions are Human Capital, Structural Capital and Relational Capital. Human capital is about human being‘s capabilities, expertise, skills, know-how and experience. Structural capital is about intellectual property, the capabilities of an organization to meet market requirements, distribution channels, networks, culture and policies. Relational capital concerns the external relationships of firms. Kok (2007) expresses that “relational capital includes the connections that people outside the organisation have with it, their loyalty, the market share, the level of back orders, and similar issues” (Kok, 2007). Figure 1 shows the sub-dimensions of intellectual capital.

[1] It will be examined in the following pages that government institutions have a significant role at knowledge economy.

Figure 1: Sub-Dimensions of Intellectual Capital



Source: Prepared with the data gathered from Kok (2007) and Matos, (2013).

According to Yodmongkon and Chakpitak (2008), "Structural capital includes customer capital (external) and organizational capital (internal). Organizational capital consists of innovation and process capitals. Process capital is the sum of a company's know-how. Innovation capital includes intangible assets and intellectual property, which is a source of renewal for the company. Human capital is defined as the collective capabilities of the employees' competence, attitude and intellectual agility (Yodmongkon and Chakpitak, 2008). At this juncture in the study, it will be beneficial to elaborate on these sub-dimensions of intellectual capital.

2.1.1. Human Capital

The first sub-dimension is human capital, which can also be called individual capital. Human capital is about people‘s social skills, formal education, experience, qualifications and personal skills. A worker must be willing to apply all these skills for the firm and this application is observed by managers or consumers. When a person working for a firm becomes ready to apply those skills and combine them for the operations, the quality of production and service operations of the firm will increase. At that point, managers play a crucial role for making people willing to use these skills. Recruitment, personal development, training and talent management are topics to be taken into account by managers in order to develop human capital within the firm. These activities support human capital accordingly. On the other hand, dismissal and other negative activities decrease human capital by decreasing the motivation of workers (Matos, 2013).

Human capital is mainly associated with the Noble Laureate Gary Becker. Gary Becker used that term when considering investment in formal education. Intellectual capital has been used for re-branding of knowledge, experiences and skills. Experience and informal knowledge have also become important for the concept of human capital (Oliveira and Holland, 2007).

Human source elements are at the basis of human capital. Supporting competencies, skills, experiences and knowledge are positive activities in terms of supporting human capital. Supporting these competencies, skills, experiences and knowledge will be beneficial for economic growth. When people are supported in terms of these qualifications, there will a positive atmosphere in the firm when it comes to using competencies and talents. In fact, there are several ways of supporting human capital. For example, focussing on people working in the firm is not the only way of supporting capital as a manager may employ a new person with high skills in order to support human capital. Human capital is predominantly concerned with individuals. When a person with high talents starts to work in a new firm, he/she will inevitably use his/her skills gained in other companies. Similarly, when a talented person leaves the firm, this is a loss of human capital for the firm accordingly. When he/she goes, he/she also takes his/her skills, knowledge and talents (Kong and Thomson, 2009).

In this case, it is observed that a human resources department can play an important role in intellectual capital. Selecting people with high talents, training people working in firms and

helping people to share and use their ideas are vital roles of human resources departments in terms of supporting intellectual capital. There is a need for added value in firms and human resource management teams must prepare valuable reports for managers about the current status of human capital (Casdaneda and Toulson, 2012).

Therefore, it must not be forgotten that intellectual capital largely depends on individuals. Competence of the individual is a core element of intellectual capital. People can act differently under different circumstances. Under different circumstances, workers need different talents and knowledge. Social skills, values, experiences and education of those workers become the determinants of success. Despite the importance of tangible assets, those assets must inevitably be used by employees. Although a firm may have a significant tangible asset capacity, that capacity is irrelevant when used by people who do not have sufficient skills. This is why human workers are the core element of firms. Intellectual capital is the competency and commitment of a person and therefore it can determine the success of a firm. When people have adequate competencies and commitment, tangible assets will be used in an appropriate manner. On the other hand, when individuals do not have adequate competencies or commitment, all tangible assets may become insignificant assets for firms (Akpınar and Akdemir, 1999).

It is not an easy task to measure human capital because it can generally only be observed in the long term. Of course, talented operations by individuals can also be observed in the short term. Human capital can be measured via observing the economic value of people working in the firm. When people have skills necessary for the operations and use those skills effectively, those people produce income and produce more economic value. Moreover, education is not the sole determinant of the success of human capital. For example, Henry Ford did not earn high-level degrees in either engineering or business. However, self-development (and perhaps some personal talents) helped Ford to prepare a system that was widely used in the 20th century (Oliveria and Holland, 2007).

Skilled workers improve the value of goods and human capital is very important for innovation. Nearly all new systems and developments are ideas that originate from people working within the firm. When human capital is effective, it is more probable to see the development of innovative processes in the firm. Skilled people perform well in terms of improving “new” systems. As a result of the more innovative environment, the human capital

capacity has been maximized in the production process. Sharing knowledge and encouraging people to "innovate" helps people to share and use their talents without any hesitation. When this is achieved, there is no need for workers to compete with each other. On the contrary, encouraging workers to cooperate and share ideas will result in better conclusions (Casdaneda and Toulson, 2012).

In short, deployment, development and knowledge are important terms used when explaining human capital. When new talented employees start to work in a firm, human capital increases. The main results of a high level of human capital are an increase in productivity and income. However, new employees do not guarantee a high level of human capital and the aforementioned productivity or income. Human resources department have a significant role in this respect. These departments must observe both the firm and the environment in the sector as a whole. Qualified workers in the firm must be observed, better people must be selected for employment and market conditions must be observed for choosing or training people in accordance with the needs of the environment (Kong and Thomson, 2009).

2.1.2. Structural Capital

Structural capital is about the firm itself. According to Zyl and Limi (2005), "it is an organisation's unique innovation and process capital that ultimately enables the achievement of sustainable competitiveness and prolonged first-mover advantage in the current dynamic market place (Zyl, 2005).

Before examining structural capital, it will be beneficial to examine the specific elements of the concept. Karchegani et.al. (2013) gathers the ideas of different authors, as displayed in Table 1.

Table 1: Some Elements of Structural Capital

Authors/Years	**Elements of Structural Capital**	
Ross et.al. (1998)	**Internal Structures** • Patents	**External Structures** • Reputation and image of the

	• Models • Concepts • Administrative Systems	company • Brand names • Relationship with suppliers and consumers
Marr and Moustaghfir (2005)	**Intellectual Properties** • Service Marks • Copyrights • Patents • Trademarks • Trade secrets • Design rights	**Infrastructure Assets** • Corporate culture • Management philosophy • Information systems • Management processes • Networking systems • Financial relations
Petty and Guthrie (2000)	**Intellectual Property** • Trademarks • Patents • Trade secrets • Design rights • Copyrights	**Infrastructure Assets** • Networking systems • Information systems • Services • Management processes • Corporate culture • Management philosophy
Seetharaman et.al. (2004)	• Management processes • Culture • Internal databases • Spirit of firm • Patents • Copyrights • Trademarks	

Source: Karchegani et.al. 2013: 568

Structural capital is divided into two sub-dimensions and these are process capital and innovation capital.

2.1.2.1. Process Capital

Process capital is concerned with the routine operations within the firm and also the memory of the firm. All firms learn new things during their operations and the different circumstances they encounter. With each situation or process, firms gain new experience. All these shape the current and future decisions of firms and these learning outcomes result in an operation system within the firm. Learning outcomes also result in new rules being established in the firm. As time passes, the firm will develop its organizational memory. According to Matos (2013), "organizational memory can be a way of registering tacit knowledge, making it explicit, so that through business processes it becomes part of the patrimony of the company, to be shared and recreated. The structural capital results from the way the know-how belonging to people is embedded in the company, producing organization, providing answers to customer needs" (Matos, 2013).

Process capital describes the activity-rooted expression of the amount of business activities. These activities are generally favoured by the firm. Productivity of management processes, economy, investments in Research and Development activities and leading time are some of these business activities. Process capital also covers data about some other topics such as error rates, quality and waiting time (Cheng, et.al. 2008).

Zyl and Limi (2005) claims that process capital is not as important as innovation capital, which will be examined in the following pages. However, process capital is especially important for prolonged first-mover advantage and competitiveness.[2] The project management styles and business processes of a firm cannot be easily imitated by competitors. Because of the fact that it is difficult for competitors to imitate those aspects, the firm may consequently have a prolonged competitive advantage. On the other hand, it must also be acknowledged that it is not easy to define and manage process capital.

Process capital is a significant tool for supporting human capital and relational capital. Without process capital, it is difficult for firms to perform well in terms of relational and human

[2] It will be beneficial to remind that competitive advantage has great significance in terms of economic growth both for firms (specifically) and countries in (general).

capital. The principle reason for that situation is that without the proper and successful management of a firm, it becomes impossible to use human capital and relational capital in an effective manner. In other words, it can be said that process capital is an infrastructure for both human capital and relational capital. Non-human capital is generally managed by process capital. Copyrights, publications, organizational culture, strategies, routines, process manuals and databases are some examples of process capital (Koçoğlu, et.al. 2009). According to Kerchegani et. al. (2013), examples of process capital can be listed as follows:

- Procedures,
- Knowledge,
- Patents,
- Processes,
- Goodwill,
- Culture,
- Routines,
- Systems,
- Databases,
- Structures,
- Intellectual properties,
- Activities,
- Knowledge,
- Environment,
- Knowledge sources (Karchegani, et.al. 2013)

Systems are an important aspect for economic growth. Process capital is the type of intellectual capital that mainly focuses on the systems within the firm. According to Akpınar and Akdemir (1999), “it involves the organization’s routines and structures that support employees’ quests for optimum intellectual performance and, therefore, overall business performance. An individual can have a high level of intellect, but if the organization has poor systems and procedures by which to track his or her actions, the overall intellectual capital will not reach its fullest potential (Akpınar and Akdemir, 1999).

2.1.2.2. Innovation Capital

Innovation is also an important sub-dimension of intellectual capital related with structural capital. Firstly, it must be mentioned that business life has changed in a rapid manner over the last decades. Today, technology and innovation are two vital terms used for economic growth, both for countries and firms. In a firm, all workers have some different skills and there is a variety of knowledge. These "knowledge" and "skills" are important for innovation. Furthermore, the knowledge and skills are inexhaustible. As a result, there is a need for encouraging workers to express their ideas and to use their skills and knowledge in order to be more innovative. When individuals use their knowledge and skills within the firm, the shared skills and knowledge may result in innovations and competitive advantage, as all firms need to produce new and developed products or services in order to survive (Matos, 2013).

Innovation capital can be defined as the ability of a firm to innovate new services and products (Van, 1999). There is a need for using new supporting systems and technology in a firm by employees. Corporate wealth may be obtained by employees using technology and support systems. When technology and support systems are available, people will become more productive and effective. Databases, innovation policies and technical communicational systems all result in better operations (Koçoğlu et.al. 2009).

Patents and brands are key terms for innovation capital. Zyl and Lima (2005) describes this as:

> *The efficient management of innovation capital is particularly important for two main reasons: patents provide a stable income stream and enable monopolies, which allow for increased and prolonged profitability, market share and competitive advantage, and also provide a highly visible starting point for the development and implementation of organisational wide intellectual asset management; and brands, particularly high-equity brands, ensure a loyal customer base that allows an organisation to protect its competitiveness* (Zyl and Lima, 2005).

Innovation is an especially complex topic in terms of intellectual capital and the reason for this is the changing nature of innovation. Compared with many other topics, it must be acknowledged that innovation is a term that is constantly evolving. An innovated product, service or management system can become an outdated product, service or management system in a short period of time. For example, a skilled employee with a great deal of talent, experience and knowledge becomes beneficial for the firm for a long time. When hired, he/she can work for the firm for many years. On the other hand, the products and service within a system need to be innovated after a period of time (Koçoğlu, et.al. 2009).

Innovation has been a popular term since the end of the 1980's (Tamm and Ukrainsky, 2011). From that time, innovation became a very important aspect of economic growth, both for firms and nations. Governments and firms began to invest in innovation activities and studies by academicians became much more prevalent. Today, nearly everybody accepts the importance of innovation for economic growth.

As time passes, a new term has started to be used called National Systems of Innovation. According to Lankhuizen and Woolthuis (2003), the National Systems of Innovation approach is a young but successful approach that helps to understand how innovation and interactive learning evolve in national economies and how they propel economic prosperity and international competitiveness. The National Systems of Innovation approach has been embraced by policy makers all around the world, because this approach offers them the potential to derive more appropriate leads for innovation policy (Lankhuizen and Klein Woolthuis, 2003).

The reason for using the term National Systems of Innovation is the acceptance of the fact that innovation is the only way of achieving economic growth in nations, especially in our modern world. Innovation and economic growth are terms that cannot be considered separately. Innovation, knowledge and competitive advantage are terms inherently linked with each other. A suitable system of innovation is necessary for generating new knowledge. Transferring knowledge, skills and artefacts are some other important aspects of innovation capital. However, it must also be acknowledged that it is not an easy task to obtain well-designed innovation capital. It is both expensive and may be time-consuming as well as requiring skilled employees (Tamm and Ukrainsky, 2011).

According to Bontis (2002), "the intellectual capital of a nation (or a region of nations, as is the case for this paper) requires the articulation of a system of variables that helps to uncover and manage the invisible wealth of a country. Most importantly, an emphasis on human capital allows for a better understanding of the hidden values, individuals, enterprises, institutions, and communities that are both current and potential future sources of intellectual wealth (Bontis, 2002).

National intellectual capital is important because of the fact that knowledge has become the fundamental resource of the modern economy (which can also be described as the knowledge economy). Learning is the most important process in a firm. Today, there is a need for knowledge more than traditional values. Moreover, another important point is that "learning" is a social topic. It is an interactive system and new knowledge can be delivered effectively and efficiently. Therefore, in a nation, newly developed knowledge or systems can be used by many other firms after a period of time and that situation can be interpreted as rapid transmission of knowledge/innovation[3] (Lankhuizen and Woolthuis, 2003).

2.1.3. Relational Capital

Relational capital is related to the external relationships of the firm. Regulators, partners, customers, networks and suppliers are all associated with relational capital. Relation capital is also important for economic growth. As a result of relational capital, firms are able to relate with suppliers in a positive manner and obtain new consumers, while preserving their relationship with current consumers (Srivihok and Intrapairote, 2005). This is a good way of gaining competitive advantage. As was shown in Table 1 for structural capital, there are also some elements of relational capital. These elements are shown in Table 2.

Table 2: Some Elements of Relational Capital

Allee (2000)	**Saint-Onge**	**Guthrie and Petty**	**Stewarts (1997)**

[3] It is not the idea of authors using the term knowledge and innovation together. I have used those terms together because it can be claimed that, considering as intellectual capital, knowledge and innovation are terms closely related with each other.

	(1997)	(2000)	
• Interactions with government, suppliers, investors, partners, customers and alliances	• Revenue potential success • Duration • Customer type • Reference list	• Franchising agreements • Favourable contracts • Licensing agreements • Business collaborations • Distribution channels • Backlog orders • Company names • Customer loyalty • Customers • Brands	• Network • Brand • Customers

Source: Karchegani, et.al. 2013: 569

Relational capital has two sub-dimensions, which are customer capital and supplier capital. At this point, it will also be beneficial to briefly summarise these sub-dimensions.

2.1.3.1. Customer Capital

Customer capital is about solving problems that consumers experience with a firm. When people working in a firm are able to solve problems faced by consumers, it can be claimed that the firm has a high level of customer capital. Solving problems faced by customers is important for economic growth, especially in the long term. When workers manage to solve the problems of customers, this will result in a long-term relationship being established between the firm and the customer. Due to customer capital, both the public image of the firm and the satisfaction of the

customer increases. According to Matos (2013), “customers are difficult to retain, whereby knowledge of the company must be invested in processes that facilitate the fixation of these clients. The correct use of networks and new technologies is crucial in interacting with customers and therefore to build a stable clients capital” (Matos, 2013).

Customer capital is an important link between customers and firms. Successful management of customer capital results in a strong relationship between customer and firm (McElroy, 2001). Successful management of customer capital is a good aspect of the culture of customer value. For that reason, it can be claimed that customer capital is the set of processes and behaviours concerned with meeting the demands of consumers, solving their problems and is focused on customer value (Karchegani et al. 2013). Furthermore, it is not only customers, but also the interaction with other stakeholders that is covered by customer capital (Cheng, at.al. 2008).

2.1.3.2. Supplier Capital

In the same way that customer capital focuses on customers, supplier capital focuses on suppliers. As a result, it is important to solve the problems of suppliers. Some frustrated managers may overestimate the importance of solving problems of suppliers. However, supplier capital should be recognized as an important topic (Akpınar and Akdemir, 1996).

At this point, there is another important aspect that should be mentioned regarding all the sub-dimensions of intellectual capital. As mentioned previously, intellectual capital is a topic that should be managed by human resource departments as human capital, structural capital and relational capital all have an impact on human resources strategies and practices. Table 3 shows those effects.

Table 3: Effects of Intellectual Capital on Human Resources Management Strategies and Practices

Effect of Human	**Effect of Structural**	**Effect of Relational Capital**

Capital on		**Capital on**		**on**	
Human Resources Strategies	**Human Resources Practices**	**Human Resources Strategies**	**Human Resources Practices**	**Human Resources Strategies**	**Human Resources Practices**
Making succession plans for senior executives	Sharing knowledge through regular informal sessions	Fostering a learning culture through communities of practices	Observing tacit knowledge (know-how) among organizational members through job rotation	Attracting potential employees through the promotion of organizational image and reputation	Organizing joint functions with key partners

Source: Kong and Thomson, 2009

In summary, it can be seen that intellectual capital is a vital topic to be evaluated for the understanding of economic growth. For that reason, many authors have studied the topic. As mentioned previously, it is difficult to measure intellectual capital. However, as it is very important for business life, some models have been developed for measuring intellectual capital. In the following section of the study, the main topic to be discussed will be measuring intellectual capital.

2.2. Measuring Intellectual Capital

The combination of human capital, structural capital and relational capital can be defined as intellectual capital. As understood from the previous pages, intellectual capital is vital for competitive advantage and for improving performance of the firm. There is a need for a well-designed communication within the firm and good governance of intangible assets as well as

tangible assets. For that reason, there is a need to monitor measure and report on the intellectual capital process (Talukdar, 2008).

Measuring intellectual capital is also important for nations in a broader sense. The measurement of intellectual capital is based on benchmarking and analysing capabilities and competencies (Lin and Edvinsson, 2008).

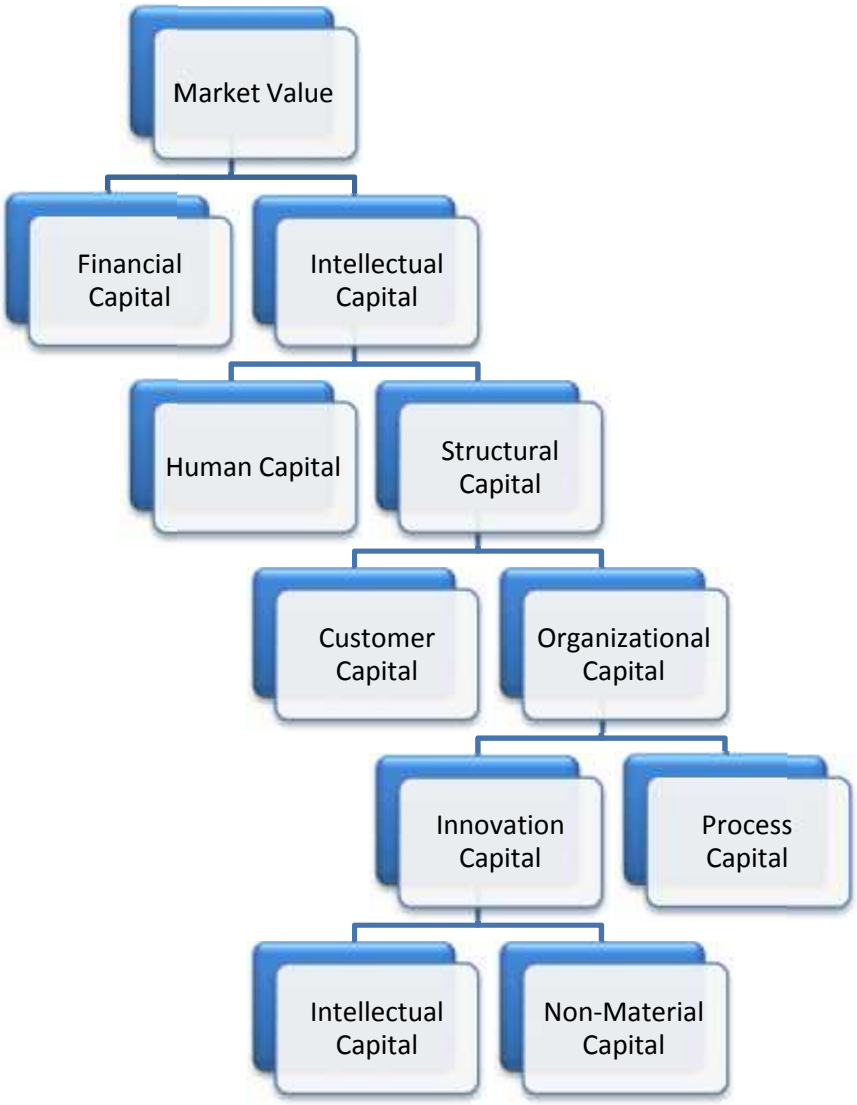
In this part of the study, theories about measuring intellectual capital will be examined. Reviewing the literature, it is seen that there are some principal theories that are discussed on the subject. They are Skandia Intellectual Capital Measure, IC Index, Technology Broker, Intangible Asset Monitor, Economic Value Added (EVA), Market Value Added (MVA) and Citation-Weighted Patents. It could be stated that analysing these theories may be beneficial for managing economic growth supported by intellectual capital, especially in a knowledge economy.

2.2.1. Skandia Intellectual Capital Measure

Skandia Navigator is a model proposed by Edvinsson and Malone (1997). Skandia Navigator divides intellectual capital into two dimensions, which are human capital and structural capital. According to Skandia Navigator, intellectual capital is the sum of human capital and intellectual capital, resulting in high quality value (Matos, 2013).

According to Edvinsson and Malone (1997), market value has two dimensions, which are financial capital and intellectual capital. Intellectual capital can be divided into two further sub-dimensions, customer capital and structural capital. Structural capital is divided into two sub-dimensions as innovation capital and process capital; innovation capital is divided into two other sub-dimensions as intellectual capital and non-material capital (Edvinsson and Malone, 1997). Figure 2 shows the Skandia Concept of Intellectual Capital.

Figure 2: Skandia Concept of Intellectual Capital

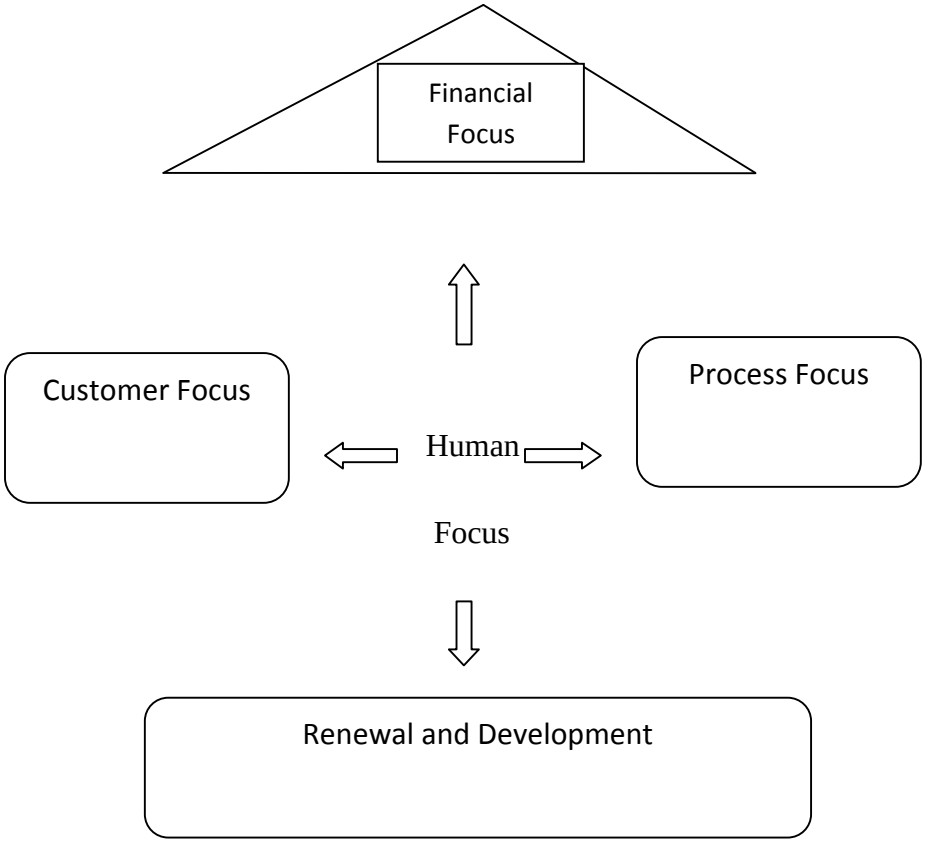


Source: Edvinsson and Malone (1997).

Leif Edvinsson is a widely known expert on the subject of intellectual capital. In fact, the name Skandia comes from the Swedish company in which Edvinsson worked as the Director of Intellectual Capital. The firm used a management system for intellectual capital that was different from others. Consequently, the model is called Skandia Navigator and it mainly focuses on book value and market value (Kok, 2007).

There are five key terms that form the Skandia Navigator. They are financial focus, customer focus, process focus, human focus and renewal & development (Mourinsen and Larssen, 2001). Figure 3 show these focus points.

Figure 3: Skandia Navigator



Source: Prepared with the data gathered from Mourinsen and Larssen, 2001.

When measuring intellectual capital, there are a total of 164 metrics to be analysed. In total, 91 of them are intellectually based and 73 of them are traditional metrics. These metrics cover the above-mentioned components (financial focus, customer focus, process focus, human focus and renewal and development) (Jurczak, 2008).

According to Mourinsen and Larssen (2001), the various intellectual capital supplements' headlines and titles differ and present uniquely colourful expressions of what Skandia is seen to stand for:

- Visualising intellectual capital,
- Value-creating processes,
- Customer value,
- Renewal and development,
- Intelligent enterprising,
- Power of innovation,
- Operating environment focus.

The authors express that such images are not merely descriptive terms of the actual conduct of Skandia, they also carry extended meaning (Mourinsen and Larssen, 2001).

2.2.2. Intellectual Capital (IC) Index

The IC Index was developed by Ross and his colleagues. According to the IC Index, intellectual capital can be divided into several areas, which are human, relational, and structural. In addition, there are two others added to those types that are monetary sources and conventional physical resources. The main aim of the IC Index is to teach both what is good and bad for management. The IC Index also focuses on how to increase value in the economy (Ross et.al., 1998).

According to the IC Index, intellectual capital can be developed by practice, consulting and research. It is important to be aware of the importance and ways of maximizing the flow of intellectual capital (Ross, et.al., 1998).

The IC Index aims to visualize growth by measuring intellectual capital. It is designed to be used by managers for observing growth. On the other hand, it must be mentioned that specific properties of the IC Index may vary in different firms. The IC Index has four categories and there are three stages in which those categories are formed. The first stage is "a critical review of existing indicators", the second stage is "development of indicators that represent the flows between different Intellectual Capital categories", and the third stage is "develop a hierarchy of

Intellectual Capital indexes" (Jurczak, 2008). Table 4 shows detailed information about the IC indexes.

Table 4: IC Indexes

Human Capital Indexes	Customer or Market Capital Indexes	Structural Indexes
• Average years of service with the company • Hours spent in debriefing • Revenue/employee • Number of employees • Average age of full-time employees • Average age of employees • Employee turnover • Number of managers • Profits/employee • Time in training (days/year) • Number of female managers • Number of full-time employees • Percentage of company managers with advanced degrees	• Market share • Support expense / customer • Satisfied customer index • Customer rating and average customer size • Service expense /customer/contact • Average customer size • Number of new customers/ new markets / leads, etc. • Customer visits to the company and the number of hits on the company's Web site • Number of customers • IT literacy of customers	• Number of units • Administrative expense/ total revenues • Investment in IT • Processing time, out-payments • New patents/ software/etc. contracts filed without error • Computers/ employee • Processes completed without error • Training efforts - expense/ employee, hours /employee • Corporate quality

• Percentage of employees with advanced degrees • IT literacy amongst staff • Motivation index • Hours of training per employee • Average duration of employment • Annual turnover of full-time/permanent employees • Hours spent by senior staff explaining strategy and actions (overlap expertise) • Leadership index • Savings from implementation of employee suggestions • Company diversification index • New solutions/ products/ processes suggested • Empowerment index • Number of employees/employee shares in the company (percentage of shares owned by employees, programme for employees to buy company shares, etc.)	• Service expense / customer/year • Ratio of sales contacts to sales closed • Annual sales / customer • Average time from customer contact to sales response • Customers lost • Average duration of customer relationship • Days spent visiting customers • Customers/ employees	performance • Partner satisfaction index • Revenues from patents / software/ data / databases /etc.

Source: http://www.trainmor-knowmore.eu/E4C3097F.en.aspx

2.2.3. Technology Broker

According to Technology Broker, intellectual capital value is measured considering diagnostic analysis of the responses of firms to various questions. There are four major components of intellectual capital covered by these questions. They are infrastructure assets, intellectual capital assets, human-centred assets and market assets. According to the Technology Broker approach, tangible assets and intellectual capital develop market value (Jurczak, 2008).

All these four dimensions are examined by specific questions. The answers are used for identifying and evaluating intellectual capital components. The monetary value of intellectual capital for the company is the final result (Kot, 2007).

According to Sitar and Vasic (2005), "Technology Broker as a method estimates the value of intellectual capital through a diagnostic analysis of the answers to 20 questions, covering its main counterparts: human-centred assets, infrastructure assets, intellectual property assets and market assets. Each part is analysed through 178 additional detailed questions and the answers are scored on the Likert scale" (Sitar and Vasic, 2005).

Bontis (2002) states that "since the design and application of the Technology Broker (IC Audit) method demands a long-term process, the primary focus of the research was on how to design a proper implementation procedure and discover necessary measures for the company... According to their importance, the answers are weighted and used for the calculation of intellectual capital, using a cost-based, market-based or income-based approach" (Bontis, 2002).

2.2.4 Intangible Assets Monitor

The Intangible Assets Monitor was developed by Sveibly (1997). Sveibly (1997) divided intangible assets into three major groups called individual competencies, external structure and internal structure. The aim of the Intangible Assets Monitor is to assess intellectual capital using qualitative and quantitative indicators. As it offers an overview, Intangible Assets Monitor is now being used by various companies around the world. Skandia is seen as a result of the Intangible Assets Monitor. The Intangible Assets Monitor claims that there is a need for using a methodology containing a knowledge perspective. According to the Intangible Assets Monitor, traditional accounting methods are not usable (Matos, 2013).

As expressed above, the Intangible Assets Monitor divides intangible assets into three groups. These groups are shown in Table 5.

Table 5: Intangible Assets Monitor

Indicator Areas	**External Structure Indicators**	**Internal Structure Indicators**	**Individual Competence Indicators**
Indicators of Growth	• Organic Growth	• Investment in Internal Structure • Investment in Information Processing Systems	• Competence Index • Level of Education • Number of Years in the Profession • Competence Turnover
Indicators of Renewal/ Innovation	• Image enhancing customer • Sales to new customers	• Organisation Enhancing Customer • New process implemented Proportion of new	• Diversity • Training and Education Costs • Competence-Enhancing Customers

		products/services	
Indicators of Efficiency/Utilisation	• Profitability per customer • Sales per customer • Win/ Loss Index	• Proportion of Support Staff	• Proportion of professionals • Leverage effect • value added per employee • Value added per professional • Profit per employee • Profit per Professional
Indicators of Risk/Stability	• Satisfied customers Index • Age structure • Proportion of big customers • Devoted customers ratio	• Values/attitudes ındex • Age of the organisation • Support staff turnover • Seniority • Rookie ratio	• Professionals turnover • Relative pay • seniority

Source: Sveiby (1997)

In this case, it will be beneficial to elaborate briefly on these indicators. According to Sveiby (2001), an increase in bills is an example of Organic Growth. Organic Growth is about how well a market receives a certain business concept. Image Enhancing Customers is concerned with the image of the firm. For example, Fortune-500 firms have good images. Sales to New

Consumers are the proportion of products and services sold to new consumers within the previous year. Profitability per Consumer assumes that “Companies that make an effort to find out the profitability of their customer base often find, to their dismay, that up to 80% of their customer sales are not profitable”. Win/Loss Index is about the costs and earnings of the firm. Sales per Consumers are about the total of number of consumers and total sales. The Satisfied Consumer Index is about the level of consumer satisfaction (Sveiby, 2001).

Investment in Internal Structure is about investments in new systems, methods etc. in the firm. Investment in Information Processing Systems is about investments made in information technologies. Proportion of New Products/Services is about new sales. This indicator is especially important for high technology firms. Enhancing Consumers is about the proportion of assignments devoted to customers. New Processes implements focus on everyday innovation and it is important for continuous development. According to Sveiby (2001), “the proportion of support staff of the total number of employed indicates efficiency of the internal structure” (Sveiby, 2001).

The Number of Years in the Profession is about the employees’ length of service in the firm. The Level of Education is concerned the educational level that the employees within the company attained. The Competency Index is measured as: Level * Performance = Competence Index. In reference to Competence Turnover, Sveiby expresses that “By comparing the competence of people who have left the company with those of new recruits, you can derive a quotient showing how personnel turnover affects the company´s competence as a whole”. Diversity is about the attitudes of men and women towards innovation.. Competence-Enhancing Customers is about measuring consumer assignments. Proportion of Professionals is the number of professionals in the company, divided by the total number of employees. The Leverage Effect is the ability of generating revenue. It is formulated as:

$$\text{Profit per Professional} = \underbrace{\frac{Profit}{Revenue}}_{\text{General efficiency Indicator}} * \underbrace{\frac{Revenue}{No.employees + freelancers}}_{\text{Sales efficiency Indicator}} * \underbrace{\frac{No.employees + freelancers}{No.professionals}}_{\text{Personnel efficiency Indicator}}$$

Leverage Indicator

Value Added per Employee is the ability to produce. Value Added for Professions is directly about knowledge in the firms. In knowledge companies, value added per professional can be regarded as the "purest" measure of ability to produce economic value. Profit per Employee is especially important for correct salary calculations. Profit per Profession is also important for knowledge firms (Sveiby, 2001).

2.2 5 EVA and MVA

EVA is short for Economic Value Added and was originally calculated by Steward (1997). EVA focuses on the profit of a firm related to intangibles. EVA is a good method of obtaining information about how the intellectual capital of a firm is productive (Jurczak, 2008). EVA is described on the official Economic Value Added web site as:

> *Economic Value Added is a measure of economic profit. EVA is calculated as the difference between the Net Operating Profit after Tax (NOPAT) and the opportunity cost of invested Capital. This opportunity cost is determined by multiplying the Weighted Average Cost of debt and equity Capital (WACC) and the amount of Capital employed. The formula for EVA® is EVA = NOPAT - WACC*Capital. Alternatively, we can calculate EVA® by multiplying Capital by the difference between the Return on Capital (ROC) and the WACC. EVA = Capital*(ROC - WACC) the two formulas are strictly equivalent and allow us to view EVA from different perspectives (http://www.eva.com/).*

EVA is about incentive compensation and financial management. The performance and culture of the firm are also important points according to EVA. EVA calculates the wealth produced by the firm in a year (http://sternvaluemanagement.com/eva-training/).

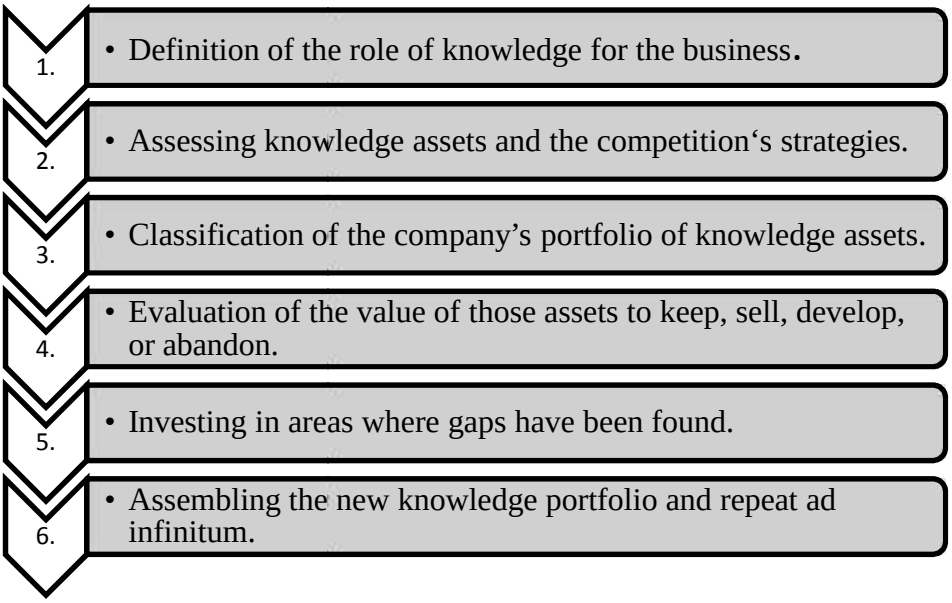
MVA stands for Market Value Added and it is supported by EVA. Bontis (2000) states that "MVA represents the spread between the cash that a firm's investors have put into the business since the start-up of the company and the present value of the cash that they could get out of it by selling their shares. By maximizing this spread, corporate managers maximize the wealth of the company's shareholders relative to other uses of capital (Bontis, 2000).

According to Shiri et.al. (2012), "while the effect of calculated intangible value (CIV) and value added intangible capital (VAIC) and its components [Human capital Efficiency (HCE), Structural Capital Efficiency (SCE), Capital Employed Efficiency (CEE)] on MVA was investigated individually and independently, the results of statistical tests indicated that, separate from the size of the firm and its financial leverage (LEV), VAIC and its components have a significant and positive relationship with MVA" (Shiri, et.al., 2012).

2.2.6 Citation-Weighted Patents

Citation-Weighted Patents are generally concerned with technology. Patents developed by the firm are calculated using Citation-Weighted Patents. Sales turnover, as well as the number and costs of patents are calculated (Jurczak, 2008). Citation-Weighted Patents was developed by Bontis (1996). There are six steps in the process for managing intellectual assets. Figure 4 shows these steps.

Figure 4: Steps of Managing Intellectual Assets



Source: Prepared with the data gathered from Bontis, 2000.

Bontis (2000) states that “Citation Weighted Patents also did as good a job as research and development (R&D) in explaining the market valued firms relative to their book value, mostly because the explanatory power of R&D declined when patent citations were included in the regression” (Bontis, 2000).

2.3.National Intellectual Capital

Economic growth and national intellectual capital are terms closely related with each other. It can be claimed that the economic growth of a nation is closely related with the intellectual capital level of the nation in a broad sense. As an important aim of the study is examining the relationship between economic growth and national intellectual capital, it is important to understand what intellectual capital is at a national level. This is important because high levels of intellectual capital of just a few firms may not be beneficial for a nation as a whole. For that reason, it is necessary to achieve high levels of intellectual capital for the majority of the firms in a country.

National intellectual capital is a term used for measuring intellectual capital, not for a specific firm, but calculating it in a broader sense. In other words national intellectual capital refers to measuring intellectual capital at a macro-economic level. As observed, national intellectual capital is especially important for the establishment of a knowledge economy and to support national foresight. It contributes to a knowledge economy‘s strategic steering. It may be difficult to observe enough knowledge about the economic impact of intellectual capital at a macro-economic level. Although there is an assumption that “national intellectual capital effects economic growth”, this has not yet been proved. Stahle (2009) expresses that we are unsure as to whether intellectual capital effects economic growth at the macro-economic level or not.[4]

National intellectual capital is a term used for describing the measurement and application/management of intellectual capital at the macro-economic level. This is especially important for the future development of a country. In order for economic growth to perform well at a national level, there must be effective and well-managed intellectual capital. Reviewing the literature, it is seen that both governments and other bodies focus on intellectual capital as well as academics. There have been several studies regarding the role of intellectual capital in the macro-economic performance of a country. National foresight activities are widely supported and intellectual capital has a significant contribution to the strategic steering of knowledge economies (Stahle and Stahle, 2011).

Intellectual capital is a vital topic for the macro-economic development of a country. It must not be forgotten that intangible assets have great influence on the overall economic performance of countries. In order for the macro-economic value to increase, the economic politics of a country must also focus on intangible assets as well as tangible assets. At this point, it can be said that some intangible assets such as intellectual capital must be taken into consideration in a country. According to Bradburn and Coakes (2004), cultural capital, social capital and intellectual capital have significant importance for the macro-economic growth of a country.

At the macro-economic level, there are some crucial elements of intellectual capital. Purely focusing on numeric data will not reveal the exact situation of a country, especially in

[4] That is why this study would have great significance about the topic.

terms of future expectations. At a national level, intellectual capital performs well in terms of sustainable economic growth. When a country wants to be successful in terms of economic growth, the elements of intellectual capital to be considered are as follows:

- Clusters,
- Networks,
- Technology,
- Science parks,
- International cooperation,
- Universities,
- Openness of trade and
- Educational level (Stahle and Stahle, 2011).

According to a report prepared by the OECD (2006), investment in intellectual assets is less than the investment in equipment and machinery in OECD countries. However, it can be said that states are becoming steadily more aware of the importance of intellectual capital. Nowadays, it can be claimed that governments implement more measures that support intellectual capital. The reason for this situation is the benefits of intellectual capital in the macro-economic indicators of a country. According to the OECD (2006) report, a large number of studies show that intellectual assets such as R&D, human capital and software make a substantial contribution to economic growth:

- Econometric studies suggest that estimated private rates of return to R&D investment are high and that estimates of social rates of return (including gains that may spill over to firms not involved in the research effort) are even higher, although with substantial differences across sectors.
- By the second half of the 1990s, human capital (measured as the improved composition of labour input) had become a key driver of growth, contributing between 15% and 90% to labour productivity growth in the G7 countries.
- At an aggregate level, software has been the most dynamic component of intellectual capital investment in OECD countries in recent years. Investment in software has

generally contributed more to labour productivity than other intellectual capital investments, such as communication and information technologies equipment.

- Given the quantitative importance of intellectual assets, their inclusion in measures of economic activity (e.g. GDP) is important for obtaining an accurate picture of economic growth, productivity and cyclical developments. The increasing importance of intellectual assets also poses new challenges to the system of national accounts, which are trying to grapple with this difficult area of measurement (OECD, 2006).

As one can see, it is important to acknowledge that intellectual capital is vital for the macro-economic development of a country. For that reason, there are various measures that should be undertaken by governments and other related bodies. According to (Wiśniewski, 2012), some of those measures are as follows:

- Effective industry regulation,
- Certification,
- Professional development,
- Responsible macroeconomic policies,
- Strategy and practice,
- Sustainable development,
- Codes of conduct,
- Contractual agreements,
- Implicit agreements (Wiśniewski, 2012).

In fact, it is difficult to understand the economic effects of intellectual capital at a national level. However, it is known that intellectual capital has significant influence on the macro-economic growth of a country. As a result of the fact that it is impossible to materialize the impact of intellectual capital on economic growth at a national level, it is not possible to measure accurately how intellectual capital affects a country's economy (Stahle and Stahle, 2011).

Reviewing the literature, it is found that many authors support the idea that intellectual capital at national level is a necessity for economic growth. According to Lin and Edvinsson (2011),

“intellectual capital, the source of the competencies and capabilities deemed essential for national economic growth, human development and quality of life, have been attracting an increasing amount of attention. Particularly, the results of national level intellectual capital studies and ranking provide a direction for nations to benchmark and to make wise decisions in the effective investment of national intangible assets and their development in the era of the knowledge economy” (Lin and Edvinsson, 2011).

National intellectual capital is known for measuring and evaluating intangible assets at the macro-economic level. In contrast to measuring intellectual capital for firms, measuring intellectual capital for a nation is an especially difficult topic (Navarro, et.al. 2011).

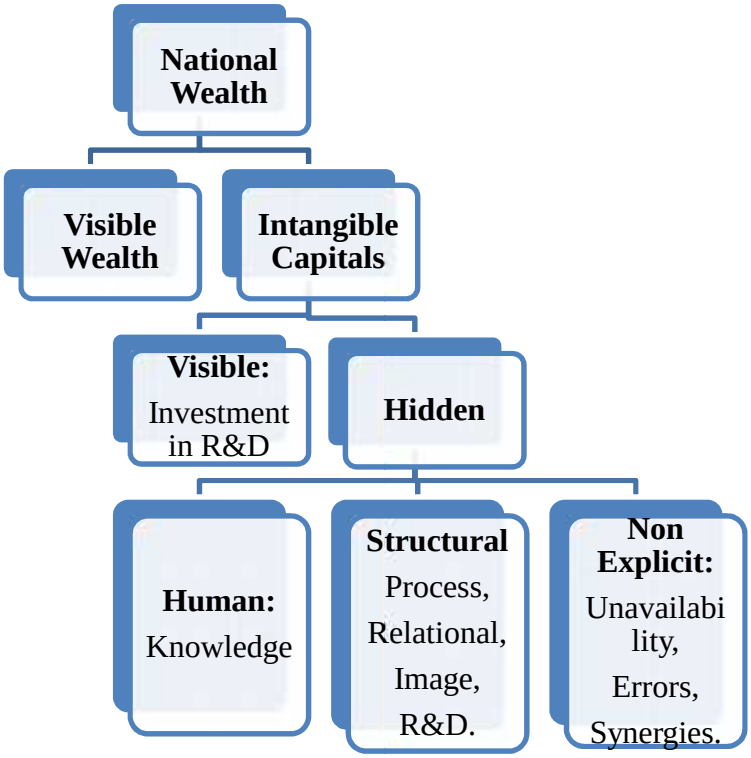
When studying national intellectual capital, it should be added that intangible assets must be seen as significant sources of progress and prosperity. There is a need for more understanding at the macro-economic level. Despite the fact that it has been proven that intellectual capital is vital for a firm, there is still a need for studying it at the macro-economic level. However, it is not easy to measure the intellectual capital of a nation. Articulation of comprehensive variable systems is required to understand the intellectual capital of a nation. There are some important aspects that nations should have information on regarding their intellectual such as their renewal capability, international trade, education system, infrastructure etc. These competencies are important for the competitiveness of a nation when compared with other nations (Lin and Edvinsson, 2010).

National intellectual capital is a term that provides information to nations about future competitiveness areas. National intellectual capital is also important for the policy makers of a country (Lazuka, 2012). For that reason, it can be claimed that there is a strong interaction between national intellectual capital and economic growth, especially for the future of the economy.

Navarro et.al. (2011) makes a framework of national wealth and expresses that intangible capitals have significant importance for national wealth. According to the authors, national wealth is divided into two sub-groups: visible wealth and intangible capitals. Intangible capitals are also divided into two sub-groups: visible and hidden. Furthermore, hidden is divided into three sub-groups: human, structural and non-explicit.

Figure 5 shows this framework. According to Lin and Edvinsson (2010), there are four types of national intellectual capital. The first type is human capital and it is about the competencies of people in relation to a nation's targets. Knowledge about laws, facts and principles can be considered to fall under this type of intellectual capital. Education is one of the most important aspects of human capital. The second type is market capital and it is mainly related to international clients. The third type is process capital, which refers to non-human sources of knowledge-economy. Finally, the fourth one is renewal capital. It is defined as a "nation's future intellectual wealth and the capability for innovation that sustains a nation's competitive advantage" (Lin and Edvinsson, 2010).

Figure 5: National Wealth Framework of Navarro et.al. (2011)



Source: Navarro et.al. 2011.

Lin (2011) expresses indicators of each type. According to the Author, indicators of human capital can be listed as follows:

- R&D Researchers,
- Gender Equality,
- Students' PISA Results,
- 15-64 year-old population,
- Teacher-Pupil Ratio,
- Employee Training,
- Skilled Labour,
- Secondary Education Enrolment,
- Public Expenditure on Education,
- Qualified Engineers,
- Human Development Index and
- Years of Education.

According to the author, indicators of market capital can be listed as:

- Globalization Index,
- Country Credit Rating,
- Current Account Balance (% of GDP),
- Capital Availability,
- Transparency of Government Policies,
- Cross Border Ventures,
- Corporate Tax Encouragement,
- Openness of Culture,
- Image of the Country,
- Trade to GDP Ratio (Imports + Exports),
- Investment Flows (% of GDP),
- Investment Risk.

The author states that indicators of process capital are as follows:

- Freedom of Speech,
- Health and Environment,
- Unemployment % + Youth Unemployment %,
- Goods and Services Distribution Efficiency,
- Internet Subscribers + Broadband Subscribers,
- Government Efficiency,
- Business Competition Environment,
- Computers per Capita + Mobile Subscribers,
- Convenience of Establishing New Firms + Start-up Days,
- Overall Productivity,
- Consumer Price Inflation,
- Corruption.

Renewal capital indicators are listed as:

- Business R&D Spending,
- R&D Spending / GDP,
- IP Rights Protection,
- Cooperation Between Universities and Corporations,
- Patents per Capita,
- Development and Application of Technology,
- Basic Research,
- R&D US$ Per Capita,
- R&D Expenditure / Utility Patents,
- Scientific Articles,
- Entrepreneurship,

- Venture Capital (Lin, 2011: 4).

The author also lists the top 10 national intellectual capital countries between the years 2001 and 2010, with rankings and scores. The list is as follows:

1. Switzerland 42.038
2. Finland 41.930
3. Sweden 41.838
4. Denmark 41.374
5. USA 40.859
6. Singapore 40.519
7. Netherlands 39.986
8. Norway 39.961
9. Iceland 39.882
10. Canada 39.822

National intellectual capital is important for economic growth. According to Malhotra (2000), there is an increasing realization that knowledge management is the key driver of national wealth, the driver of innovation and learning, as well as that of the country's gross domestic product (GDP). The increasing importance of knowledge assets and intellectual capital has been drawing more attention to the non-financial indicators of future growth and performance from not only company chief executive officers (CEOs), but also national policymakers, (Malhotra, 2000).

3. LITERATURE REVIEW ON KNOWLEDGE ECONOMY

With of the aim of this study in mind, there is a need for understanding what the knowledge economy actually is. Rapid developments have been observed in business life. Previously, people were generally interested in agriculture until the industrial revolution introduced mass production as a significant economic driver. Nowadays, the era of knowledge is taking over business life. In order to survive and gain competitive advantage, firms need information, technology, innovation etc. This has become so important in modern society that knowledge has become an essential intangible asset in business life. In order to achieve competitive advantage, there is now a greater need for data mining, innovation, gaining new knowledge and using this knowledge for the aims of the firm. This is vital for the decision making process (Loshin, 2003).

As a result of the facts stated by Loshin (2003), the knowledge economy has been a critically important topic for nearly two decades. According to the OECD (1996), "the knowledge based 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 all of these by the business and public sectors. Knowledge and technology have become increasingly complex, raising the importance of links between firms and other organisations as a way to acquire specialised knowledge. A parallel economic development has been the growth of innovation in services in advanced economies" (OECD, 1996).

There are some important aspects of knowledge economy. These aspects can be listed as:

- Knowledge based economy focuses on intangible assets more than concrete assets,
- Knowledge can be obtained by people in an easier way,
- More people can obtain information,

- There is an exchange of intangible assets,
- Workers are well-educated,
- Training is seen as vital,
- Communication technologies are widely used,
- Workers can apply knowledge,
- Technology is a key term,
- Innovation is a key term,
- Skills are developed regularly,
- Knowledge is the key to gaining competitive advantage in knowledge-based economies (Mousavi, et.al. 2013).

These days, people accept that knowledge is vital for economic success as knowledge is required in order perform routines and innovation activities (Barakat, et.al. 2013). Therefore, at this point it will be beneficial to study the interaction between economic growth and knowledge economy.

3.1 Economic Growth and Knowledge Economy

Knowledge plays a crucial role as a production factor in a highly competitive environment in the modern world. Companies that operate in the service industry have recognized the contribution that knowledge makes to the production process and regard knowledge as a value-adding factor that improves their competitiveness. This is to say that, for a knowledge economy, knowledge becomes a profit generating factor in the production process.

According to Chavula (2010), knowledge is at the heart of economic growth, which increases the ability to take advantage of existing technologies and innovations, enhanced competitiveness and productivity. In a knowledge economy, general purpose technology provides a powerful infrastructure that increases productivity and offers new opportunities to any knowledge-driven activity (Foray, 2006). For economic growth, many countries are seeking to shift their economies from an industrial economy to a knowledge-based economy.

3.1.1 Role of Knowledge at a Macroeconomic Level

Knowledge has a vital role in the economy, as it can be seen as a driving force for competitive advantage. It is generally associated with formal innovation activities. However, knowledge cannot be limited to innovation activities. All kinds of information gathering activities may be seen as components of knowledge. All learning activities, R&D activities and information gathering about the firm itself, consumers, suppliers and competitors must be taken into account (Jetin, 2007).

Knowledge asserts a significant impact on the economic growth of a country as it promotes economic growth and investment in knowledge changes productivity by increasing efficiency. The productivity of a country develops significantly via investment in knowledge. Moreover, despite the fact that it is expensive to make investments in knowledge, it can also be claimed that it is cheaper than investing in tangible assets. In other words, a report prepared by the OECD (2013) expresses that when gained, knowledge can be used repeatedly, which is different from tangible assets as they require tangible resources for each operation. Consequently, scale of production increases at the same time that cost of production decreases.

Governments must support knowledge in the overall economy of a country. In particular, training, education and R&D activities result in great knowledge resources and these resources increase the income level of country. This is also good for the society itself. By using knowledge in business life, both individuals and states may experience dramatic income increases (Nour, 2013).

As Nour (2013) expressed, knowledge is necessary for both macro-economic growth at a national level and social well-being. Knowledge-intensive entrepreneurship is seen as a very important mechanism and there is a need to produce knowledge and use it in the economy to stimulate economic growth at a national level as well as social well-being. In this regard, there are two dimensions to be considered for successful integration of produced knowledge into national economies. They are production systems and knowledge generation and diffusion systems. These systems are greatly influenced by social contexts such as institutions, culture, customs etc. (European Commission, 2008)

In today's world in which technology and information are widely used, it can be claimed that knowledge means "production" in the same manner. At the macro-economic level, sectors in a country that use knowledge heavily during the production phase gain competitive advantage compared with sectors in other countries. As a result of knowledge, those sectors increase production while decreasing costs. Therefore, countries establishing knowledge-based economies become good at macro-economic indicators thanks to high export levels (Huang and Wu, 2008).

Productivity, economic growth and knowledge are closely related terms, affecting each other immensely. According to Nour (2013):

> *...differential in the productivity and growth of different countries is significantly related to improvement in the quality of human capital, technical progress, factors of production and the capacity to create new knowledge and ideas and incorporate them in equipment and people. Recent growth literature show increasing evidences of the growing relative importance of intangible capital in total productive wealth and the rising relative share of GDP attributable to intangible capital. Intangible capital largely falls into two main categories: on the one hand, investment geared to the production and dissemination of knowledge (i.e. training, education, R&D, information and coordination); on the other hand, investment geared to sustaining the physical state of human capital (health expenditures)* (Nour, 2013).

Another important benefit of investment in knowledge is that it makes great contributions to the macro-economic conditions of a country by providing new business opportunities. For example, investment in design and R&D activities provides new products and services. All these new products and services can be marketed around the world to contribute significantly to national income. The OECD Report (2013) expresses that "growth accounting studies for the European Union and the United States show that business investment in knowledge contributes 20% to 27% of average labour productivity growth. In addition, during the global crisis, investment in knowledge has been relatively resilient (OECD, 2013).

Policy makers at a national level have to change their perspectives about R&D activities, according to the OECD (2013). According to the report, policy makers must adopt an enlarged concept of innovation and that concept must go beyond the traditional view of R&D activities. There is a need for a specific policy action for determinants such as obtaining value from data/information, organizational capital and design. Some other important topics that should be discussed by policy makers in a country are designing long-term programmes supporting innovation, supporting investment in knowledge production, fostering collaboration for innovation and providing easy access for financing innovation activities. Moreover, there must be stability in those policies (OECD, 2013).

An important role of knowledge in an economy is providing support to policy makers. Firstly, policies must be made in an appropriate manner in order to be successful. During the policy-making process, policy makers need accurate information about almost everything that could affect their decision making. Business life is changing regularly and policies must be upgraded regularly as well to keep up to date. Under that kind of circumstance, there is a necessity for correct knowledge inflow at all times. Having accurate and immediate knowledge will be helpful for policy makers. This is the key for the success and effectiveness for both firms and countries (Vedmetskaya, 2013).

In addition to policy making, another important topic is the use of knowledge during the production stage. It is necessary to incorporate production processes and knowledge. When knowledge is used during the production process, the firm will operate more effectively than its competitors will. As obtaining knowledge is not an easy task, consequently using this knowledge also complex. Transforming knowledge into standard economic transactions is difficult. First of all, obtained knowledge must be correct and accurate. Secondly, it must be useful for the production process. When knowledge obtained is not correct or it cannot be used by the firm effectively, that kind of knowledge will not be beneficial (OECD, 1996).

Networks and communities must be used. Knowledge is generally analysed with information technologies, which is beneficial for competitive advantage. Another role of knowledge in the economy is “sharing”. When knowledge is shared with others within an economy, the nation will obtain great benefit. When obtained from outside sources, knowledge becomes easier to acquire and that situation reduces costs. When a beneficial system or

knowledge is developed, it will provide competitive advantage. At that point, intellectual property becomes a useful tool for firms (Brinkley, 2006).

It is generally accepted that knowledge is a key element of social progress and economic development. Particularly in developed countries, knowledge has a fundamental role for value added and economic growth. Knowledge has an increasing importance in economies. As a result of this, the term "knowledge economy" is now being heavily utilised. In the knowledge-based economy, knowledge is used for distribution, production and application (Mousavi et.al. 2013).

The importance of knowledge was not only realized during the last decade. In fact, the importance of knowledge for economic growth has been discussed for a long time. In 1996, the OECD expressed that knowledge can make great contributions to the economy. Obtaining, transmitting and using the knowledge results in successful achievements (OECD, 1996). That is why innovation has now become a keyword.

Knowledge is important for both business and human life. It can be claimed that the more useful the knowledge, the higher standard of human life. In business life, easy transmission of knowledge via information and communication technologies and better availability of knowledge due to globalization makes knowledge more and more important. Information and communication technologies, innovation and R&D activities provide great advantages to firms and countries especially in terms of their competitive advantage (Jetin, 2007).

3.1.2 Knowledge and Human Skills

As mentioned above, information and communication technologies have great importance for the knowledge economy. On the other hand, it must also be mentioned that knowledge does not solely depend on technology; it also depends on human skills. Murnane and Levy (2006) express that people have skills that are important for using knowledge and gaining competitive advantage. They are expert thinking, complex communication, as well as routine cognitive, routine manual and non-routine manual tasks.

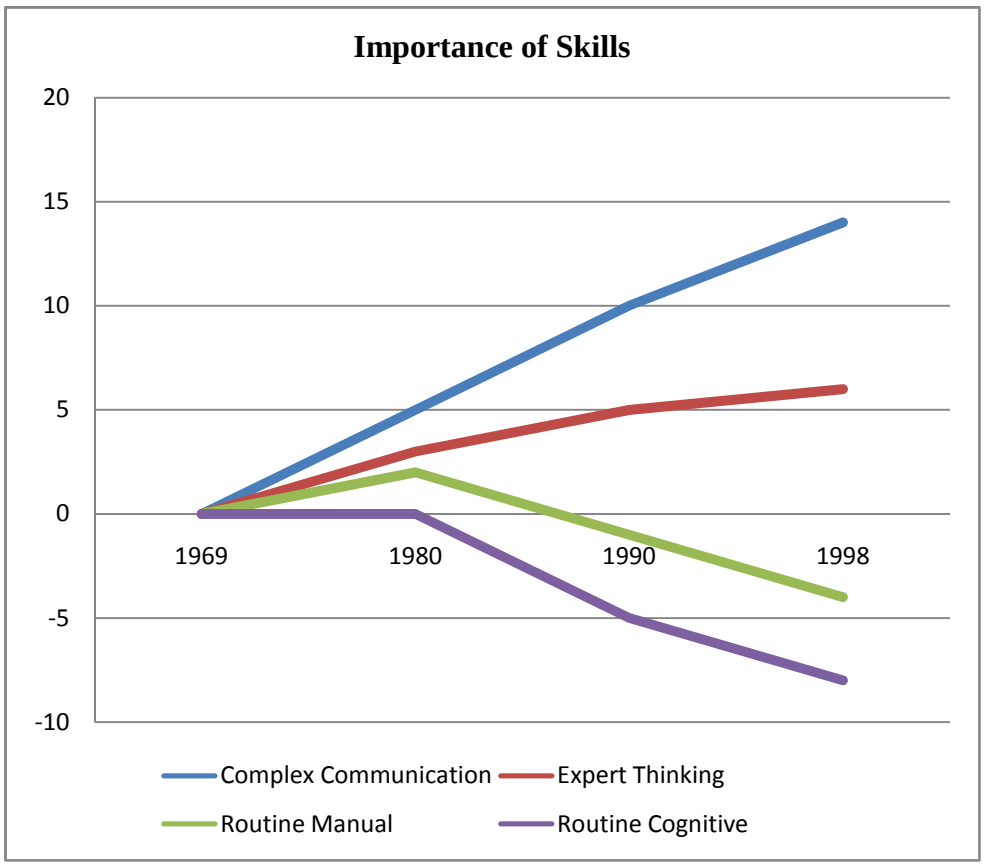
According to Brinkley (2006), expert thinking is "solving problems for which rule-based solutions do not exist. Computers cannot substitute for human beings but can assist by making information more readily available" (Brinkley, 2006 in Levy and Murane, 2006).

Dede (2009) states that “complex communication requires the exchange of vast amounts of verbal and non-verbal information. The information flow is constantly adjusted as the communication unpredictably evolves. A skilled teacher is an expert in complex communication, able to improvise answers and facilitate dialogue in the unpredictable, chaotic flow of classroom discussion” (Dede, 2009).

According to Brinkley (2006), routine cognitive can be defined as “mental tasks closely described by rules such as routine processing application forms and claims – these jobs are often vulnerable to Computerisation”. Routine manual is about physical activities generally performed by taking rules into account. Non-Routine Manual tasks are not governed by rules (Brinkley, 2006 in Levy and Murane, 2006).

Jobs that require routine manual and thinking skills are giving way to jobs that involve higher levels of knowledge and applied skills such as expert thinking and complex communicating. Figure 6 shows the skills required in today‘s jobs.

Figure 6: Today‘s Jobs Require New Skills (Importance of Skills)



Source: Prepared with the data gathered from 21st century, 2010.

Dede (2009) expresses that "declining portions of the labour force are engaged in jobs that consist primarily of routine cognitive work and routine manual labour—the types of tasks that are easiest to program computers to do. Growing proportions of the nation's labour force are engaged in jobs that emphasize expert thinking or complex communication—tasks that computers cannot do.

3.1.3 Knowledge Economy Variables

At this juncture, another important topic to be discussed is that of knowledge economy variables. This is also important for our study. Reviewing the literature, it can be seen that researchers focus on four main variables of knowledge economy. These are Physical Capital, Intellectual Capital, Technology and Labour.

3.1.3.1 Physical Capital

In order to be successful in a knowledge economy, it is not only sufficient to be competent in the intellectual capital or technology aspects; it is also necessary to be successful at physical capital as well. In order to have a competitive advantage, the physical capital of a firm must be supportive of the functions of the firm. A physical employee is a good helper for a knowledge employee (Choudhury, 2010).

Some countries face serious problems related to a lack of physical capital. Without physical capital, it becomes especially difficult to function properly. A firm cannot benefit effectively from its skilled employees if they are unable to work properly because of insufficient physical capital. The potential of a skilled workforce cannot be used effectively under that kind of circumstance (Salman et.al. 2012).

Technological physical capital provides great support to workers. According to Roth and Thum (2010), "in addition to the 'image' projected by a firm or a product and the quality of the training of workers, the management of a production process involving highly technological physical capital has also become important. As goods become more and more sophisticated, production processes are becoming more complex and the organisational capital of a firm becomes crucial (Roth and Thum, 2010).

In order to achieve added value, the existence of physical capital is required for effective human capital. Moreover, intellectual capital performance is affected by physical capital as well. It is impossible to use human capital without physical capital. It would be unwise to ignore the importance of physical capital, as it is a key factor for operations to function effectively (Bannany, 2008).

Previously, physical capital was much more important when compared with today. Qualifications and the amount of physical assets were main drivers of economic growth. Although physical capital is not as important as it once was, it must be acknowledged that physical capital still has important influence for the activities of a firm. In the 20th century,

physical capital and labour were mainly considered as the main sources of success (Salman et.al. 2012).

For production, intellectual capital is not sufficient, as the physical capital of the firm is still vital for production processes. In the process of wealth production, physical capital is still more important than intellectual capital in the agricultural and manufacturing sectors (Bannany, 2008).

On the other hand, many other sectors need intellectual capital more. For example, Lipunga (2015) expresses that "although physical capital is essential for banks to operate, it is the intellectual capital that determines the quality of services provided to customers" (Lipunga, 2015). In short, even manufacturing and production companies use intellectual capital combined with their physical capital to enhance their competitive edge within and outside their industries (Salman et.al. 2012).

3.1.3.2 Intellectual Capital

As described in detail previously, intellectual capital is very important, especially in a knowledge economy. Intellectual capital can be expressed from a value creation perspective. Intellectual capital has the role of being a valuable knowledge based resource and can also be seen in management activities in a knowledge economy. Relationship networks, structural relationships, management activities, human resources and management activities are the main intangible value drivers (Kianto et.al. 2013).

Reviewing the literature, it can be seen that the term intellectual capital and knowledge are closely related with each other. Intellectual capital is seen as a set of intangible assets such as capabilities, resources and competencies, which are related to organizational knowledge (Huang and Wu, 2008: 14). As we know, intellectual capital is a good supporter of competitive advantage by providing knowledge about nearly all areas of operations of the firm (Wu and Sivalogathasan, 2012).

Intellectual capital has been recognized as the most important source of competitive advantage for various organizations, which leads to an increase in business performance and a country's economic growth (Wu and Sivalogathasan, 2013).

Djurice (2014) expresses that, unlike physical resources that are under the influence of the law of diminishing returns, the growth of investments in intellectual capital causes productivity to increase. Intellectual capital has an additional important characteristic: it cannot be copied by competitors, which significantly increases its importance for creating sustainable competitive advantage. The competitiveness of a national economy significantly depends on the competitiveness of its companies (Djurice, 2014).

3.1.3.3 Technology

Technology is a crucial variable of the knowledge economy. It is a fact that the higher level of technology that is used, the better results for both firm and country in terms of competitive advantage. Technology usage is a great driver for economic growth, especially in a knowledge economy. As technology always makes it easier to operate, competitive advantage is significantly gained via technology (Djurice, 2014).

To increase competitive advantage, firms and countries are looking for ways to improve innovation and technology. Supporting innovated products and services is also crucial. Adding to innovation, usage of high technology is favourable for firms. Knowledge and technological innovations go hand in hand in the knowledge economy. As there is a shift from producing in a traditional manner to technological production methods, using or producing recent technologies results in the desired conclusions (Lipunga, et.al. 2015).

Technology usage is a good way for establishing a knowledge economy and also a knowledge based society. Economic, social, science, political development and technological processes are needed for knowledge based societies and knowledge economies (Djurice, 2014).

In order to be successful in the marketplace, technology usage of the firm must also be supported by some other factors. For example, the norms, beliefs, culture and products must go hand in hand with technology usage in a knowledge economy (Wu and Sivalogathasan, 2013).

In terms of the usage of technology, employees make great contributions to firms. Huang and Wu (2008) express in their study that “individuals and their associated human capital are crucial for exposing an organization to technology boundaries that increase its capability to absorb and deploy knowledge domains” (Huang and Wu, 2008).

3.1.3.4 Labour Capital

As described previously, physical capital and labour capital have some common properties. On the other hand, it must be stated that these variables are different from each other. According to Iazzolino et.al. (2013), "in a capital intensive firm, capital (intended as physical capital such as plants, tools, etc.) is more important than labour (intended as human effort); in a labour-intensive firm, labour has the greater importance. Labelling a firm as a knowledge-intensive company implies that knowledge has more importance than other inputs.

In all sectors, despite the amount of technology used, labour capital is needed in some form. One may require labour capital more in a sector, while there could be little need for labour capital in another sector. However, in all firms, labour capital must be considered as an important variable. Otherwise, there could problems in some ways with a lack of proper labour capital, especially in some sectors that have low technology needs and therefore require good labour capital (Wu and Sivalogathasan, 2012).

It must be acknowledged that labour capital is not as important as it was in the past. Previously, there was a huge need for labour capital in economies and this situation did not change significantly after the industrial revaluation. Then, with some developments, labour intensive production shifted to mechanically intensive production. This was a period of reduction in the importance of labour capital. Moving forward, as knowledge and technology has become more and more important; the significance of labour capital has gradually decreased. However, there is still a need for labour capital (Salman et.al. 2012).

In the agricultural sector, labour capital has greater importance, while there is a need for intellectual capital in some sectors such as banking. The necessities of sectors are determiners of which variable is important (Bannany, 2008).

In relation to this, Djurice (2014) states that "while in the factor-driven economy, the main resources of the total and export competitiveness in particular is cheap labour and natural resources, in investment-driven economy – efficiency in production of standardized products, in innovation-driven economy, dominant source of competitive advantage, is ability to produce innovative products and services by application of the most advanced technologies" .

In general, labour capital is still necessary for firms. On the other hand, there has been a shift from the industrial economy to the knowledge economy. Knowledge is becoming more and more important than labour capital every day (Choudhury, 2010).

3.1.4 Major Economic Growth Models

The Extended Cobb-Douglas production function will be used in this study. However, before discussing the Extended Cobb-Douglas production function, it may be beneficial to mention some major economic growth models that focus on "knowledge".

One of these models is the New Growth Theory developed by Romer (1986). According to that theory, technological progress must be seen as a conclusion of economic processes. Previous theories considered technological progress as a conclusion of nonmarket forces. However, New Growth Theory considers technology as a type focusing on market functions. In other words, New Growth Theory claims that technology is developed and shared in accordance with the needs of markets (Zaman and Goschin, 2010).

Knowledge is an important topic for New Growth Theory. In his Theory, Romer (1998) expresses that:

> *Knowledge is accumulated by devoting resources to research. Production of consumption goods exhibits constant returns as a function of tangible inputs (e.g., physical capital and labour) and therefore exhibits increasing returns as a function of' tangible and intangible inputs. Privately produced knowledge is in some cases assumed to be partially revealed to other agents in the economy. Because the descriptive models do not use explicit objective functions, questions of existence are generally avoided, and a full welfare analysis is not possible. Moreover, these models tend to be relatively restrictive, usually constructed so that the analysis could be carried out in terms of steady states and constant growth rate*.

As can be seen, Romer (1988) focuses on the accumulation of knowledge. On this subject, Romer (1998) also expresses that:

> *While exogenous technological change is ruled out, the model here can be viewed as an equilibrium model of endogenous technological change in which long-run growth is driven primarily by the accumulation of knowledge by forward-looking and profit-maximizing agents. This focus on knowledge as the basic form of capital suggests natural changes in the formulation of the standard aggregate growth model. In contrast to physical capital that can be produced one for one from forgone output, new knowledge is assumed to be the product of a research technology that exhibits diminishing returns. That is, given the stock of knowledge at a point in time, doubling the inputs into research will not double the amount of new knowledge produced. In addition, investment in knowledge suggests a natural externality. The creation of new knowledge by one firm is assumed to have a positive external effect on the production possibilities of' other firms because knowledge cannot be perfectly patented or kept secret. Most importantly, production of consumption goods as a function of the stock of knowledge and other inputs exhibits increasing returns: more precisely, knowledge may have an increasing marginal product*

As one can see, New Growth Theory advocates that investment in knowledge is crucial for economic growth. The model focuses on the determinants of technology and there are four factors in the model. They are technology, human capital, labour and capital. Technology is represented by a stock of manufacturing industrial models (designs of goods), which are accumulated over time as a result of research efforts. Human capital is related to training, education and non-rival technological components. Labour is about the unskilled workforce working in the firm. Capital is about the technological level of production and products (Zaman and Goschin, 2010).

Romer mainly focuses on how technology is produced and why. Romer also explains the technological changes. As described before, technological change is shaped in accordance with the demands of markets (Stern, 2004).

According to Romer, individuals have separate ideas and they put forward those ideas. After collecting ideas, knowledge is then used accordingly. At that point, the productivity of

workers gains importance. Romer claims that universities and libraries are great sources of knowledge where people express ideas and others may collect them (Bhattarai, 2004).

Another model was developed by Lucas (1988). Lucas expresses that human capital has great importance in the economy and that individuals are the main determiners of productivity in a firm. In terms of the importance of knowledge, Lucas focuses on how individual knowledge is important for economic growth. In reference to knowledge, Lucas (1998) expresses that:

> *I think when we talk in this way about differences in "technology" across countries; we are not talking about "knowledge" in general, but about the knowledge of particular people, or perhaps particular subcultures of people. If so, then while it is not exactly wrong to describe these differences by an exogenous, exponential term like A(t), neither is it useful to do so. We want a formalism that leads us to think about individual decisions to acquire knowledge, and about the consequences of these decisions for productivity. The body of theory that does this is called the theory of "human capital", and I am going to draw extensively on this theory in the remainder of these lectures* (Lucas, 1988).

About knowledge, Lucas (1998) also expresses that

> *'..... Considerations such as these may convince one of the existences of external human capital, and even that it is an important element in the growth of knowledge. But, they do not easily lend themselves to quantification. Here again I find Jacobs's work highly suggestive. Her emphasis on the role of cities in economic growth stems from the observation that a city, economically, is like the nucleus of an atom: If we postulate only the usual list of economic forces, cities should fly apart. The theory of production contains nothing to hold a city together. A city is simply a collection of factors of production capital, people and land-and land is always far cheaper outside cities than inside. Why don't capital and people*

move outside, combining themselves with cheaper land and thereby increasing profits.'

Another earlier model about growth related with knowledge called the Knowledge Production Function was developed by Griliches (1957). According to the Knowledge Production Function, knowledge is measured by Research and Development activities. Research and Development investments and patents are important indicators (Lewin and Massini, 2002). In his study, Grilliches states:

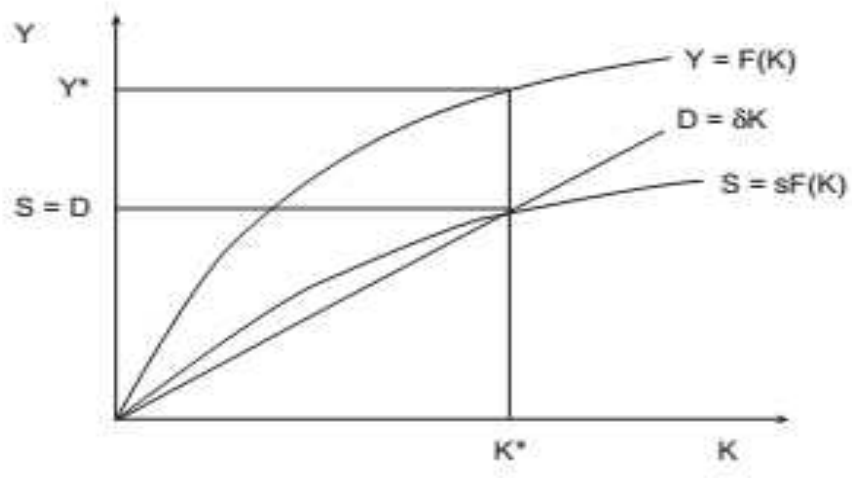
> *In this context, the assumption that knowledge does not depreciate is not too bad if one is interested in time series comparisons within a well-defined industry or aggregate and the total stock of R&D capital is changing only slowly. Then the difference between changes in gross and net investment is unlikely to be very large. This, of course, need not be true for cross-industry comparisons or for periods where one might suspect a significant obsolescence of the previously accumulated but now irrelevant R&D capital; for example, the situation following the rise of OPEC, with past R&D results having been based on the assumption of continued low oil prices and hence subject to significant obsolescence* (Grilliches, 1988).

Grilliches was one of the first authors focusing on R&D and focusing on R&D stock in his knowledge – capital model.

Another important model was developed by Solow called the Basic Growth Model. Solow's model is one of the simplest models. According to this model, it is important to take both labour force and GDP into account. Capital stock is also an important aspect. Capital stock is in equilibrium (and so unchanging in size) when saving equals depreciation. The model assumes that output increases at a decreasing rate as the amount of capital employed rises (Stern, 2004). Figure 7 shows this growth model.

Figure 7: Solow Growth Model[5]

[5] D : Depreciation,
S : Stock (capital stock)



Source: Stern, 2004.

According to the model, technological change plays an important role in long-term growth. Economic growth may not be achieved without considering technology. Therefore, technology must also be considered vital for governments as it fosters the economic growth of the country (Enache, 2003).

3.1.5 Extended Cobb-Douglas Production Function

As previously stated, the extended Cobb-Douglas production function will be used in this study. For that reason, it will be prudent at this point to briefly describe what the Cobb-Douglas production function is. In terms of growth and productivity, the Cobb-Douglas production function is still an important form to be used in theoretical and empirical analysis. The estimation of aggregate production functions‘ parameters has significance for today‘s work on technological change, growth, labour and productivity (Felipe and Adams, 2005). These (technological change, growth, labour and productivity) are important concerns for our study and this situation is one of the main reasons for choosing the Cobb-Douglas production function.

K : Capital
Y : Output

The Cobb-Douglas production function was first seen in the study titled "A Theory of Production" by Cobb and Douglas in 1928. In that study, the authors express that it is important to measure physical production in terms of the changing amount of capital and labour. One of the main aims of the work was determining the relationship between capital, product and labour (Cobb and Douglas, 1928). As those three factors have interaction with productivity, the Cobb-Douglas production function is a good model to be used in accordance with the aims of this study.

In their study, the authors ask five main questions. These questions are as follows:

- Is it possible to estimate whether or not productivity has interactions with factors such as technique, quantity of labour and quantity of capital?
- Is it possible to determine the influence of labour upon production as compared with capital?
- Proportions of labour change every year. Is it possible to deduce the amount added to the physical product of the units of capital and labour?
- Is it possible to measure the probable slopes of the curves of incremental products that are imputed to capital and labour?
- Are the distribution processes modelled closely upon the production of values? (Cobb and Douglas, 1928).

Douglas generally studied the flexibility of capital and labour. Moreover, he also studied the effects of those variations on income distribution. The Cobb-Douglas production function was therefore a good model for Douglas during his studies (Felipe and Adams, 2005).

According to the Cobb-Douglas production function, the function of labour and capital is formulated as (Cobb and Douglas, 1928)[6]:

$$P' = 1.01L^{3/4}C^{1/4}$$

- P' is Actual Production
- P' is zero when either labour (L) or Capital © approach zero

[6] Detailed information and other formulas are used in the book.

- Deviations of P‘ form P are significant individually
- P‘ approximates P over the period
- When we induce secular trends, P‘ correlated closely with P
- When we eliminate secular trends, P‘ correlated closely with P

Douglas developed the Cobb-Douglas Production Function later. His last contribution, published posthumously in 1976, appeared almost half a century after his initial paper. Douglas’s body of empirical research is one of the major achievements in economic measurement in the first half of the twentieth century (Jorgenson, 1991).

3.2 Importance of Productivity on Economic Growth

Productivity has always been an important term for business life. Just as it was in the past, productivity is also an important term today. These days, growth theories focus on productivity along with other terms such as innovation, skills, growth performance etc. It is known that investment in knowledge has vital importance for economic growth. However, investment in knowledge alone is not enough for success (Brinkley, 2006).

It must be stated that low worker performance and lower labour productivity in several sectors results in unsuccessful processes. Without productivity, it is nearly impossible to gain competitive advantage. Economic growth and competitive advantage are terms that cannot be seen separately. In order to gain competitive advantage, there is a need for productivity growth in nearly all sectors such as manufacturing, service sectors, business services, financial intermediation, communications, transportation, storage etc. (Lee and McKibbin, 2014).

Productivity is important in the knowledge economy and has relationships with some important variables. In a report, the OECD expresses that fact effectively. According to the OECD’s report (1996):

> *OECD countries continue to evidence a shift from industrial to post-industrial knowledge-based economies. Here, productivity and growth are largely determined by the rate of technical progress and the accumulation of*

> *knowledge. Of key importance are networks or systems, which can efficiently distribute knowledge and information. The knowledge intensive or high-technology parts of the economy tend to be the most dynamic in terms of output and employment growth, which intensifies the demand for more highly skilled workers. Learning on the part of both individuals and firms is crucial for realising the productivity potential of new technologies and longer-term economic growth* (OECD, 1996).

Productivity is also important for emerging economies. As we know, emerging economies have fewer resources compared with developed economies. For that reason, it is more important for emerging economies to use resources in an effective manner. Therefore, productivity is a good supporter of economic growth for those countries (Norris, et.al. 2013).

Bailer et.al. (2007) emphasized that the growth of total factor productivity and the growth of human and physical capital have relative importance. The authors carried out that study using data from 145 countries. According to the results of the study, for all countries, only 14% of the average output growth per worker was associated with total factor productivity growth. The authors used information from previous theories to construct estimates of the relative importance of the variances of aggregate input growth and total factor productivity growth across the countries. Much of the importance of the variance of total factor productivity growth across countries is associated with negative total factor productivity growth (Bailer, et.al. 2007).

3.3 Some Major Knowledge Economy Frameworks

There are some well-known knowledge economy frameworks. In this section of the study, the APEC Framework, OECD Framework and the work of the World Bank will be examined.

3.3.1 APEC Framework

The Asian-Pacific Economic Cooperation (APEC) published a knowledge economy framework November 2000. According to APEC, a Knowledge-Based Economy is defined as an economy in

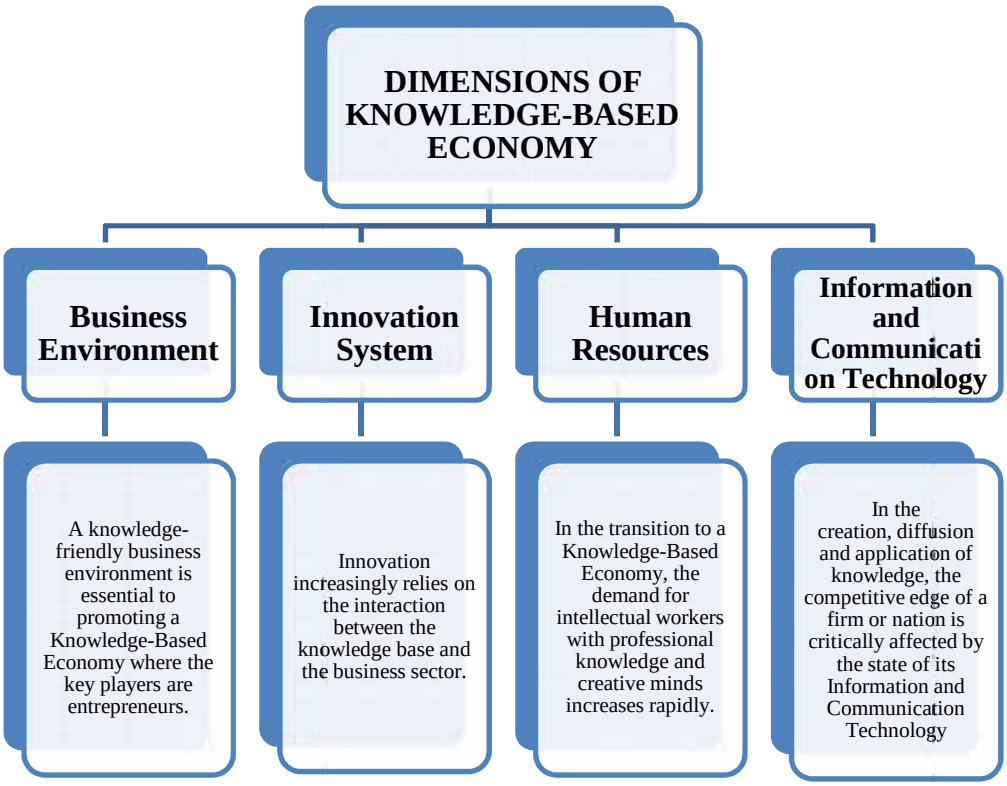
which the main drivers of growth are production, delivery and the usage of knowledge. In that type of an economy, wealth production and employment are supported by knowledge. The APEC Report stated that it is not only important to be knowledge-based in technology, it is important to be knowledge based in all sectors. Technology is not the only solution for being knowledge-based. Important aspects of a Knowledge-Based Economy must include the following:

- Well-designed education,
- Training,
- Life-long learning,
- Developed infrastructure of communication,
- Developed infrastructure of information,
- Well-governed macro-economic policies,
- Openness to new ideas,
- Openness to new enterprises and
- Openness to trade (APEC, 2000).

According to the report by APEC, it is important to be a Knowledge-Based Economy because of its benefits to the public. Furthermore, “Public-Good” is a term used in the report. APEC states that there are some important aspects of economies showing significant growth. The first aspect is that in those economies, technological change and innovation are pervasive and strongly supported by national innovation systems. The second aspect is pervasive human resource development. The third aspect is a developed infrastructure system, especially for communication and information technology. The final aspect is the business environment supported for innovation (APEC, 2000).

The APEC Framework divides Knowledge-Based Economy aspects into four dimensions. These dimensions are Innovation Systems, Human Resources Development, Information and Communication Infrastructure and Business Environment. Figure 8 shows the properties of these dimensions.

Figure 8: Dimensions of the APEC Framework for Knowledge Economy



Source: APEC, 2000.

APEC also makes some suggestions in the framework. There are three main suggestions in the report: Establishment of a "Knowledge Clearing House", Generation of "Igniting Policies" for Triggering the Transition to Knowledge-Based Economy and Inclusion of '"Knowledge-Based Economy Status Indicators" in the APEC Economic Committee's "Economic Outlook". Table 6 shows the aims and potential benefits of those recommendations.

Table 6: Aims and Potential Benefits of the Recommendations in the APEC Framework

Recommendation	Aim	Potential Benefits
Establishment of a "Knowledge Clearing House"	APEC Knowledge Clearing House (KCH) aims to facilitate the exchange of various types of knowledge (including statistical data, know-how, manuals, guidelines, et cetera) pertaining to the development of a Knowledge-Based Economy among member economies.	Reducing gap about knowledge between developing countries and developed countries, Providing benefits to both knowledge-taking countries and to knowledge-providing countries.
Generation of "Igniting Policies" for Triggering the Transition to Knowledge-Based Economy	This report provides ample information regarding the preconditions of and policies for Knowledge-Based Economy development	Being a reference for other activities, Reducing costs of searching.
Inclusion of '"Knowledge-Based Economy Status Indicators" in the APEC Economic Committee's "Economic Outlook"	APEC provides information on how APEC is progressing towards a Knowledge-Based Economy, both collectively and individually.	Providing information about how valuable efforts are supporting being knowledge-based, Comparing economies and activities.

Source: Prepared by data gathered from APEC, 2000.

An important aim of APEC is promoting cooperation about knowledge. Another framework to be examined is the OECD Framework.

3.3.2 OECD Framework

The OECD framework for knowledge economy was prepared in 1996 and the name of the report is “The Knowledge-Based Economy”. The aim of the OECD at that point was maximizing the well-being and performance of Knowledge-Based Economies through technological, scientific and industrial policies. The key terms used by the OECD are more highly-skilled labour, high-technology investments, high-technology industries and associated productivity gains. Knowledge distributions, employment, science systems and knowledge-related indicators are other topics studied within the OECD framework (OECD, 1996).

In the report, the OECD focuses on three main as aspects, which are Trends and Implications, Role of Science Systems in the Knowledge-Based Economy and Indicators of Knowledge Based Economy. Under the Trends and Implications title, of the OECD reports focuses on the following subtitles:

- Knowledge and economics,
- Knowledge codification,
- Knowledge and learning,
- Knowledge networks,
- Knowledge and employment and
- Government policies.

Under the title of Role of Science Systems in the Knowledge-Based Economy, the report focuses on the following subtitles:

- Knowledge production,
- Knowledge transmission,
- Knowledge transfer and
- Knowledge policies.

Under the title of Indicators of Knowledge Based Economy, the report focuses on the following subtitles:

- Measuring knowledge,
- Measuring knowledge inputs,
- Measuring knowledge stocks and flows,
- Measuring knowledge outputs,
- Measuring knowledge networks and
- Measuring knowledge and learning (OECD, 1996).

Under the title of knowledge and economies, the OECD focuses on the fact that knowledge has a great effect on economies. There is a need for incorporating knowledge into production processes. Knowledge codification requires understanding about "know-who, know-how, know-why, know-what". Under the title of knowledge and learning, it is expressed that there is a need for codified and tacit knowledge and a range of knowledge and skills. Considering formal education, the report emphasises the importance of learning by doing. Knowledge networks focus on sharing knowledge obtained with subgroups. There is a need for establishing networks for sharing knowledge in order to obtain significant benefits in the overall economy of the nation. Knowledge and employment focuses on having a highly-skilled workforce. The Government policies section focuses on the activities of governments during the transmission to a knowledge economy from a post-industrial economy. In this regard, the main priorities of governments are promoting organizational change, upgrading human capital and enhancing knowledge diffusion (OECD, 1996).

Under the title of Role of Science Systems in the Knowledge-Based Economy, the subtitle called knowledge production focuses on producing knowledge. On that subject, the report focuses on scientific knowledge as well as the distinctions between science and technology and Research and Development. Knowledge transmission mainly focuses on the education of individuals. Education and training of scientists and engineers, production of new researchers and providing a broad-based education are the main topics of that subtitle. Knowledge transfer is about the delivery of knowledge. Diffusion of knowledge, university/industry collaborations, and public or governmental components of the science system are main topics discussed under that

title. Government policies are a subtitle focusing on the activities of government regarding knowledge. The contribution of government, efforts to measure the contribution of scientific knowledge and the impact of science on the economy are topics discussed under that title (OECD, 1999).

The first subtitle under the title “Indicators for the Knowledge-Based Economy” is Measuring Knowledge. On this subject, the report states that, although some aspects of economy (such as GDP) are easy to measure, the impact of knowledge cannot easily be measured, as its impact cannot be estimated in advance. Measuring knowledge inputs, Measuring knowledge stocks and flows, Measuring knowledge outputs, Measuring knowledge networks and Measuring knowledge and learning are all discussed under the Measuring Knowledge subtitle. Measuring knowledge inputs, Research and Development expenditures, patents and technology balance of payments are discussed. In terms of Measuring knowledge stocks and flows, there are some important topics explained such as stock of knowledge capital, flows of knowledge, flows of embodied knowledge and flows of disembodied knowledge. In reference to the subtitle “Measuring Knowledge Outputs”, the report states, “The standard Research and Development-related measures do not necessarily show successful implementation or the amount and quality of outputs. Nevertheless, these input and flow indicators form the starting point for measuring knowledge outputs and for gauging social and private rates of return to knowledge investments”. Measuring knowledge networks focuses on networks of transmitting knowledge. Tacit forms of knowledge and innovation surveys are discussed under that subtitle. The Measuring knowledge and learning title focuses on education and training. Learning economy, social rates of return, private rates of return and micro-level or firm-level indicators are concepts defined under that subtitle (OECD, 1999).

3.3.3 World Bank Framework

In this section of the study, there are two important subtitles to be discussed. These are the Knowledge Assessment Methodology of the World Bank and the Knowledge Economy Index of the World Bank. In particular, the Knowledge Economy Index of World Bank must be discussed in detail for the purposes of this study.

3.3.3.1 Knowledge Assessment Methodology (KAM) of the World Bank

The KAM was developed by the World Bank Institute. It is designed in order to help member states understand the knowledge-based economic growth in their countries. The main aim is helping member states to perceive their development as a means for the achievement of economic growth. The KAM goes hand in hand with both the APEC and OECD frameworks and there are not significant differences between the KAM and those frameworks. It is stated in the KAM that the key element of economic growth is knowledge. In order to be successful at transforming into a knowledge economy, it is necessary to focus on the economic conditions that are ideal for conductive market transactions, modern information infrastructure, developing innovation capability, expenditure of Research and Development activities and long-term education expenses (Aflaz, 2014).

An important target of the KAM is helping the above-mentioned member states transform into knowledge economies. According to the World Bank (2011a) "The KAM consists of 148 structural and qualitative variables for 146 countries to measure their performance on the four pillars of the Knowledge Economy (KE): Economic Incentive and Institutional Regime, Education and Skills, Innovation Systems, and Information and Communication Infrastructure. The variables are normalized on a scale of 0 to 10, relative to other countries in the comparison group" (World Bank, 2011a).

There are six different display modes of the KAM. These are Basic Scorecard, Custom Scorecards, KEI and KI Indexes, Overtime Comparison, Cross-Country Comparison and World Map. According to the World Bank (2011a), the properties of these display modes are as follows:

- The **Basic Scorecard** uses 12 key variables as proxies to benchmark countries on the aforementioned four KE pillars and to derive their overall KEI and KI indexes. The scorecard allows comparisons to be made for up to three countries for the years 1995, 2000 and the most recent available year.
- The Custom Scorecard allows any combination of the 148 variables and can compare up to three countries or regions for the year 2000 and the most recent available year.

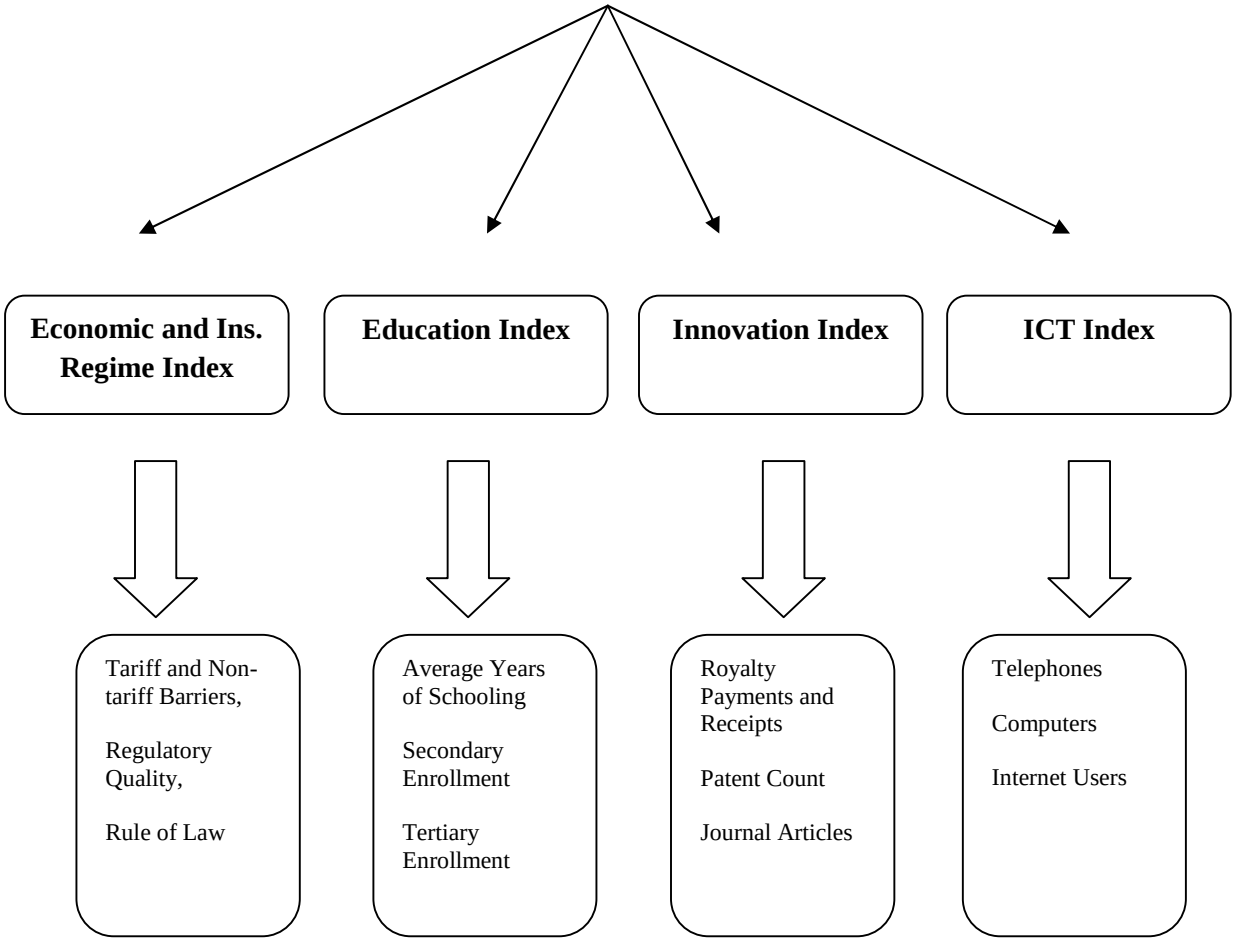
- The KEI and KI Indexes present performance scores in a sortable table format for all countries on the KEI and KI indexes, as well as on the four KE pillars,.
- The **Over Time Comparison** demonstrates the countries' progress on Knowledge Economy pillars and indexes from 1995, 2000 to the most recent year.
- The Cross-Country Comparison allows bar-chart comparisons of up to 20 countries on their KEI and KI indexes, while demonstrating the relative contribution of the different KE pillars to the countries' overall knowledge readiness.
- The World Map provides a colour-coded map for a global view of the world's KE readiness for 1995, 2000 and the most recent year (World Bank, 2011a).

Another report published by the World Bank states, "The KAM is a user-friendly interactive Internet-based tool that provides a basic assessment of countries and regions' readiness for the knowledge economy. It is designed to help client countries identify problems and opportunities that they may face, and where they may need to focus policy attention or future investments, with respect to making the transition to the knowledge economy. The unique strength of the KAM lies in its cross-sectoral approach that allows a holistic view of the wide spectrum of factors relevant to the knowledge economy" (World Bank, 2011b).

3.3.3.2 Knowledge Economy Index (KEI) of the World Bank

In the KEI, there are 109 structural and qualitative variables measured for 146 countries. The aim is measuring the performance of these countries. There are four main knowledge economy pillars, which are Economic Incentive and Institutional Regime, Education and Training, Innovation and Technological Adoption, and Information and Communications Technologies (World Bank, 2015). Figure 9 illustrates these pillars.

Figure 9: Knowledge Indexes



Source: World Bank, 2013.

In this part of the study, all of these sub-indexes will be explained in detail.

3.3.3.3 Sub-Indexes of the KEI

The following sections are designed to analyse the four sub-indexes of KEI in detail.

- **Economic and Institutional Regime**

The first sub-index of the KEI is Economic and Institutional Regime. It is a known fact that knowledge economy is important for economic growth. This fact makes it compulsory for governments to make incentives for sectors related to knowledge. Aside from private sectors,

governments are obliged to realize the importance of knowledge in public spheres. The development of modern states depends heavily on the success of knowledge through education, modernization of public spheres and supporting scientific activities. Governments have abilities for the development of knowledge. To this end, governments must manage to establish a supporting environment for knowledge. Advanced economies in particular focus on technology, science, education and similar programs. This is also important for developing countries (Vedmetskaya, 2013). The following table shows the sub-indexes of the Economic and Institutional Regime Index.

Table 7: Variables of the Economic and Institutional Regime Index

Tariff & Non-Tariff Barriers	The first variable, tariff and non-tariff barriers, as described by Heritage Foundation, provides a measure of the degree of competition, and is a composite of the rating on the average tariff rate, non-tariff barriers, and corruption in the customs service. The other two variables have been chosen from WBI's Governance dataset
Regulatory Quality	Regulatory quality measures the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development
Rule of Law	Rule of law measures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts

Source: World Bank (2014).

In knowledge-based economies, governments have to take measures related to industry, education, technology and science. Activities concerning these areas will be supportive for the innovation systems of firms operating in the country. Moreover, governments must also focus on infrastructure. In particular, improvements to the infrastructure for information and communication technologies will have the desired results. Enhancing knowledge diffusion, promoting organizational change and upgrading human capital are other important policies associated with this topic (OECD, 1996).

- **Education Index**

Another index in the KEI is called the Education Index. Education plays a crucial role in all parts of life and it is important for both individuals and societies as a whole. Similarly, education is a term that has great significance for human resources. The importance of education is a result of that fact that education makes an employee qualified. In a knowledge-based economy, well-educated people support innovation processes. Information society development goes hand in hand with science (Lopes, 2005).

In knowledge economies, there is a struggle for qualified employees among firms and managers, which can be called a "war for talent". Firms offer many incentives for talented people such as high salaries and many other enticements. Employing talented people results in success at competence, function and performance (Brown, 2008: 13).

Managers and firms look for two important properties when employing people in knowledge economies. One of these properties is that it is more beneficial if the employee being hired is young. The other important property is the level of competence. In terms of both education and experience, it is important to be skilled. Highly-skilled workers predominantly earn high salaries and can earn additional incentives. One of the most important properties of these people is that they are well-educated. Not only education, but also organizational training courses can result in success in terms of having high skilled workers (OECD, 2001).

In addition to school systems, life-long learning is also seen as a crucial factor. It is especially important for the development of knowledge of workers. This helps workers to use their capabilities for using knowledge and to develop that capacity. Knowledge-oriented societies deal with life-long learning. It can be claimed that this situation also supports formal education systems. As a result of life-long learning activities, problems with the lack of formal education will be solved. In a knowledge economy, life-long learning may also be seen as more important than formal education. In a knowledge economy, it will not be sufficient just to memorize knowledge and procedures. Moreover, there is a need for actually using and developing knowledge. Due to the rapidly changing nature of knowledge in today‘s economy, it is now a necessity to develop the knowledge of workers. Moreover, there is a need for knowledge at all times. As time passes, the need to develop new knowledge increases (OECD, 2009).

In the next section, the Adult Literacy Rate, Secondary School Enrolment and Tertiary Enrolment sub-indexes will be examined. The following table details the sub-indexes of the Education Index

Table 8: Variables of the Education Index

Adult Literacy Rate	Adult literacy rate refers to the percentage of people aged 15 and above who can, with understanding, read and write a short, simple statement on their everyday lives. Gross enrolment ratio is the number of people enrolled in education, regardless of age, divided by the population of the age group that officially corresponds to the level of education indicated.
Secondary School Enrolment	Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented

	instruction using more specialized teachers.
Tertiary Enrolment	Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.

Source: World Bank (2014).

Repeated and memorized knowledge obtained in schools should be used and developed in real life activities. During formal education activities, it may not be so popular to perform experiments and real-life activities (Brown, 2008).

- **ICT Index**

There is a close relationship between technology and knowledge economy. The use of new technologies is especially beneficial for firms in knowledge economies. In this regard, information and communication technologies have greater importance for usage, storage, transmitting activities etc. Internet usage and many other developments make it easier for firms to operate in knowledge economies (Lopes et.al. 2005).

When information and communication technologies develop, know-why and know-what will be easier. A well-designed infrastructure of information and communication technologies provides solid foundations for firms operating in the country. Due to these technologies, it is easy today to transmit knowledge from one point to another point in a matter of seconds (OECD, 1996).

In addition to business life, information and communication technologies are also important for the everyday lives of people. By using these technologies, people make their lives easier and more entertaining. These technologies are especially beneficial for learning new information from important sources such as the internet. Thanks to the internet, there is no longer the need for searching for knowledge from various books, which can take significant time and effort. Moreover, it is difficult to learn knowledge from various sources. On the other hand, as a result of the internet, one can obtain knowledge in seconds by accessing information from

different libraries at the same time. Therefore, people must be able to use technology for gathering knowledge (Craig, 2009).

According to the OECD (1996) “Electronic networks now connect a vast array of public and private information sources, including digitised reference volumes, books, scientific journals, libraries of working papers, images, video clips, sound and voice recordings, graphical displays as well as electronic mail (OECD, 1996). Moreover, these technologies are also good for bringing and developing intellectual capital (Kok, 2007). The following table summarizes the ICT Index

Table 9: Variables of the ICT Index

Number of telephone lines per 1000 people	Telephones per 1,000 populations is the sum of telephone mainlines and mobile phones and provides a better indicator of connectivity than either of them in isolation.
Number of computers per 1000 people	Computers per 1,000 population refers to the number of self-contained computers designed to be used by a single individual and is an indicator of personal computer penetration and use of relatively new technology for information processing.
Number of Internet Users	Internet users per 10,000 population refers to the number of computers with active Internet Protocol (IP) addresses connected to the Internet and is used as an indication of how well a population has advanced to the level of adapting and using advanced communication channels (Internet) to serve its priorities.

Source: World Bank (2014).

Developed information and communication technologies provide great support for firms. These technologies may be used in many ways. Communication, storing data about consumers, supplies and employees are some examples of how these technologies support firms. New technologies make it easier for firms to operate and provide a competitive advantage (Matos, 2013).

- **Innovation Index**

As described previously, innovation is a very important topic in a knowledge-based economy. Innovation can also be seen as a process starting with scientific research with further development. There may be many sources of innovation such as development of products or scientific research. On the subject of innovation, it is necessary to mention that technology is a term related with innovation. Moreover, there is a need for collaboration between many groups such as universities, firms, institutions etc. for the development of innovation processes (OECD, 1996).

In competitive environments and knowledge economies, innovation has become a core element for gaining competitive advantage (OECD, 2004). According to a report by the OECD (2001), technological change and innovation drive the development of the knowledge based economy through their effects on production methods, consumption patterns and the structure of economies. Both are closely related in recent growth performance (OECD, 2001). In relation to this, the sub-indexes Royalty Payments and Receipts, Patent Count and Journal Articles will be examined. Table 10 shows the Innovation Index.

Table 10: Variables of the Innovation Index

Royalty Payments and Receipts	These are payments between residents and non-residents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights (such as patents,

	copyrights, trademarks, industrial processes, and franchises) and for the use, through licensing agreements, of produced originals of prototypes, such as manuscripts and films.
Patent Count	Patents granted by the USPTO include utility patents and other types of U.S. documents, such as design patents, plant patents, reissues, defensive publications, and statutory inventions and registrations. The origin of the patent is determined by the residence of the first-named inventor.
Journal Articles	The number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.

Source: World Bank (2014).

4 DEVELOPMENTS IN THE NORTH CYPRUS ECONOMY AND KNOWLEDGE BASED INITIATIVES (1980-2014)

In order to examine and explain the development and application of knowledge economy variables in Northern Cyprus, it is essential to present some background information about the history, geography, demography and economy of the country.

4.1 Introduction

Cyprus is the third largest island in the Mediterranean after Sicily and Sardinia; it is the biggest island in the Eastern Mediterranean. It lies 65 km to the south of Turkey and 112 km to the west of Syria.

Over the centuries, the island has been ruled by the Assyrians, Phoenicians, Persians, Greeks, Egyptians, Romans, Byzantines, Franco-English, Franks, Venetians, Ottoman Turks and British. After an unsuccessful and violent cohabitation experience under an unworkable constitution (Mallison, 2005), Turkey become guarantors of the constitution and territorial integrity of the Republic under the 1960 'Territory of Alliance and Guarantee'. The island was divided into two territories; the South inhabited by Greek Cypriots and North by Turkish Cypriots.

The Turkish Cypriot Community established its own state in 1983 under the name of the Turkish Republic of Northern Cyprus (TRNC, North Cyprus), which is recognized only by Turkey. International diplomatic efforts are underway in order to find a peaceful solution to the Cyprus problem (Sagsan and Yıldız, 2010). North Cyprus has an area of 3,355 square kilometres, which amounts to around a third of the island. The de-jure population of the TRNC was estimated to be 274,462 in mid-2008. The official language is Turkish but English is widely spoken and understood in official and commercial circles. The predominant religion is Islam, with Muslims making up 99% of the population.

The TRNC has a typical Mediterranean climate with about 300 days of sunshine per year. It enjoys dry, warm summers and mild winters. Like other small islands, North Cyprus has also capitalized on its favourable climatic and geographical advantages to launch tourism-based sustainable development (Kakazu, 1994).

4.2 Country Profile

Cyprus is the third largest island in the Mediterranean, after Sicily and Sardinia, and is located in the north east region of the sea. Geographically, it is perfectly situated at the crossroads of Europe, Asia and Africa. The island has played a crucial role in the history of the eastern Mediterranean. The first settlers on the island were the Hellenic people (325-58 BC), the Byzantines (330-1191 AD), the Lusignans (1192-1489) and the Venetians (1489-1571) (http://www.kypros.com/Cyprus/cyhistory.htm, Cyprus Brief History, 25, 02, 2015)

In 1571, the Ottomans obtained the island and the Turkish occupation lasted until 1878, when the Turks granted Cyprus to Britain, and it became part of the British Empire in 1925. After the Second World War was over, rebellion and violence against the British rulers by the Greek Cypriots started to occur, as the Greek Cypriots believed the island should be joined to Greece. To solve the ongoing problem, the UN attempted to find ways to create an independent Cyprus in 1957, and this was established with the Treaty of Zurich, in 1960, signed and supported by Britain, Greece and Turkey, who all agreed to maintain the rights of the Turkish Cypriot community.

The independent 'Republic of Cyprus' was founded in 1960 and became the 99th member of the United Nations (UN). Consequently, Britain, Greece and Turkey had limited rights to intervene in internal affairs, and the constitutional framework of Cyprus recognized the equality of the Turkish and Greek Cypriots. The 1960 Cypriot laws were based on the equal political status and participation between the two communities, which suggested a prudential government system. This meant that the Greek Cypriot President and the Turkish Cypriot Vice-President would be elected by their own communities every five years. Furthermore, each side had a veto power as a form of insurance for the minority community.

Independence did not ensure peace. Serious problems concerning the functionality and interpretation of the constitutional system appeared immediately. These problems reflected the sharp bi-communal division in the constitution and the historical and continuing distrust between the two communities. In November 1963, President Archbishop Makarios (the Greek Cypriot leader) unilaterally preceded a series of constitutional reformations formulated to remove the mechanism to protect the basic rights of Turkish Cypriots.

However, as a result of the Turkish Cypriots' objection to a series of constitutional reformations, the Turkish Cypriot people became the target of armed attacks in December 1963. In 1963, the Turkish Cypriot ministers withdrew from the cabinet and their participation in the Central Government came to an end (Meyer, 2000). The Turkish Cypriot members of the government had by now withdrawn, creating an essentially Greek Cypriot administration in control of all state institutions. After the partnership government collapsed, the Greek Cypriot led administration was recognized as the legitimate government of the Republic of Cyprus at the debates in New York in February 1964 (Cyprus-Mail, 2014). Turkish Cypriots formed paramilitary groups to defend the enclaves, leading to a gradual division of the island's communities into two hostile camps. The violence had also seen thousands of Turkish Cypriots attempt to escape the violence by emigrating to Britain, Australia and Turkey (Boroviec, 2000).

4.2.1 History and Geography

Cyprus is strategically located in the eastern part of the Mediterranean Sea and is the third largest island in the Mediterranean Sea, after Sicily and Sardinia. The island is about 65 kilometres south of Turkey, 103 kilometres of Syria, 386 km north of Egypt and the Suez Canal and 800 km south-east of the Greek mainland (Joseph, 1997). It covers an area of 9,851 square kilometres and the island is divided between the Greek Cypriot South and Turkish Cypriot North. The Turkish Republic of Northern Cyprus (TRNC) controls an area of 3,355 square kilometres, which covers 37% of the island. The island also contains two British sovereign military base areas of 254 square kilometres. According to the census of 1960, the population of island was about 77 % Greeks, 18.3%Turks and 4.7% other ethnic groups, such as Maronites, Americans and Latins (Necatigil, 1993). The total population of Cyprus is estimated to be 792,604 (World facts, 2008). The Greek Cypriots are predominantly Orthodox Christians and speak Greek. On the other hand, Turkish Cypriots are of the Muslim faith and speak Turkish. Because of its geopolitical position, Cyprus has often been the centre of political conflict.

Ozçelik (2013) stated that the Cyprus conflict could be analysed on different geostrategic levels, each with cross-cutting historical and psychodynamic implications. At one level, it is an inter-communal conflict that began as a colonial struggle against British rule. At another level, it

is a regional conflict because of the relationship between Greece and Turkey over territory and resources in the eastern Mediterranean as well as their relationships with the two communities on the island. It is also an international conflict that involves superpower politics as well as international and regional organisations such as the United Nations and European Union. Cyprus was colonized in the thirteen century BC by Aegean and Greek settlers. Although many violations and periods of foreign rule have occurred, the Greek language and culture became dominant.

Throughout the medieval period, Cyprus was controlled by Western countries. In 1571, the island was overthrown by the Ottoman Turks. During the Ottoman period, the Greek and Turkish populations lived together relatively peacefully (Bahçeli, 1990). The Greeks and Turks cooperated to protest against Ottoman rule when it was accused of enormous taxation (Dood, 1993).

During the early period of British Administration (1878-1925), the two ethnic communities lived in relative functional harmony, with physical intermixing and social tolerance prevalent, but without integration (Fisher, 1992). The Cyprus conflict can be defined by the Greek Cypriots wanting to achieve the Megali Idea: Enosis (unification of the island with Greece) coupled with the Turkish Cypriots' antagonistic movement (Sonyel, 1997). Turkish Cypriots coordinated themselves with the British, adapted Taksim (partition) as a countermeasure to Enosis and formed the paramilitary organisation TMT (Turkish Resistance Organisation) to defend their interests (Fisher, 1992).

After the acute and violent inter-communal fighting and the anti-British attempt by the Greek Cypriots, a solution was negotiated by Britain, Turkey and Greece and resulted in the London and Zurich Accords in 1959 and 1960. The Zurich Treaty prohibited Enosis and Taksim and suggested a bi-communal/federal solution for the island. Britain, Greece and Turkey maintained the right to intervene, unilaterally or together, in order to restore the state of affairs on the island (Ozçelik, 2013).

4.2.2 Political Conditions

After the independence of Cyprus in 1960, both Greek and Turkish Cypriots shared power in the government of the 'Republic of Cyprus', but this constitutional arrangement came to an end after

the brutal attacks by Greek Cypriots (EOKA) on Turkish Cypriots in December 1963. Enosis (unification with Greece) was the main aim of the Greek Cypriots. The Turkish Cypriots were aware of their threatened position and feared that there would be no rights left for them if the objective of Enosis was achieved by the Greek Cypriots.

Economic and social division of island had occurred before 1974, with the breakdown of the constitution in 1963. The intervention of Turkey in 1974 was the most important turning point for the island and its economy. Turkey intervened on the island to protect and to secure the lives of the Turkish Cypriots. To prevent any social interruption, Turkey supported the Turkish Cypriots in organizing their economic activities after 1974. The Turkish Lira (TL) was substituted for the Cyprus Pound (CYP) for domestic transactions and as a result of this; the North Cyprus economy imported the inflation of the Turkish economy and the effects of the devaluation of the TL. Turkey also supported the North Cyprus economy with periodic economic protocols, especially for infrastructural issues.

Since 1974, the economy in North Cyprus has experienced a rapid change and reasonably high growth rate, in spite of the political difficulties caused by lack of recognition. The North Cyprus economy is typical of other island economies, including features such as limited natural resources, transportation and energy problems. (Statistical Yearbook, 2003). Their limited economic size also means that states have reduced opportunities to take advantage of economies of scale, which tends to lead to high unit costs. Small island developing states, therefore, must devote a large proportion of their scarce financial and human resources to providing basic infrastructure and services. These countries also suffer from particular diseconomies of scale (Commission on Sustainable Development, 1996).

The aim of the development policy in North Cyprus is the realization of structural adjustment required for the achievement of the highest possible rate of growth compatible with the maintenance of economic stability, a more equable distribution of national income and an improvement in the standard of living. For the recognition of these targets, long-term plans and annual programs have been prepared and put into action since 1977, which marked the beginning of the planning period. (2002 Year Program, 2002).

4.3 Developments in the North Cyprus Economy

After the 1980s, the North Cyprus economy began to adopt a liberal market structure. The economy in North Cyprus is dominated by the services sector (69% of GDP in 2007), which includes the public sector, trade-tourism, transport-communication, financial institutions, ownership of dwellings, business and personal services, public services and import duties (SPO, 2008).

Over the past decade, the northern part of Cyprus has experienced a considerably improved economic performance. The tourism sector and rental sales have the biggest share in this significant improvement on production and performance of the economy. The northern part of Cyprus is a relatively small island community on the periphery of the EU and is based on low-technology industries.

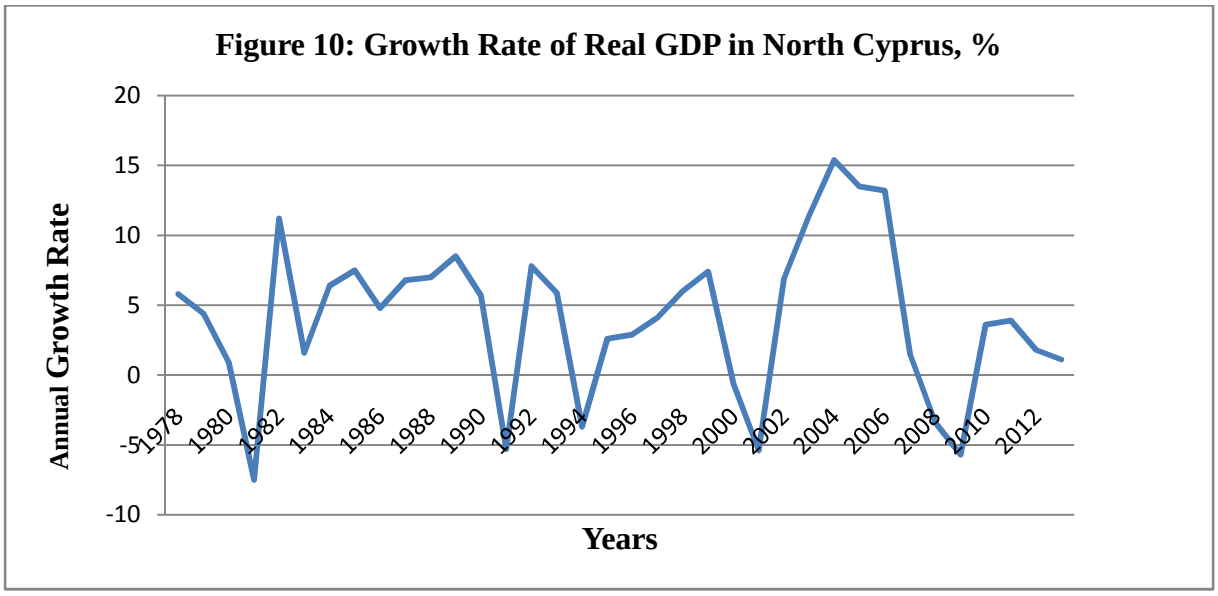
With its strategic geographical location between the three continents, the northern part of Cyprus could easily provide access to the EU market and to other international markets in the south eastern Mediterranean. On the other hand, having a small market makes it easy to adapt to new technologies/techniques and methods.

The Turkish Lira (TL) is the official currency used in the area, where the stability of the macro-economy has shown positive progress in recent years (YAGA 2015).

The following sections discuss the North Cyprus economy, especially focusing on the real GDP growth, inflation rates, interest rates, exchange rates, investment, foreign trade, tourism, education, public sector and foreign aid.

4.3.1 Real GDP Growth

The North Cyprus economy experienced high growth rates over a period of time, but this was not continued during the investigated period. Fig 10 presents the detailed annual growth rate of real GDP in North Cyprus from 1978 to 2013.



Source: State Planning Organisation, Economic and Social Indicators, 2014.

North Cyprus experienced significant contraction periods, especially in 1981, 1991, 1994, 2000 and 2009. As a result, the country was faced with unstable economic conditions during the establishment period of the Turkish Republic of Northern Cyprus.

From 1985 to 1990, North Cyprus was faced with strong growth rates in real GDP, such as 7.5% in 1985 and 8.5% in 1989. However, in 1991, there was a contraction in the economy and real growth rate dropped by 5.3%. This sharp decline in real growth of GDP was mainly attributable to two factors; the failure of the major investor Asil Nadir at the end of 1990 and the Gulf War in 1990-1991. Asil Nadir was the only major foreign investor in North Cyprus in the 1980s. He was the chairman of a large multinational company, Poly Peck International, and invested generally in industry, citrus production and tourism. Almost 8,000 people were employed in Nadir's companies. However, in 1990, Nadir's investments collapsed and the North Cyprus economy was heavily affected by his financial difficulties. In 1990-1991, the Gulf war was the other important factor, which had an adverse effect on the North Cyprus economy.

From 1992 to 1994, the North Cyprus economy exhibited sustained growth. In 1992, annual growth of real GDP was 7.8% but it fell to 5.5% in 1993. In 1994, the North Cyprus economy again collapsed and real GDP growth fell by 3.7%. In 1994, Turkey experienced a significant currency crisis. As a result of the currency crisis in Turkey, the North Cyprus economy became heavily affected and experienced economic contraction. In addition to the currency crisis, in North Cyprus, the bankruptcy of two privately-owned commercial banks created further problems in the financial market. Furthermore, a new law was issued by the European Court of Justice and EU member states based on agricultural products. Agricultural production was the major export product of the North Cyprus economy. In 1994, 25.7% of total exported products were agricultural products (SPO, 2013). However, according to the new law, North Cyprus (the unrecognised area of the island), could not export agricultural products unless there was a certificate stating proof of origin (EUR1), which could only be provided by the Greek Cypriot authorities (Chaltabaeva, 2003). Under the circumstances, it was impossible for Turkish Cypriots to obtain this certificate from South Cyprus. This decision made by the European Court of Justice imposed an embargo on the North Cyprus economy. Inevitably, it was faced with dramatic decline in annual growth of real GDP as a result of the three unfavourable situations detailed above.

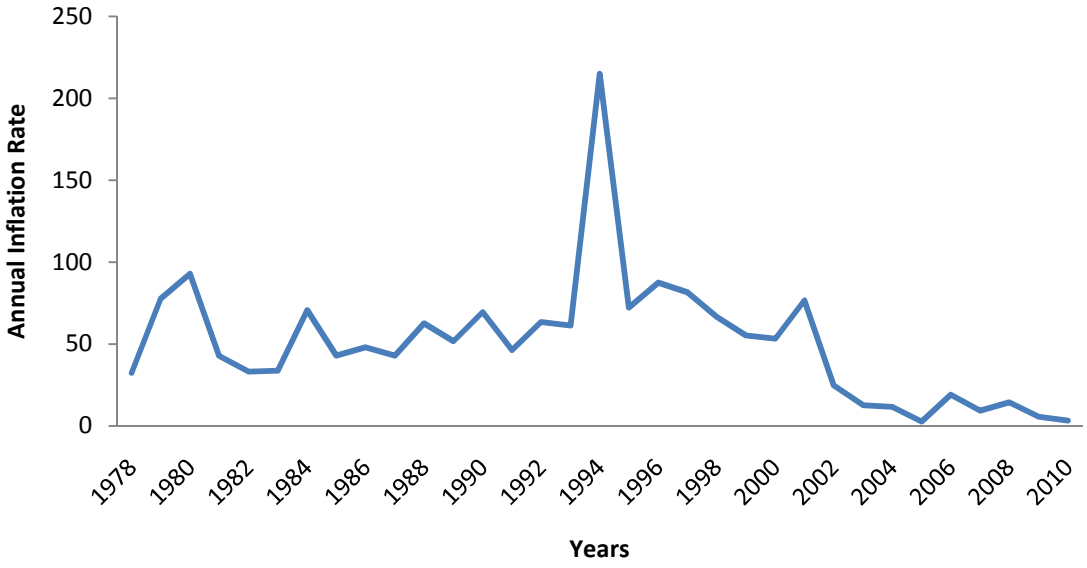
Nevertheless, annual real GDP growth did not fall continually. In 1995, economic growth increased by 2.6%, in 1997 reached 4.1% and peaked at 7.4% in 1999. However, annual GDP growth dramatically dropped to the level of 0.6% in 2000 and continued to decline by 5.4% in 2001, caused by the negative impact of economic crises in Turkey. In addition to the economic contradiction, the financial sector was substantially damaged and commercial banks weakened confidence in the financial system. In 2000 and 2001, the market was faced with the failure of almost 10 commercial banks, which significantly damaged the financial system and credit creation.

However, from 2002, the North Cyprus economy experienced positive growth as a result of the Government’s timely intervention. The annual growth rate of real GDP increased by 11,4%, 15,4% and 13,5% in 2003, 2004 and 2005 respectively. Annual real GDP growth slowdown in recent years still has a positive trend but from 2012 to 2013, real GDP growth was only 1.1%.

4.3.2 Inflation Rate

Figure 11 shows the annual inflation rate in North Cyprus from 1978 to 2013. Between 1984 and 2002, the average inflation rate was around 51%, which clearly indicates that a high rate of inflation has been observed in North Cyprus.

Figure 11: Inflation Rate in North Cyprus (1978-2013), %



Source: State Planning Organisation, 2014.

As can be seen from Figure 11, the inflation rate increased first (in 1978) then decreased, followed by small fluctuations occurring continually until 1993. In 1994, as a result of the economic crisis in Turkey, the Turkish Lira devalued, which led to Turkey's inflation problem having an effect on the North Cyprus economy. As a consequence of the 1994 currency crisis, the inflation rate increased sharply and reached 215% in North Cyprus.

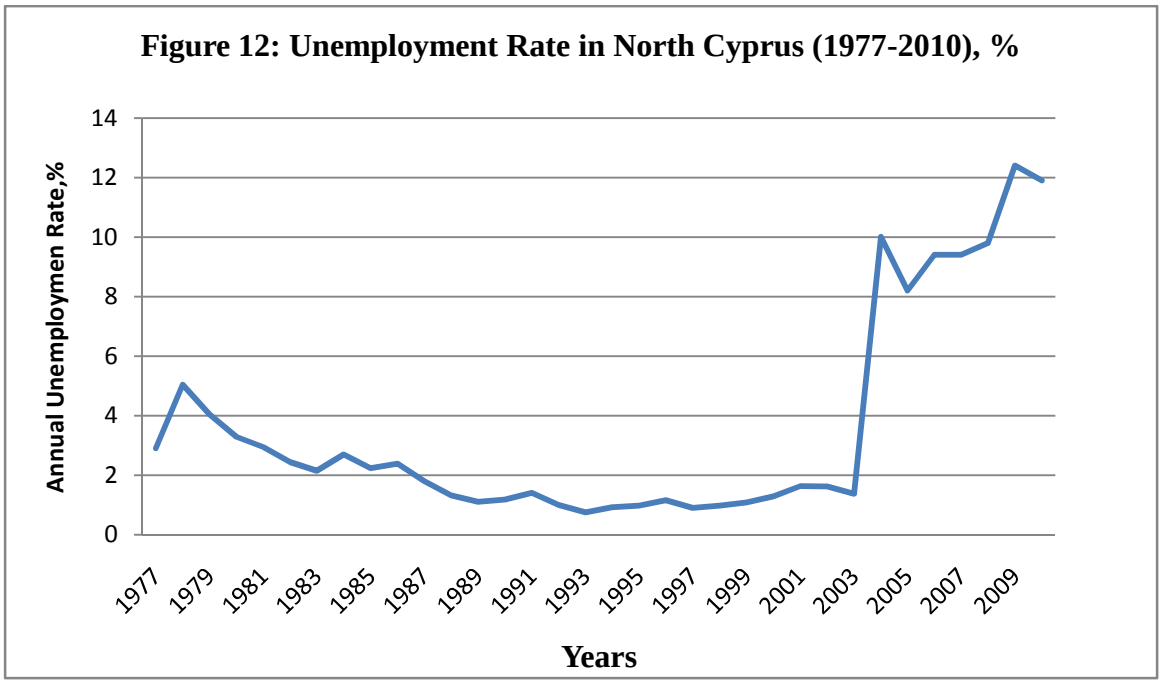
The devaluation of the Turkish Lira added to the tremendous inflation rate changed the preference of residents away from Turkish Lira towards foreign currencies, especially the British pound sterling.

As a result of a three year anti-inflation program, which was supported by the IMF and implemented by Turkey, the inflation rate slowed down and started to follow a negative trend until 2010. As a consequence of the success of the anti-inflation stabilization program in Turkey, the inflation rate declined and reached its lowest rate in 2005 with 2.7%.

4.3.3 Unemployment Rate

Figure 12 displays the annual unemployment rate from 1977 to 2010. The unemployment rate followed a negative trend until 2004. In total, 19% of the working population was working for the government (SPO, 2013). Statistical data collection techniques for unemployment are based on the ratio of registered unemployed to labour force. Unfortunately, in the market, those who were unemployed were not aware of the importance of registration and they considered registration to be something unnecessary. Because of this, the registered unemployed figures were actually less than the real number of unemployed in the economy. The unemployment rate that was announced by the government did not represent the actual rate of unemployment in North Cyprus.

In early 2004, the state planning organisation carried out a household survey, which deeply analysed the labour force activity in North Cyprus. After this study, the most accurate unemployment rate was announced by the government. Until 2003, the average annual unemployment rate in North Cyprus was 1.9%, while in 2004 the annual unemployment rate dramatically reached 10%. As a consequence of changing the unemployment calculation method, the reason for a sharp increase in the annual unemployment rate from 2003 to 2004 become clear. Government authorities announced that, from 2004, the new method would be used to explain precisely the annual unemployment rate.



Source: State Planning Organisation, 2014.

The annual unemployment rate reached its peak in 2009 at 12.4% per year. In 2010, the annual rate of unemployment fell to 11.9%, which was still high compared with the average annual unemployment rate in the EU (3.9% in 2013) and the USA (7% in 2013).

4.3.4 Sectoral Distribution of GDP (1977-2013)

Table 11 displays the sectoral distribution of GDP from 1977 to 2013. Agriculture, Trade-Tourism and Public Services comprised a majority share of the GDP. The agriculture sector share of the GDP decreased from 16.4% to 5.3% in 1977 and 2013 respectively.

The Trade and Tourism sector contributed 21.2% of GDP in 1977, then declined and reached its lowest point in 2007, with 13.7%. However, it then recovered and reached 20.1% of GDP in 2013. The Trade and Tourism sector picked up in 1983 with 28.4% of the overall share of GDP in North Cyprus, which was also the establishment year of the Turkish Republic of Northern Cyprus.

On average. Public Services held 19% of total GDP during the investigated period. The highest share that the public sector had within the GDP can be seen in 2000, with 24%.

During the investigated period, the Industry and Construction Sectors increased until 1992, but this rising trend did not last very long. From 1993 to 2013, both sectors followed negative trends based on their share of the annual GDP.

The Transport-Communication Sector had a share of 6.8% of GDP in 1977, reached its highest share in 2002 with 13.2% and declined to 9.4% in 2013.

Table 11 Sectoral Distribution of Annual GDP in North Cyprus, %

Years	Agriculture	Industry	Construction	Trade-Tourism	Transport-Communication	Financial Institutions	Public Services
1977	16.4	9.7	4.1	21.2	6.8	3.1	19.9
1978	17.3	10.2	4.4	23.3	7.3	4	16.4
1979	16.2	10.1	5..7	23.6	9.8	3.4	16.3
1980	17	13.9	5.7	24.7	8.6	3.3	16
1981	27.1	10.8	5.7	24.9	7.9	3.5	17.4
1982	15.7	11.4	5.7	24.6	8.9	3.4	15.9
1983	11.7	10.8	4.4	28.4	7.9	5	16.2
1984	16.4	9	5.1	25.6	7.8	4.6	17.4
1985	20.9	9.3	4.3	24.5	7.7	4.1	14.7
1986	14.6	10.7	8.3	22.9	7	4.4	17.8
1987	12.7	11.5	8	23.5	7.2	4.6	16.6
1988	11.4	11.2	6.8	23.5	7.7	6.3	16.2
1989	10	13.8	6.8	23.3	10.2	5.7	14.7
1990	9.2	12.4	5.6	23.6	9.5	5.1	16.9
1991	8.3	13.5	7.1	20.8	8.4	6.6	19.3
1992	10.2	12.7	7.8	18.3	9	7.2	18.7

1993	10.8	11	6.5	20.8	8.6	6.7	18.7
1994	8.9	9.9	5.5	22.2	9.5	7	22
1995	10.2	13	3.7	18.6	8.7	11.2	20.6
1996	9.7	13.1	3	14.5	10.4	10.9	19.5
1997	7.1	13.4	4.4	16.5	10.5	9.4	19.2
1998	7.8	12.1	4.4	16.6	9.8	8.1	21.4
1999	8.1	10.6	4.1	17.1	11	6.4	22.6
2000	6.9	10.5	4.5	16.1	13	6.4	24
2001	7.4	11.4	3.6	15.4	12.5	8.7	18.6
2002	8.9	11.2	4.4	15.3	13.2	6.4	19.7
2003	9.4	10.2	5	16	11.8	6.1	21.6
2004	9.1	9.4	4.3	15.9	10.5	7.6	20.8
2005	7	9.2	5.4	17.6	10.7	6.4	20.5
2006	6.3	9.5	7.9	15.5	11	6.5	20.3
2007	6.3	9.4	7.9	13.7	11.6	6.7	21.8
2008	5.1	10.7	7.1	14.2	12.1	7	21.7
2009	5.6	9.6	6.5	14.3	11.1	7.1	22.3
2010	5.9	9.8	5.6	16	9.4	7.2	21
2011	5.6	8.6	6.3	18.7	8.5	7.2	19.9
2012	5.6	8.4	4.8	19.9	9.3	7.2	18.6
2013	5.3	8.4	4.9	20.1	9.4	7.6	17.7

Source: State Planning Organisation, 2014.

The share of the financial institutions sector to GDP was seen on average to be 6.3% within the investigated period. In 1995, the financial institutions sector picked up and reached 11.2% of total GDP. However, this share did not continue for a long time. From 1996 to 2013, it started to decline and reached 7.6% of annual GDP in 2013.

The Trade and Tourism Sector include wholesale and retail trade as well as hotels and restaurants. The transport and communications sector includes public highways, airways,

maritime transportation services, radio and television services, business and personal services. Public services includes education (10 universities have become an important source of foreign earnings).

Trade-Tourism, Transport-Communication and Public Services are the sectors that have increased in value and have improved their share of GDP within the investigated period.

5. RESEARCH METHODOLOGY

The study aims to analyse the impact of National Intellectual Capital on economic growth in North Cyprus. While doing this, the study will use the Knowledge Assessment Method (KAM), which measures the Knowledge Economy Index (KEI), an index developed and still used by the World Bank.

The KAM uses variables that are measured in different units and on different scales. To calculate aggregate knowledge economy indexes, as well as to simplify the graphical representation of the countries comparative performance, the study brings all the indicators to the same standard of measurement through the process of normalization. The normalization process starts with ranking the countries from 'best' to 'worst', using their actual scores on each variable and normalizing the scores on a scale of 0 to 10 against all countries in the comparison group.

$$\text{Normalized (u)} = 10*(1-(Nh/Nc)),$$

Where: Nh= number of countries with higher rank

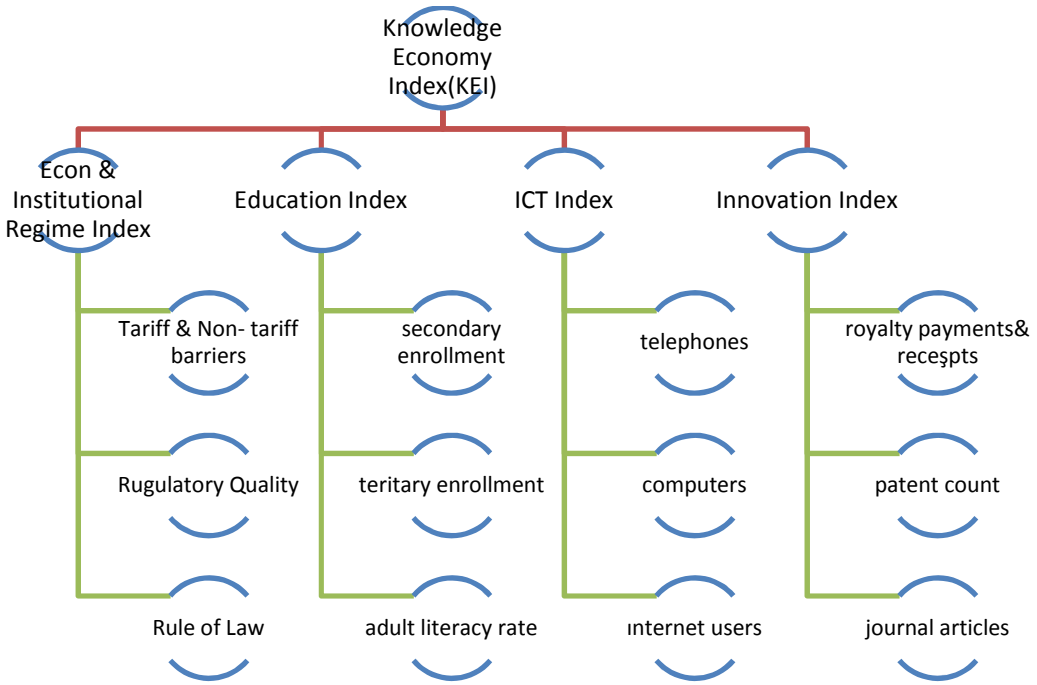
Nc= total number of countries in the sample, (www.worldbank.org/kam/usersguide)

The KAM makes a comparison based on 83 structural and qualitative variables that serve as proxies for the four knowledge economy pillars described above. All 83 variables are normalized on a scale from 0 (weakest) to 10 (strongest) and all 140 countries are ranked on an ordinal scale. The KAM therefore reports the relative performance of countries on the knowledge economy.

The KEI summarizes each country's performance on 12 variables corresponding to the four knowledge economy pillars (World Bank, K4D Program, and Measuring Knowledge in the World's Economies 2012).

While imposing the KAM for North Cyprus, the study also will use the same 12 variables for the computation of the KI. These four economy pillars and 12 variables can be seen in the figure below:

Figure 13 Knowledge Economy Index



Source: KAM Users Guide, The World's Bank Methodology for KEI, www.worldbank.org/kam.

The study will use data from the state planning organization while constructing the education index and ICT index and the study will also use the Cyprus Turkish Investment Development Agency's (YAGA) annual reports for the required data for the Economics and Institutional Regime Index and Innovation Index.

The State Planning Organization is a government office working under the umbrella of the Prime Minister's Office and regularly announces the main economic and social indicators, macroeconomic statistics and five-year development programs. Since 2008, YAGA has been regularly preparing the 'Doing Business Report: North Cyprus', which utilises the World Bank

Doing Business Methodology. The report contains a summary of research, which aims to measure the ease of doing business in the northern part of Cyprus as well as to provide a basis for benchmarking with other economies (YAGA, 2008).

The study will also investigate the source of productivity growth by using the Ordinary Least Squares method (OLS) of estimation, using the extended growth model and drawing attention to the role that national intellectual capital may have.

The study will use the following extended Cobb-Douglas production function to measure the impact of national intellectual capital on growth.

$$Y=T\ (K_{NIC\ +}K_{IT} + K_O)^{\alpha}\ L^{(1-\alpha)}$$

Where,

Y= output,

T =technology,

KNIC = national intellectual capital,

$K_{IT\ =}$ information technology capital,

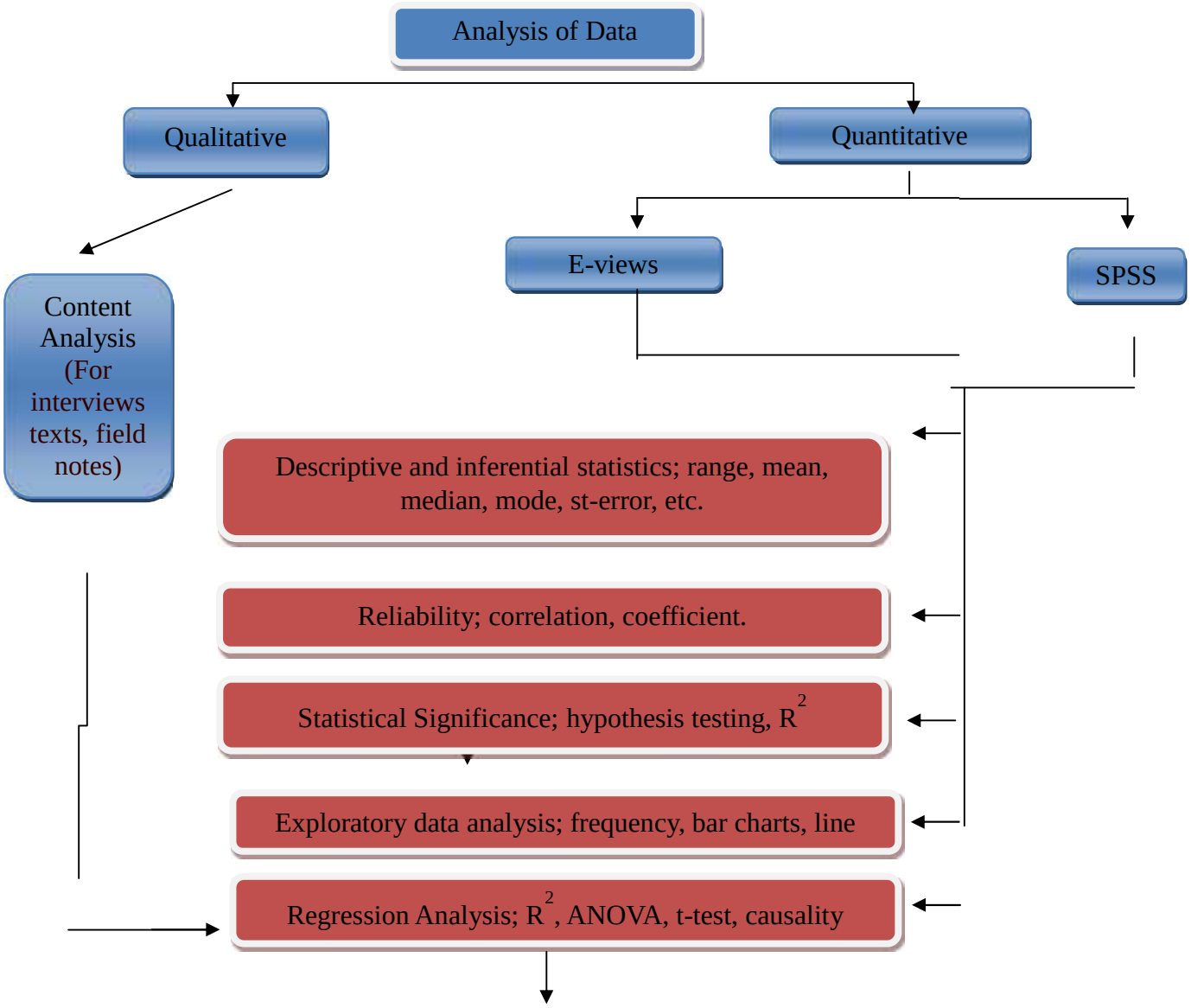
K_O = other capital,

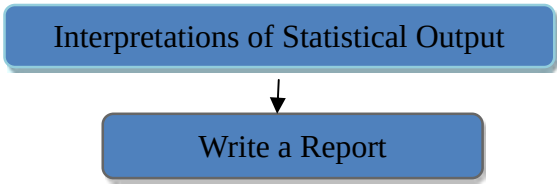
L = labour (Source: S.Kim, Y.Yoon, B.H. Kim, B.Y.Lee, H.J.Kang, 2006.)

The study will use the extended production function of Cobb-Douglas instead of the traditional production function for investigation of NIC and economic performance as well as detailed analysis of knowledge variables on economic growth. The extended production function also gives further information while analysing the effects of capital on economic growth.

The figure 14 summarizes the data analysis and the statistical techniques that will be used in this study.

Figure 14 Summaries of Data Analysis and Statistical Techniques Used in the Study





Source: Author

5.1 Defining the Knowledge Assessment Method (KAM)

The World Bank Institute's Knowledge for Development Program (K4D) measures knowledge with the knowledge assessment method (KAM). This program helps build the capacity of client countries to access and use knowledge to become more competitive and improve growth and welfare (www.worldbank.org/kam).

The World Bank's KAM is a useful tool that produces the Knowledge Economy Index (KEI), which represents a country or region's overall preparedness to compete in the Knowledge Economy (KE). The KEI is based on a simple average of four sub-indexes:

- Economic Incentive and Institutions Regime(EIR)
- Innovation and Technology Adaptation
- Education and Training
- Information and Communication Technologies(ICT) Infrastructure

The KAM has been widely used by government officials, policy makers, researchers, representatives of civil society and the private sector because its ease of use, transparency and accessibility.

The World Bank KAM also highlights the close relation between economic development and knowledge. The correlation between KEI and GDP per capita values also underlines the importance of knowledge on growth.

The first step in building a National Knowledge Economy is to understand your country's strengths and weaknesses, as well as the strengths and weaknesses of actual and potential competitors. Countries must determine their goals and develop policies and investments to achieve them (World Bank, 2005).

The Knowledge for Development program has developed an interactive benchmarking tool that allows countries to identify the problems and opportunities that they may need to focus policy attention on to encourage future investments. K4D has developed a four-pillar framework that countries can use as the basis for their transition to a knowledge economy.

5.1.1 The Four Pillars of the Knowledge Economy:

- Economic and Institutional Regime:

The country's economic and institutional regime must provide incentives for the efficient use of existing and new knowledge and the flourishing of entrepreneurship.

- Education and Skills:

The country's people need education and skills that enable them to create, share and to use the skills they have acquired effectively.

- Information and Communication Infrastructure:

A dynamic information infrastructure is needed to facilitate effective communication, dissemination, and processing of information.

- Innovation System:

The country's innovation system - firms, research centres, universities, think tanks, consultants and other organizations - must be capable of tapping the growing stock of global knowledge, assimilating and adapting it to local needs and creating new technology.

The KAM can also produce customized country analysis and cross-country comparisons on indicators selected by the user.

Each pillar of the knowledge economy has three indicators and represents the corresponding sub-indexes. Knowledge indicators are listed below in Table 12. The same indicators are also used to compile the knowledge economy index.

Table 12 Four Pillars of the Knowledge Economy to the KAM

Pillar	Indicator
Economic and Institutional Regime	• Tariff and non-tariff barriers • Regulatory quality • Rule of law
Education and Skill of population	• Adult literacy rate • Gross secondary enrolment ratio • Gross tertiary enrolment ratio
Information Structure	• Telephones per 1,000 people • Computers per 1,000 people • Internet users per 1,000 people
Innovation System	• Royalty payments and receipts, US$ per person • Technical journal articles per million people

	• Patents granted to nationals by the patent and trademark office per million people

Source: Author

5.1.1.1 Economic Incentive and Institutional Regime:

The first pillar of the KAM is the Economic and Institutional Regime, which consists of three indicators. The basic average of these three indicators constructs the economic incentive and institutional regime index, which is one of the sub-indexes of the knowledge economy index.

a. Tariff and non-tariff barriers:

Tariff and non-tariff barriers determine the trade openness of the country. Trade freedom is a composite measure of the extent to which tariff and non-tariff barriers effect the imports and exports of goods and services. The trade freedom score is based on two inputs:

- ✓ The trade-weighted average tariff rate and
- ✓ Non-tariff barriers (NTB)

Countries are often faced with different import goods and impose different tariffs on them. As a result, there are not unique rates of tariff in the country. The average tariff uses weights for each tariff based on the share of imports for each good. The weighted average tariffs are a purely quantitative measure and account for the calculation of the base trade freedom score using the following equation:

$$\text{Trade Freedom}_i = (((\text{Tariff}_{max} - \text{Tariff}_i) / (\text{Tariff}_{max} - \text{Tariff}_{min})) * 100) - \text{NTB}$$

Where Trade Freedom_i represents the trade freedom in country i; Tariff_{max} and Tariff_{min} represents the weighted average tariff rate (%) in country i. The minimum tariff is naturally zero percent, and the upper bound is set as 50%. An NTB penalty is then subtracted from the basic score. The penalty of 5, 10, 15, or 20 points is assigned according to the following scale:

- 20 - NTBs are extensively across many goods and services and/or act to impede a significant amount of international trade.
- 15 - NTBs are widespread across many goods and services and/or impede the majority of potential international trade
- 10- NTBs are used to protect certain goods and services and impede some international trade.
- 5- NTBs are uncommon, protecting few goods and services, and/or have very limited impact on international trade.
- 0- NTBs are not used to limit international trade.

Restrictive rules that prevent trade are widely diversified. The categories of NTBs considered as a penalty include:

- Quantity Restrictions - import quotas; export limitations; voluntary export restraints; import-export embargoes and bands; countertrade, etc.
- Price Restrictions - antidumping duties; countervailing duties; border tax adjustments; variable levies/tariff rate quotas.
- Regulatory Restrictions - licensing; domestic content and mixing requirements; safety and industrial standards regulations; packaging, labelling, and trademark regulations; advertising and media regulations.
- Customs Restrictions - advance deposit requirements; customs valuation procedures; customs classification procedures; customs clearance procedures.
- Direct Government Interventions - subsidies and other aid; government industrial policies; government-financed research and other technology policies; competition policies; government procurement policies; state trading; government monopolies, and exclusive franchises.

b. Regulatory Quality:

Regulatory quality is an indicator of the efficiency of government regulation of business. The quantitative score is derived from a range of measurements that calculate the ease of starting, operating, and closing a business.

The regulatory quality score of the country can be qualitatively measured and numbered between 0-100, where 100 indicates the freest business environment. The score is based on 10 sub-factors (all weighted equally);

- Starting business – procedures (numbers):
- Starting business - time (days);
- Starting business - cost (% of income per capita);
- Starting business - minimum capital (% of income per capita);
- Obtaining license – procedures (numbers)[7]:
- Obtaining license - time (days);
- Obtaining license - cost (% of income per capita);
- Closing Business - time (years);
- Closing Business - cost (% of estate); and
- Closing Business - recovery rate (cents of dollar)[8].

Each of these sub-factors is converted to a scale of 0 to 100, after which the average of the converted values is computed. The result represents the country's regulatory quality.

Each sub-factor is converted to a scale of 0 to 100 using the following equation:

$$\text{Factor Score}_i = 50*(\text{factor}_{average} / \text{factor}_i)$$

The above formula is based on the ratio of the country data for each sub-factor relative to the world average, multiplied by 50.

c. Rule of Law:

Rule of Law is a qualitative assessment of the extent to which a country's legal framework allows individuals to freely accumulate private property, secured by clear laws that are enforced effectively by the government. It measures the degree of a country's law, the level of rights protection and the extent to which those laws are respected.

[7] Obtaining a license indicates necessary procedures, time, and cost in getting construction permits.
[8] The recovery rate is a function of time and cost. However, the business freedom components uses all three sub-variables to emphasize closing a business, and dealing with licenses equally.

The more effective the legal protection, the higher a country's score. Similarly, the greater the chance of government nationalization of property or the less independent the legal system is, the lower a country's score.

Each country's Rule of Law score is assessed according to the following criteria:

- 100 - Private property is guaranteed by the government. The court system enforces contracts efficiently and quickly. The justice system punishes those who unlawfully confiscate private property. There is no corruption or expropriation/nationalization.
- 90 - Private property is guaranteed by the government. The court system enforces contracts efficiently. The justice system punishes those who unlawfully confiscate private property. Corruption is nearly non-existent, and expropriation is highly unlikely.
- 80 - Private property is guaranteed by the government. The court system enforces contracts efficiently but with some delays. Corruption is minimal, and expropriation is highly unlikely.
- 70 - Private property is guaranteed by the government. The court system is subject to delays and lax in enforcing contracts. Corruption is nearly non-existent, and expropriation is highly unlikely.
- 60 - Enforcement of property rights is lax and subject to delays. Corruption is possible but rare, and the judiciary may be influenced by other branches of government. Expropriation is unlikely.
- 50 - The court system is inefficient and subject to delays. Corruption may be present, and the judiciary may be influenced by other branches of government. Expropriation is possible but rare.
- 40 - The court system is highly inefficient and delays are so long that they deter people from using the court system. Corruption is present, and the judiciary is influenced by other branches of government. Expropriation is possible.
- 30 - Property ownership is weakly protected. The court system is highly inefficient. Corruption is extensive, and the judiciary is strongly influenced by other branches of government. Expropriation is possible.

- 20 - Private property ownership is weakly protected. The court system is so inefficient and corrupt that outside settlement and arbitration is the norm. Property rights are difficult to enforce. Judicial corruption is extensive. Expropriation is common.
- 10 - Private property is rarely protected and almost all property belongs to the state. The country is in such chaos (for example, because of ongoing war) that protection of property is almost impossible to enforce. The judiciary is so corrupt that property is not protected effectively. Expropriation is common.
- 0 - Private property is outlawed, and all property belongs to the state. People do not have the right to sue others and do not have access to the courts. Corruption is endemic.

5.1.1.2 Education and Skill of Population:

A modern and good quality education system is the fundamental building block for the socio-economic development and property of any society. It does not only provide return to the educated individuals, but also helps with facilitating economic development and growth, as well as decreasing poverty and bringing other social benefits to the society (SESRIC, 2010).

The country's people need education and skills that enable them to create, share and to use their skills effectively. The second pillar of the KAM is the Education and Skill of the Population and consists of three variables; adult literacy rate, gross secondary enrolment rate and gross tertiary enrolment rate. Before understanding the computation of this sub-index, the study will give more in-depth information about each indicator.

a. Adult Literacy Rate:

The World Bank defines an adult as a person aged 15 years and over. In addition, it defines the adult literacy rate as the total percentage of the population aged 15 and above who can, with understanding, read and write a short, simple statement on their everyday life. Generally, 'literacy' also comprises 'numeracy'' the ability to make simple arithmetic calculations. The adult literacy rate is calculated by dividing the number of literates aged 15 years and over by the corresponding age group population and multiplying the result by 100. The general formula for the calculation of the adult literacy rate as follows:

Adult Literacy Rate = (number of literate population aged 15 and over / total population of aged 15 and over) * 100

The UNESCO Institute for Statistics (UIS) is the official source of data used to monitor education and literacy targets associated with Education for All (EFA) and the Millennium Development Goals. The UIS collects data on youth and adult literacy through its annual survey on literacy and educational attainment. Adult literacy rates concern the population aged 15 years and older, while youth literacy rates cover the population between the ages of 15 and 24 years. According to the statistical data, the adult literacy rate is low in underdeveloped and developing countries when compared with developed countries. Thus, these statistics also show the clear relationship between education, literacy rate and development.

b. Gross Secondary Enrolment Rate:

Gross enrolment ratio is a statistical measure of education, which tries to determine the number of students enrolled in school at different grade levels: elementary, middle school and high school. UNESCO (2003) describes 'gross enrolment ratio' as the total enrolment within a country in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group corresponding to the level of education.

The general formula used by most countries to calculate Gross Enrolment Ratio (GER) is: the number of individuals who are actually enrolled in schools divided by the number of children who are of the corresponding school enrolment age. Gross Secondary Scholl Enrolment Ratio (GSER) considers children usually to be in the 12-17 age group.

GSER = (number of actual students enrolled in secondary school/ number of potential students aged 12-17) *100

c. Gross Tertiary Enrolment Rate:

Gross tertiary enrolment ratio (GTER), is the sum of all tertiary level students enrolled at the start of the school year, expressed as a percentage of the mid-year population in the 5-year age group after the official secondary school leaving age.

To calculate the Gross Enrolment Ratio, one must first determine the population of people of official school age for each level of education by reference to the theoretical starting ages and durations of the International Standard Classification of Education (ISCED97); Level 1 (primary education) and Levels 2 and 3 (secondary education) as reported by the country (Labe, 2010).

The population of the official age for tertiary education is the 5-year age group immediately following the end of secondary education. Then, the number of pupils or students enrolled in each level of education is divided by the population of official school age for that level of education, and the result is multiplied by 100.

Gross Tertiary Enrolment Ratio (GTER) can be calculated by the following formula. The ratio of

GTER = (actual number of pupil/student enrolled in higher education/ total number of school age population, aged 5 and above) *100

Tertiary education is the education at the third level (International Standard Classification of Education—ISCED—levels 5, 6, and 7), such as universities, teachers colleges, and higher professional schools—requiring as a minimum condition of admission the successful completion of education at the second level or evidence of the attainment of an equivalent level of knowledge. The Tertiary Enrolment Ratio and the Higher Education Enrolment Ratio can be considered the same thing. In this study, the Higher Education Enrolment Ratio will be used instead of the Tertiary Enrolment Ratio of the country.

5.1.1.3 The Innovation System:

The third pillar of the KAM is the innovation system. The concept of the innovation system stresses that the flow of technology and information among people, enterprises and institutions is key to an innovative process. It contains the interaction between the actors who are needed in order to turn an idea into a process, product or service on the market.

Systems of Innovation are frameworks for understanding innovation that have become popular, particularly among policy makers and innovation researchers, firstly in Europe, but now anywhere in the world, as the World Bank and other UN affiliated institutions accepted in the 90's.

Freeman (1995) defines the national innovation system as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technology'. According to Lundvall (1985), an innovation system is made up of the elements and relationships that interact in the production, diffusion and use of new and economically useful knowledge within the border of the nation. A general definition of a national innovation system is the national institutions, their incentives structures and their competencies, that determine the rate and direction of technological learning in a country (Patel and Pavitt, 1998).

The innovation system covers the activities of businesses, research centres, universities, advisory institutions and other organizations that adapt their activities to the preferences of increasingly demanding consumers (Strozek, 2014).

The country's innovation system - firms, research centres, universities, think tanks, consultants, and other organizations - must be capable of tapping the growing stock of global knowledge, assimilating and adapting it to local needs, and creating new technology.

The innovation system index can be measured by the three indicators, which are: Royalty and License Fees Payments and Receipts, Patent and Trademark Applications, and Scientific and Technical Journal Articles.

a. Royalty and License Fee Payments and Receipts:

Royalty and license fee payments are made for the right to use various kinds of intellectual property such as patents, trademarks, copyrights, industrial designs, utility models, and technical instructions, and there exist a variety of arrangements to do so (Gutterman, 1995).

Royalty and license fees are payments and receipts between residents and non-residents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights and for the use, through licensing agreements, of produced originals of prototypes (such as films and manuscripts).

b. Patent and Trademark Applications:

Patent and trademark applications shows the number of domestic patent documents (i.e., utility patents, design patents, plant patents, reissue patents, defensive publications, and statutory invention registrations) granted. (K4D, KAM, World Bank, 2014)

c. Scientific and Technical Journal Articles:

This indicator refers to scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. National Science Foundation, Science and Engineering Indicators. Sources: Thomson Reuters, SCI and SSCI; The Patent Board; and National Science Foundation, Division of Science Resources Statistics, special tabulations. (K4D, KAM, World Bank, 2014)

5.1.1.4 Information Infrastructure

Information infrastructure is one of the four pillars of the knowledge economy. According to the World Bank, the KAM basic scorecard information infrastructure is a dynamic process and is needed to facilitate effective communication, dissemination and processing of information.

Telephones per 1,000 people, computers per 1,000 people and internet users per 1,000 people are the three main indicators of information infrastructure. Information infrastructure is also called Information and Communication Technologies (ICT) in the literature on knowledge economy. In the KAM, this pillar is also known as the ICT Index.

The KEI is an index that is the average of the Education Index, Economics and Institutional Regime Index, Innovation Index and ICT Index.

5.2 Defining the Knowledge Economy Index (KEI):

The most commonly cited of the KAM's several indexes is the KEI. The KEI is a broad measure of the overall level of preparedness of a country or region for the KE. The other KAM indexes are the Knowledge Index (KI), economic and institutional pillar index, and the information and communications technologies (ICT) pillar index.

The KEI summarizes each country's performance based on 12 variables, corresponding to the four knowledge economy pillars. The KEI is constructed as the simple average of the normalized values of those indicators, from 0 to 10. A KEI score that is close to 10 implies a relatively good development of the four knowledge economy pillars as compared to other countries, while a score close to 0 indicates relatively poor development. (K4D, KAM, 2014)

Countries' investments on education, research, ICTs and better institutions are very important. Countries competing with each other in terms of knowledge may lose their ranking on the KEI, unless they are investing more than others are, or unless their investments are paying off faster than those of others.

According to the World Bank's Knowledge for Development Program, economic development and knowledge are closely related (FİG 4/ Page 7 REF 01). The KEI measures the accumulation of knowledge and the World Bank indicated that the correlation between KEI and economic development is around 87%. The K4D program report also showed that countries with higher KEI values tend to have higher levels of economic development and vice versa. In fact, positive correlation does not support a causal relationship between KEI and economic development. It is very reasonable that high-income countries are able to invest more on knowledge. Econometric analysis on the World Bank's report also showed that

accumulation of knowledge, as measured by KEI and growth, has a statistically significant causal relationship; accumulation of knowledge leads to future economic growth.

The World Bank uses the Knowledge Index (KI) and Knowledge Economy Index (KEI) to compare knowledge across the world's countries. According to the World Bank, the Knowledge Index (KI) measures a country's ability to generate, adopt and diffuse knowledge. KI is an explanation of the overall potential of knowledge development in a given country. The World Bank Institute constructed a methodology to measure the KI, which is also known as the Knowledge Assessment Method (KAM). The KAM is a general method for the KI when measuring knowledge. The KI is the simple average of the normalized key variables in the three Knowledge Economy pillars – education and human resources, innovation systems and information and communication technology (ICT). (See the World Bank- KEI, 2012)

The Knowledge Economy Index (KEI) takes into account whether the environment is helpful for knowledge to be used adequately for economic development. It is an aggregate index that represents the overall level of development of a country or region towards the Knowledge Economy. (http://siteresources.worldbank.org/INTUNIKAM/Images/KEIindex.jpg)

The KEI is calculated based on the average of the normalized performance scores of a country or region on all four pillars related to the knowledge economy - economic incentive and institutional regime, education and human resources, the innovation system and ICT. The economic incentive and institutional regime pillar includes tariff and non-tariff barriers, regulatory quality and rule of law. The education and human resources pillar includes average years of schooling, secondary enrolment and tertiary enrolment. The innovation systems pillar includes royalty and license fees payments and receipts, patent applications granted by the US Patent and Trademark Office and scientific and technical journal articles. (Powell and Snellman (2004) and OECD (1996)

The KI is an economic indicator prepared by the World Bank in order to measure a country's ability to generate, adopt and diffuse knowledge (World Bank, 2011b).

5.3 Data Collection

This section begins with an outline of the methodological framework used for the collection of data. Data was collected from the State Planning Organization (SPO), Prime Ministry (PM), Official Receiver and Registrar Office (ORRO), Telecommunication Department (TD) and YAGA.

The data collection process was completed over a twelve-week period. In doing so, periodic journals from SPO, PM, YAGA and TD were used to construct a data poll for the necessary variables. A personal interview with the head of ORRO was conducted and necessary information was collected. With limited data, the study aimed to implement the KAM to construct the KEI and KI for North Cyprus in 2012 and the study also aimed to apply the extended Cobb-Douglas production function for the period 2000-2013.

5.4 Application of the KAM on North Cyprus

Given its ease of use, transparency and accessibility, the KAM has been widely used by government officials, policy makers, researchers, representatives of civil society and the private sector. It provides valuable background information for policy dialogues on the knowledge economy between the World Bank and officials from client countries. The easily understood graphical interface allows policy makers to quickly identify their country's challenges and opportunities, and to pinpoint areas where policy attention or investment may be required. Benchmarking analysis from the KAM has been used to produce reports on the knowledge economy, such as K4D's Building Knowledge Economies: Advanced Strategies for Development (World Bank Institute, 2007), a regional report on the knowledge economy in the Middle East and North Africa, as well as detailed country reports on China, Finland, India, Japan, Korea, Mexico, Senegal, Tanzania and Qatar. (World Bank, 2005)

The KAM is consistently measured by the World Bank. The KAM is also regularly updated with data from a variety of sources. While measuring the KAM, the World Bank's internal databases and published datasets are used as well as other publicly accessible data, which is obtained from alternative organizations such as Freedom House, the Heritage Foundation, the International Labour Organization, the International Telecommunication Union, the U.S. Patent and Trademark Office, UNESCO's Institute for Statistics, and the World Economic Forum.

5.5 Constructing the KI and KEI for North Cyprus

The World Bank's KAM method was used to compute the KEI and KI of North Cyprus. The KAM also helped to determine the education index, ICT index, innovation index and economic incentive and institutional regime index. The KEI of North Cyprus was ranked according to the global index.

In order to assess the positions of different countries in the knowledge economy development, Table 13 contains the ranking list according to the score of the aggregate KEI index. The ranking list normally includes 146 countries; however, for this study, North Cyprus was added to the list and the rankings were determined on the basis of 147 countries.

To calculate the aggregate knowledge economy index, the study brings all the indicators to the same standard of measurement through the process of normalization. The KEI summarizes each country's performance on 12 variables, corresponding to the four knowledge economy pillars. The KEI and KI for North Cyprus have been computed with the KAM method. Firstly, the four pillars of the KEI were computed separately and then the simple average of them gives the KEI index value. In terms of a simplicity comparison, the study computed the KEI of North Cyprus only for 2012. Each pillar has three variables. Actual values of variables were collected from the SPO, ORRO and Prime Ministry. Each variable was processed in the normalization procedure and normalized values were computed. Each sub-index was computed with the simple average of normalized values of corresponding variables.

The three key indicators represent each pillar. The KEI is calculated as the simple average of normalized results in all four pillars. Normalization means the expression of different indicators using the same standards for measuring and reducing them to values between 0 (lowest score) and 10 (best score) (Kristic and Stanisic, 2013).

In order to identify the strength and weaknesses of the countries, it is necessary to analyse the results of individual pillars in the knowledge society, based on which, the aggregate index is calculated. According to this analysis, it is possible to determine which factors influence the change in the ranking position compared to the previous ranking, as well as the weaknesses that hinder their further progress towards a knowledge society.

Analysis of the economic area and the results achieved in the first pillar of knowledge society is based on the measurement of the three key indicators, which are the basis for determining the value of the Economic Incentive and Institutional Regime Index (Kristic and Dzunic, 2014). Tariff & non-tariff barriers, regulatory quality and rule of law are the key variables for the first pillar of the knowledge society. Trade freedom is a composite measure of the extent of tariff and non-tariff barriers that affect the imports and exports of goods and services. The trade freedom score is based on two inputs: the trade-weighted average tariff rate and non-tariff barriers. With the help of the formulas given by the World Bank' The Index of Economic Freedom (2015), actual values were computed and put into the normalization procedure to calculate the normalized values of tariff and non-tariff barriers for North Cyprus.

Table13: Computation of Actual and Normalized Values for Tariff and Non-tariff Barriers in North Cyprus

Actual Value	Normalized Value
=((Tariff $_{max}$-Tariff$_i$)/Tariff$_{max}$)*100-(non-tariff barriers) =((30%-17,5%)/30%) *100-(10) =31,6	Normalized(u)= 10*(1- (Nh/Nc)) =10* (1-(107/147)) =2,7

Source: author

With the help of the formula and procedures used by the World Bank KAM methodology, the normalized value of tariff and non-tariff barriers is computed as 2.7.

Regulatory Law is the second variable of the first pillar, calculated using the formula below:

Regulatory Quality = Σ Factor Scores/10

There are ten factors that are taken into consideration when computing the regulatory law index. These factors are listed in Table 14 below and the corresponding values in North Cyprus and the global averages are also given. To find out each Factor Score, the following formula has been used.

$$\text{Factor Score} = (\text{Factor}_{\text{average}} / \text{Factor}_{i}) * 50$$

Table 14: Comparison of the Factors for Regulatory Law in North Cyprus and the Global Average:

Factors:	North Cyprus	Global Average
Factor $_1$: Starting business - procedures(numbers)	16	7
Factor $_2$: Starting business - time (days)	29	19.3
Factor $_3$: Starting business - cost (% of income per capita)	19.6	22.2
Factor $_4$: Starting business - minimum capital (% of income per capita)	0	15.6
Factor $_5$: Obtaining license – procedures (numbers)	11	14.5
Factor $_6$: Obtaining license - time (days)	255	162.5
Factor $_7$: Obtaining license - cost (% of income per capita)	488	5
Factor $_8$: Closing Business - time (years)	1.5	2.9
Factor $_9$: Closing Business - cost (% of estate)	11	15.6
Factor $_{10}$: Closing Business - recovery rate (cents of dollar).	38	37.7

Source: Doing Business database, World Bank and Doing Business Report, YAGA, 2013.

Given the actual values of the factors, each of the factor scores has been computed and the regulatory quality has been computed as the average of them. Then, the actual value of regulatory

quality was put into the normalization procedure and the normalized value of regulatory quality was computed as 1.4. Table 15 represents the computation of each factor score, as well as the actual and normalized value of regulatory quality.

Table 15: Computation of Actual and Normalized Values for Regulatory Quality:

Actual Value	Normalized Value
Factor Score= ($Factor_{average}$ / $Factor_i$)*50 Factor Score $_{(1)}$ = (7/16)*50=21.87 Factor Score $_{(2)}$ = (19.3/29)*50=33.27 Factor Score $_{(3)}$ = (22.2/19.6)*50=56.63 Factor Score $_{(4)}$ = (15.6/0)*50= 0 Factor Score $_{(5)}$ = (14.5/11)*50= 65.9 Factor Score $_{(6)}$ = (162.5/255)*50= 31.86 Factor Score $_{(7)}$ = (5/488)*50= 0.51 Factor Score $_{(8)}$ = (2.9/1.5)*50= 96.66 Factor Score $_{(9)}$ = (15,6/11)*50= 70.9 Factor Score $_{(10)}$ = (37.7/38)*50= 49.6 Regulatory Quality = Σ Factor Scores/10	Normalized(u)= 10*(1- (Nh/Nc)) = 10* (1-(126/147)) =1,4

=427.2/10 =42.72	

Source: author

The third variable for the Economic Incentive and Institutional Regime is the Rule of Law. The Rule of Law score for North Cyprus was assessed according to the criteria given in the list in Section 5.1.1.1(c). According to the Doing Business Report by YAGA (2013), the most appropriate score for North Cyprus is 50. Therefore, the study also used 50 as the actual value of Rule of Law. The normalization procedure was applied, as shown in Table 16 below. According to the computations, the normalized value for Rule of Law is 0.5 in North Cyprus.

Table 16: Computation of Normalized Value for Rule of Law in North Cyprus:

Actual Value	Normalized Value
50 - The court system is inefficient and subject to delays. Corruption may be present, and the judiciary	Normalized(u)= 10*(1- (Nh/Nc))

may be influenced by other branches of government. Expropriation is possible but rare. (YAGA, Doing Business Report, 2013)	=10*(1- (139/147) =0.5

Source: Author

The Economic Incentive and Institutional Regime Index can be computed as the simple average of the normalized values of the three variables in this pillar. The study determined that the first pillar has a value of 1.53.

The second pillar of the knowledge economy is education. Adult literacy rate, gross secondary enrolment rate and gross tertiary enrolment rate are the key indicators for the second pillar of the knowledge society. Actual values of each variable are normalized with the normalization procedure and the simple average of them gives the education index value of North Cyprus. (See Table 17)

Table 17: Actual and Normalized Values of Education Variables:

	Actual Value	Normalized Value Normalized(u)= 10*(1- (Nh/Nc))
Adult literacy rate	100.00	=10*(1-(28/147))

		=8.1
Secondary enrolment ratio	100.00	= 10* (1- (50/147)) =6.6
Tertiary enrolment ratio	95.00	=10* (1- (18/147)) =8.8

Source: author

Adult literacy rate, secondary and tertiary enrolment ratios have normalized values of 8.1, 6.6 and 8.8 respectively. The education index can be computed with the simple average of these three normalized values. Therefore, the education index value for North Cyprus is computed as 7.83.

The third pillar of the knowledge economy is innovation. It is important to monitor a number of measures of innovation activities. These measures are relevant for the government of any country in order to use them for leading the national economy towards development based on innovation. Innovation systems are the engine of economic development in the modern economic environment. The KAM methodology enables the measurement of innovation at the level of the national economy by incorporating three vital indicators; royalty and license fee payments, scientific and technical journal articles and patent applications. Table 18 lists the innovation variables and shows the necessary calculations for normalized values of each variable.

Normalized values of royalty and license fee payments and receipts, patent applications and the scientific and technical journal articles are 1.7, 0.5 and 1.8 respectively. Therefore, the innovation index of North Cyprus can be computed as 1.33.

Table 18: Actual and Normalized Values of the Innovation Variables:

	Actual Value	Normalized Value

		Normalized(u)= 10*(1- (Nh/Nc))
3.1 Royalty and License Fee Payments and Receipts	4200	=10* (1-(122/147)) =1.7
3.2 Patent Applications	14	= 10*(1-(139/147)) =0.5
3.3 Scientific and Technical Journal Articles	221	= 10* (1-(120/147)) =1.8

Source: author.

The fourth pillar of the knowledge economy is ICT. The development of this pillar of the knowledge economy is evaluated using the KAM methodology based on three criteria; the number of telephone lines per 1,000 people, the number of computers per 1,000 people and the number of internet users per 1,000 people. The following table shows the ICT variables, their actual values and the computation of their normalized values.

Table 19: Actual and Normalized Values of ICT Variables:

	Actual Value	Normalized Value Normalized(u)= 10*(1- (Nh/Nc))

4.1 Telephones per 1,000 people	1,706	= 10* (1- (14/147)) =9.05
4.2 Computers per 1,000 people	375	=10* (1-(56/147)) = 6.2
4.3 Internet users per 1,000 people	507	= 10* (1- (29/147)) = 8

Source: author.

As can be seen from Table 19, the normalized values for telephone, computer and internet users per 1,000 people are 9.05, 6.2 and 8 respectively. As a result, the ICT index can be computed as the simple average of them, which is 7.75.

The Education index scored the highest index value among the all sub-indexes, with an index value of 7.83, followed by the ICT index with an index value of 7.75. The Economic incentive and institutional regime index and the ICT index have very low index values, with 1.53 and 1.33 respectively.

The KEI is an index that is the simple average of all four sub-indexes (the economic incentive and institutional regime index, education index, innovation index and ICT index). On the other hand, the KI does not consider the economic incentive and institutional regime index.

The KEI for the North Cyprus is computed as 4.61, with the simple average of the economic incentive and institutional regime index, education index, innovation index and ICT index. The simple average of the education index, innovation index and ICT index constructs the KI index value for North Cyprus, which is computed as 5.63. Table 20 also represents the KEI and KI values of North Cyprus with rankings.

Table 20: KI and KEI for North Cyprus

Variable	Actual value	Normalized value	
The Economic Incentive and Institutional Regime		**1.53**	
▪ Tariff & non-Tariff Barriers	31.6	2.7	
▪ Regulatory Quality	42.72	1.4	
▪ Rule of Law	50	0.5	
Education and Human Resources		**7.83**	
▪ Adult Literacy Rate,%	100.00	8.1	
▪ Secondary Enrolment Ratio, %	100.00	6.6	
▪ Tertiary Enrolment Ratio, %	95.00	8.8	
The Innovation System		**1.33**	
▪ Royalty and License Fee Payments and Receipts	4,200	1.7	
▪ Patent Applications	14	0.5	
▪ Scientific and Technical Journal Articles	221	1.8	
Information and Communication Technology(ICT)		**7.75**	
▪ Telephones per 1000 people	1,706	9.05	
▪ Computers per 1000 people	375	6.2	
▪ Internet Users per 1000 people	507	8	

Annual GDP Growth,%			
Human Development Index			
Knowledge Index, KI			**5.63**
Knowledge Index, KI, Rank			**59**
Knowledge Economy Index, KEI			**4.61**
Knowledge Economy Index, KEI, Rank			**78**

Source: Author

The simple average of the education index, innovation index and ICT index gives the KI index value of North Cyprus. According to the KEI index value, North Cyprus is in 78th place, while the KI index value of North Cyprus puts it in 59th place out of 147 countries. According to the amount/value of the aggregate KEI index in 2012, North Cyprus takes 78th place with an index value of 4.61 out of the 147 countries.

5.5.1 Knowledge Economy Index, Rankings and North Cyprus:

The comparison of the KEI and KI index values for North Cyprus with other countries is very important. The following table shows the KEI index value of selected countries with their rankings.

Table 21: Knowledge Economy Index (KEI) 2012 Rankings

Country	KEI	Rank
Sweden	9.43	1
Finland	9.33	2
Denmark	9.16	3
Netherlands	9.11	4
Switzerland	8.87	10
United States	8.77	12
Spain	8.35	21
Japan	8.28	22
France	8.21	24
Italy	7.89	30
Malta	7.88	31
Portugal	7.61	34
Cyprus	7.56	35
Greece	7.51	36
Uruguay	6.39	46
Ukraine	5.73	56
Thailand	5.21	66
South Africa	5.21	67
Turkey	5.16	69

Mexico	5.07	72
Jordan	4.95	75
Guyana	4.67	77
North Cyprus	**4.61**	**78**
El Salvador	4.17	88
Ecuador	3.72	98
Indonesia	3.11	108
Uganda	2.37	118

Source: KAM 2012 (www.worldbank.org/kam).

Sweden achieves the best rank among all the countries with an index value of 9.43. Finland occupies the second position, with the index value of 9.33, followed by Denmark (KEI index value 9.16), Netherlands (KEI index value 9.11) and Germany (KEI index value 8.90). Cyprus has a KEI index value of 7.56 and ranks at number 35, which does not represent the whole of Cyprus, but instead represents only the south side of the island. Turkey takes 69th place with the KEI index value of 5.16. If North Cyprus is considered within this list as the 147th country, it has a KEI index value of 4.61 and is ranked at number 78 among all the countries within the list.

Table 22 represents the comparison of the KEI and KI of North Cyprus with Turkey, South Cyprus, Europe, lower-middle income countries, upper-middle income countries and the global average. North Cyprus has a KEI index value, which is less than Turkey and Cyprus, but more than the average index value of lower-middle income countries. The KI index value North Cyprus is greater than its KEI index value. The KI index value is also less than Turkey, South Cyprus and Europe, but more than the lower-middle income, upper-middle income countries and global average. The KEI of North Cyprus is below but close to the global average, while the KI index value is above the global average. As can be seen from the table below, the Education

Index and ICT index value of North Cyprus is above its rivals and the global average, but the economic incentive and institutional regime index and innovation index of the country is quite low. Because of this, the KEI and KI of North Cyprus declines and reach 4.61 and 5.63 respectively.

Table 22: Comparison of the KEI and KI of North Cyprus with Cyprus and Turkey:

	Cyprus	Turkey	North Cyprus	Europe	Lower-Middle Income Countries	Upper-Middle Income Countries	World Average
KEI	**7.56**	**5.16**	**4.61**	**7.47**	**3.42**	**5.1**	**5.12**
KI	**7.5**	**4.81**	**5.63**	**7.64**	**3.45**	**5.07**	**5.01**
EIRI	7.71	6.19	1.53	6.95	3.32	5.18	5.45
IT	7.71	5.83	1.33	8.28	4.9	6.21	7.72
EI	7.23	4.11	7.83	7.13	2.84	4.72	3.72
ICT	7.57	4.5	7.75	7.5	2.62	4.28	3.58
Rank	**35**	**69**	**78**				

Source: author

The low level of the KEI and KI index values of North Cyprus is based on the very low economic incentive and institutional regime and innovation indexes.

Table 23: Basic Scorecard Data for North Cyprus, 2012.

Variable	Actual	Normalized
Tariff & non-tariff barriers	31.6	2.7
Regulatory quality	42.72	1.4
Rule of Law	50	0.5
Royalty and License Fee Payments and Receipts	4,200	1.7
Scientific and Technical Journal Articles	221	1.8
Patents applications	14	0.5
Adult literacy rate	100	8.1
Gross secondary enrolment	100	6.6
Gross tertiary enrolment	95	8.8
Total telephones per 1,000 people	1,706	9.05
Computers per 1,000 people	375	6.2
Internet users per 1,000 people	507	8

Source: adapted by World Bank Basic Scorecard method.

5.6 Application of the Extended Cobb-Douglas Production Function on North Cyprus

The sources of productivity growth in North Cyprus are analysed by the Ordinary Least Squares (OLS) estimation method using the extended Cobb-Douglas production function. The extended Cobb-Douglas production function is preferred because it considers both physical capital and intellectual capital and aims to understand the increasing returns to scale in the knowledge economy.

This part of the study assumes that the growth of economies mainly depends on independent inputs, which are physical capital, national intellectual capital and labour. Here, the study aims to analyse the effects of the factors of production on the total production/output of the economy. The main reason why the study selects the extended Cobb-Douglas production function is to take into consideration the vital explanatory variable: intellectual capital. The original Cobb-Douglas production function is restricted to two factors of production, namely capital and labour. To increase the precision of the model, it is necessary to add new explanatory variables into the model so that it becomes more up to date. Because of this, the study uses the extended Cobb-Douglas production function instead of the original one. This function aims to measure the effect of percentage change in labour, percentage change in capital, and percentage change in national intellectual capital on percentage change in the growth rate of the GDP of the country. The extended Cobb-Douglas production function is also used to determine the elasticity of the independent variables - capital, national intellectual capital and labour - against the dependent variable, GDP growth. To investigate the elasticity between variables, the study uses the following model:

$$Y=tK^{\beta 1}NIC^{\beta 2}L^{\beta 3} \qquad (1)$$

Where, Y = GDP,
K= physical capital
NIC = national intellectual capital
L = labour

The OLS estimation method is based on the linearity assumption, which assumes that the model is linear in both parameters and variables. Equation 1 is not a linear equation

because the logarithm of both sides of the equation has been taken and the following form constructed:

$$LnY = lnt + \beta_1 lnK + \beta_2 lnNIC + \beta_3 lnL \qquad (2)$$

$$Y^* = t^{*+} \beta_1 K^* + \beta_2 NIC^* + \beta_3 L^* \qquad (3)$$

Where, Y^* = GDP growth

K^* = growth of physical capital accumulation

NIC^* =growth of national intellectual capital

L^* = growth of labour

β's = corresponding elasticity of variables against GDP growth.

As a result of the above procedure, the model becomes a linear one in both parameters and variables and is ready to be put into the OLS estimation process. The required data was collected annually from SPO (2013), the Official Receiver and Registrar Office (ORRO, 2014) and the Prime Ministry of the TRNC.

5.6.1 Data Analysis and Results

The Extended Cobb-Douglas production function has been used to measure the effects of knowledge variables on the economic growth of North Cyprus. To measure the impact of the independent variables on the economic growth of North Cyprus, the study uses the Ordinary Least Squares (OLS) estimation method with the extended Cobb-Douglas production function. Physical capital, national intellectual capital and labour are used as explanatory variables, which explain the economic growth of the country. Data collected from both SPO and ORRO is used. Instead of physical capital, capital stock of the country is used. The national intellectual capital of the country is calculated using the formula given by the World Bank (www.worldbank.org/kam) Knowledge Assessment Methodology (KAM), which is equal to the summation of real market

value of patents and trademarks in the country.[9] The total number of the labour force of the country is used as the labour variable in the model. The investigated period is restricted to 14 years (2000-2013), because of a lack of statistics. Table 24 presents the estimation results after the use of the extended Cobb-Douglas production function with OLS estimation method with the necessary time series data.

Table 24: Regression Results of Extended Cobb-Douglas Production Function

Dependent Variable: LY

Method: Least Squares

Date: 01/04/15 Time: 11:58

Sample: 2000-2013

Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.268903	3.692286	0.885333	0.3968
L*	0.377577	0.176812	2.135471*	0.2025
NIC*	0.212203	0.100172	2.118386*	0.1079
K*	0.523417	0.037029	14.13525**	0.0000

R-squared	0.964462	Mean dependent var	9.436354
Adjusted R-squared	0.953801	S.D. dependent var	0.223125
S.E. of regression	0.047958	Akaike info criterion	-3.002011
Sum squared resid	0.023000	Schwarz criterion	-2.819423
Log likelihood	25.01408	Hannan-Quinn criter.	-3.018913
F-statistic	90.46398	Durbin-Watson stat	1.810061
Prob(F-statistic)	0.000000		

(* =significant at 5% significance level, ** = significant at 1% significance level)

[9] National intellectual capital$_t$ = (registration fee*number of patents$_t$)+registration fee*number of trademarks$_t$)+ (registration fee* geographical brand$_t$)

T-critical (0.01) = 2.718, T-critical (0.025) =2.201, T-critical (0.05) =1.796,

T-critical (0.10) =1.363

Estimation results can be written as follows:

$$Y^* = 3.26 + 0{,}52K^* + 0{,}21NIC^* + 0{,}37L^*$$

(standard error) (3.69) (0.03) (0.10) (0.17)

(t-statistic) (0.88) (14.13^{**}) ($2.11)^{*}$ ($2.13)^{*}$, $R^2 = 0.96$

Where Y^* = GDP growth

K^* = growth of physical capital accumulation

NIC^* =growth of national intellectual capital

L^* = growth of labour

β's = corresponding elasticity of variables against GDP growth.

The above model shows statistically significant variables with low standard errors and high R-squared. Each of the independent variables is statistically significantly different from zero. This is because t-values exceed the critical t-values at a given significance level. R squared= 0.96 means that 96% of the variation of GDP growth can be attributed to the physical capital, national intellectual capital and labour input together, which indicates the goodness of fit of the model.

The OLS estimation method assumes the series are stationary and that there are no autocorrelation, heteroscedasticity or multicollinearity problems within the variables. The test results are presented in Tables 25, 26 and 27 to verify if any of the above problems exist in the study.

Table 25: Unit Root Test For Labour

Null Hypothesis: D(LL) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.482461	0.0309
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

Table 26: Unit Root Test for Capital

Null Hypothesis: D(LK) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.059103	0.1478
Test critical values:	1% level	-4.121990	
	5% level	-3.144920	
	10% level	-2.713751	

Source: author

Table 27: Unit Root Test For National Intellectual Capital

Null Hypothesis: D(LKNIC) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.563008	0.0014
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

Source: author

The unit root test was applied to each of the explanatory variables to see whether the series were stationary or not. According to the test results, the series are stationary. Durbin Watson (DW) statistics give us information as to whether an autocorrelation problem exists. This was calculated as DW = 1.81. If the DW value is above the critical DW = 1.779, the Hypothesis, which assumes a serial autocorrelation exists (D_L=0,767 and D_U =1,779 with n=14 and k=3), can be rejected. This study indicates that there is no autocorrelation problem.

The White test measures whether there is a heteroscedasticity problem or not. According to the test results presented in Table 28, the observation times R squared = 4.78 is greater than the Chi-square = 0.78. Therefore, the study rejects that there is a heteroscedasticity problem, which means the error terms have a unique variance, homoscedastic error terms, and no heteroscedasticity problem.

Table 28: Heteroscedasticity Test: White Test

F-statistic	0.324604	Prob. F(8,5)	0.9235
Obs*R-squared	4.785637	Prob. Chi-Square(8)	0.7802
Scaled explained SS	2.382742	Prob. Chi-Square(8)	0.9670

Source: author

The multicollinearity problem can be seen in the case of high R squared and low t-statistics. However, the study directly cancels the multicollinearity problem with high R squared and high t-values.

According to the statistical analysis above, the regression is stationary and there are no heteroscedasticity, autocorrelation or multicollinearity problems. Therefore, the model can be used with high confidence.

The regression results of the OLS estimation on three variables with necessary diagnostic tests indicate that the model is statistically significant with conventional levels of significance. The results show that there is a positive relationship between capital growth, national intellectual capital growth and labour growth with GDP growth. The capital growth has the highest impact on GDP growth; this means that a 1% change in capital input will increase GDP by 0.52%. A 1% change in both labour and in NIC will cause a 0.37% growth and a 0.21% growth in GDP, respectively. The summation of coefficients ($\beta1+\beta2+\beta3$) gives us information about returns to scale, which equals 1.11 (0.52+0.37+0.21) and represents increasing returns to scale. In a knowledge economy, one of the important identifications for an economy is increasing returns to scale. If the knowledge variables are used in the production process, then the increases in output will be more than the increases in inputs.

The result of the analysis suggests that North Cyprus economy is not a knowledge economy yet, but the main knowledge economy variables such as national intellectual capital have a positive effect on the GDP growth of the country.

6 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDIES

This chapter summarizes the main findings of the study with regards to the research questions. General conclusions based on the findings of the study are also presented in this thesis. Furthermore, the strengths and limitations of this thesis are considered and suggestions for further research are presented.

This study aimed to understand the knowledge based economy and find out the relationship between the national intellectual capital and economic growth. Through the use of the Knowledge Assessment Methodology, the study calculated the Knowledge Economy Index (KEI) to draw a comparative statement between the North Cyprus and South Cyprus economies. Furthermore, the study also aimed to measure the overall level of preparedness of the North Cyprus economy for the Knowledge Economy and to create awareness of knowledge and

increase the understanding of the importance of technology in the knowledge economy. In the light of information about macroeconomic data, the study investigated the source of productivity growth in North Cyprus, using the Ordinary Least Squares (OLS) estimation method with the extended Cobb-Douglas production function. The overall findings of this thesis will be analysed and suggestions for future policy purposes presented.

A primary aim of this research was to provide an empirical analysis of the national intellectual capacity and its effects on the North Cyprus economy between 2000 and 2013. The study also payed attention to the knowledge-based economic system and tried to measure the KEI and KI index value for North Cyprus. In today's globalized world, many economies are seeking to shift their economies towards the knowledge economy. Knowledge-based economic activities allow countries to create value by increasing productivity of factors of production. The study also used the extended Cobb-Douglas production function to measure the productivity of production factors in the North Cyprus economy.

The development of the knowledge-based economy depends directly on the formation of basic knowledge variables. Knowledge and knowledge creation play a crucial role for growth in the knowledge-based economy. Because knowledge and information are two important factors that allow countries to create value with increasing productivity, there is a close relationship between the economic growth and knowledge. In a knowledge-based economy, economic growth is not only determined by the traditional factors of production, such as land, labour and capital, but it is also determined by intellectual capital (accumulation of knowledge and information capacity). National intellectual capital distinguishes from the traditional factors of production with 'the law of increasing returns to scale'. This law is based on the increasing capacity of the economy with greater productivity in the production process.

The results of this thesis have interesting outcomes for the development of North Cyprus. The study aimed to give an answer to the following fundamental research question:

'To what extent does NIC have an effect on the economic growth of North Cyprus?'

The study also aimed to answer the following sub-questions:

- What is the rank of North Cyprus within the KEI list, which was developed by the World Bank?
- Are the North and South sides of the island compatible on the base of KEI?
- To what extent does the KEI give a reasonable solution to the development problems in North Cyprus?

This research is important in the following aspects; knowledge economy arena, location, methodology and contributions to knowledge. There have been several studies conducted on the knowledge economy arena in developed and developing countries such as the USA, Europe, China, India, Singapore and more recently Malaysia, South Korea and Oman. Unfortunately, very few studies have tackled this issue in North Cyprus. For example, the World Bank calculates the KEI and KI index values for South Cyprus without considering North Cyprus. Knowledge economy is a new concept in North Cyprus and the KEI and KI index values have not been calculated yet. This research will be the first and only one in this arena that has been conducted in North Cyprus.

Most of the current research on the knowledge economy is carried out from a comparative and benchmarking perspective. This research also used econometric methodology for analysing national intellectual capital and its effects on economic development in North Cyprus.

This study attempts to make significant input to the existing knowledge and emphasizes the importance of the knowledge economy for small islands in general, and for North Cyprus in particular. In fact, it is the first time that such a study on knowledge-economy has been undertaken by combining knowledge economy and econometric modelling for investigation of the effects of intellectual capital on the economic growth of North Cyprus. More importantly, this study creates both public and governmental awareness on the potential and viability of pursuing knowledge economy initiatives as a sustainable economic development for North Cyprus.

The study should assist North Cyprus and other small island economies with similar socio-economic characteristics in the planning of knowledge development.

Specifically, this research adds the following to knowledge:

- It is the first study to explore the potential of the knowledge economy in North Cyprus,
- It is the first study to compute the KEI and KI index values and rank of North Cyprus,
- It is the first study that used only the knowledge economy variables as indicators to measure the effects of national intellectual capital on the economic growth of the country. Furthermore, it econometrically confirms the increasing returns to scale in knowledge variables.
- It is the first study to provide a framework for knowledge economy development empirically tested on a small developing island - North Cyprus.

This research was conducted on one country. It may not be possible to generalize the findings based on this research, but it could serve as a foundation, on which research on knowledge economy development in other small island economies where similar socio-economic peculiarities exist, could be based. This study is limited to the analysis of the impact of intellectual capital on the economic growth of North Cyprus. The study used the KAM for determining the KEI and KI index values of the country and compared the findings with South Cyprus. In addition, the study was also limited to the application of the extended Cobb-Douglas Growth model using econometric analysis with the help of the E-views package program and other necessary statistical techniques. Furthermore, the variable selection was limited due to information scarcity and the lack of statistical data; therefore, some of the variables have not been considered within the model. In addition, the study was limited with the small sample size. North Cyprus is a new country; therefore, statistical data either is either not available or contains some incomplete or missing values; hence, they were not considered in the analysis. Therefore, the number of observations included in the model is considerably small. While collecting data, the study used the State Planning Organization, Economic and Social Indicators, Macroeconomic Data, Five-Years Development Program, YAGA Doing for Business program and other governmental offices for necessary statistics. The study was also limited to the years 2000-2013.

The empirical findings of this thesis summarize that NIC has a positive effect on the growth of the North Cyprus economy. NIC as a knowledge economy variable has played an important role in the development of the North Cyprus economy over the last decade. The regression results presented in the study show that knowledge economy variables have a positive

impact, and the economy's productivity level, upgrading with increasing returns to scale, is evidence that the economy of North Cyprus has the potential to be a knowledge economy.

The KEI and KI of North Cyprus were computed as 4.61 and 5.63 respectively. According to the World Bank's list, North Cyprus makes 78th place out of the 146 countries. The KEI index value of North Cyprus is less than the KI of the country as a result of the poorer economic incentive and institutional regime of the country. Both of the indexes are greater than the average index value of the lower-middle income and upper-middle income countries. However, the index value of North Cyprus is less than the global and European average. The KEI index value of South Cyprus and Turkey are 7.56 and 5.16 respectively. The KEI and KI index value of North Cyprus is lower than both South Cyprus and Turkey. South Cyprus ranks at 35th place, Turkey ranks at 69th places, while North Cyprus ranks at 78th place among the 146 countries.

As it can be seen from Table 29, North Cyprus takes 8th place within the 12 small islands in the World Banks KEI list.

Table 29: Selected Small Islands with KEI and Rankings

	Rank	KEI
1. Singapore	23	8.26
2. Malta	31	7.88
3. Cyprus	35	7.56
4. Barbados	41	7.18
5. Jamaica	58	5.65
6. Dominica	61	5.56
7. Mauritius	62	5.52
8. North Cyprus	**78**	**4.61**
9. Guyana	79	4.67
10. Cuba	87	4.19
11. Dominica Republican	90	4.05

12. Fiji	93	3.94

Source: author

Small island states may often experience high outflows of labor through migration, and reduced returns to human capital. On the negative side, labor migration (brain drain) is a net outflow of countries capital stock. On the positive side, labor migration may in the long-term serve to re-invigorate the economy, if workers return to the home country enriched with overseas experience and skills. National institutions have to provide an adequate infrastructure for this process to expand efficiently.

The KEI and KI of North Cyprus have not been calculated before this thesis. The index values of KEI and KI are two important indicators for the development of the country. The information gathered from the indexes will be able to direct the future policies of the country, especially the five-year development plan. The North Cyprus economy is not a knowledge economy yet, but the KEI, KI and other sub-indexes, which were calculated in this thesis, show that North Cyprus has the potential to become a knowledge-based economy. The overall findings answer the research questions of the thesis and highlight the importance of NIC for the North Cyprus economy.

The insufficient number of professionals in knowledge management is a weakness of the country. North Cyprus also has other exogenous obstacles such as the existence of isolation, an inadequate domestic manufacturing industry and a lack of technology-based production techniques.

To overcome these problems, North Cyprus should immediately construct its national strategy considering knowledge and knowledge based activities. Constructing a national strategy for the country will help to create awareness for the knowledge-based economy on both a governmental and public level. National strategy will also increase the demand for knowledge workers at each level of production. If the importance of knowledge in production has been understood, then the demand for domestic goods will increase and both domestic and technology based production supported. As a result of the positive effects of knowledge in production processes, the importance of accumulation of knowledge and intellectual capital comes to the

fore. National strategy has to pay attention to education and the accumulation of intellectual capital in the country. The isolation problem of the country, which prevents free trade with other countries, is one of the important macroeconomic problems. The economic incentive and institutional regime index value proves the importance of free trade in the KEI index value. Thus, the national strategy has to support possible solutions to the isolation problem, which will allow the country to trade freely with other countries.

The national strategy must include transformation strategies for North Cyprus, which are necessary to convert the economy to a knowledge-based economy. Transforming the economy from the present condition to the knowledge-based system requires: creating awareness of the importance of knowledge economy, changing the way of doing business and reshaping production techniques with knowledge variables and expanding the new production techniques for a more stable economy.

Following table indicates the actions that are necessary to be taken to create national strategy in knowledge based economy.

Table 30: National Knowledge Strategy for North Cyprus

National Strategy	Action
Creating awareness of importance of knowledge economy	Organize regular activities to increase awareness, such as; • regular meetings with non-governmental organizations, government representatives and universities, such as chamber of commerce, chamber of industry, telecommunication department, ministry of technology and transportation.
Changing way of doing business and reshaping production techniques with knowledge variables	Give subsidies to producers to assists knowledge based initiatives, such as; investments on technological infrastructure. Give regular information to the producers for using technological innovations in production; • regular meetings with farmers unions,

	chamber of commerce and chamber of industry
Expanding the new production techniques	Give regular information about the new production techniques which considering knowledge and technology Give subsidy and/or financial supports for technology based production systems Give subsidy and/or financial supports for investments in human capital; education/ training/ ...

Source: author

The national strategy aims to increase the efficiency in the production process to attain economic development. Each year, North Cyprus prepares development plans, strategy papers, and plans of action to achieve development goals. Today, the wealthiest and the most competitive countries are known as knowledge economies. The study suggests that the North Cyprus authorities should transform their economy to a knowledge-based economy immediately. In addition, a new education model emphasizing the importance of national strategy should be formulated for national development programs. Inevitably, it is necessary to create an economic environment that is conducive to enhancing the level of knowledge, and hence, the economic growth of North Cyprus.

The development and implementation of national knowledge policy have been supported by a clear and effective delegation of responsibility for policy development. Political instability is a continually risk in regards to changing national priorities. The loss of such support can delay a policy's adoption or implementation. The policy adoption or implementation process is vulnerable to unstable international assistance and support (mainly from Turkey).

External support has been predominantly in the form of limited technical assistance. There is a lack of sustained capacity for strategic planning, policy-making and project implementation that would sustain North Cyprus through repetitive policy cycles.

It is recommended that the government;

- Develops a strategic plan to facilitate the implementation of the national knowledge policy.

- Dedicating resources for the ongoing of knowledge-based policy-making staff.
- Initiating medium to long-term capacity building efforts to develop skills in knowledge based strategic planning, policy-making and project implementation. (for example, courses and training)
- Review existing national vision statements and overall national development policies and establish links with them in the national knowledge policy.
- Develop and adopt a national knowledge-based strategic plan and the national knowledge policy.
- Conduct in-depth assessment and surveys on the country as the basis for policy making.
- Establish a clear delegation of institutional responsibility for the development and implementation of a national knowledge policy.
- Establish a timeframe for the development and adoption of a national knowledge policy with clear deadlines.
- Ensure that the institution in charge of the policy's implementation has the necessary political support to carry out its task.
- Ensure the policy-makers have the necessary skills and experience to analyze and transform inputs into an effective and successful national knowledge policy.
- Identify the clear ways for obtaining the necessary funding and training for policy-making, legal and technical aspects.
- Build public awareness to promote government accountability and increase the level of political commitment.
- Manage and monitor initiatives and activities closely in order to ensure their effectiveness.
- Develop and use independent procedures for project monitoring, reporting and feedback in order to arrive at objective results.
- Review and revise national knowledge policy periodically n order to ensure they remain relevant.
- Promote coordination and information sharing in the development of knowledge policies and strategic plans.
- Simplify coordination between development partners for effective national knowledge policy.

- Promote a holistic approach to knowledge policy development assistance that takes into account capacity building and the development of a supporting knowledge within legal and regulatory framework.
- Leadership on the development of the national knowledge policy is provided by the Prime Ministry.
- The directory general for the Prime Ministry organizing the committee of officials to manage the development policy with considering knowledge.

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