İlhan GÜLER

CONTRIBUTION OF ACADEMIC RESOURCES ON INNOVATION AND ENTREPRENEURSHIP: A DEA BASED EVALUATION

M.S.
2014

FATIH UNIVERSITY

The Graduate School of Sciences and Engineering

Master of Science in
Industrial Engineering

CONTRIBUTION OF ACADEMIC RESOURCES ON INNOVATION AND ENTREPRENEURSHIP: A DEA BASED EVALUATION

by

İlhan GÜLER

July 2014

CONTRIBUTION OF ACADEMIC RESOURCES ON INNOVATION AND ENTREPRENEURSHIP: A DEA BASED EVALUATION

By

İlhan GÜLER

A thesis submitted to

the Graduate Institute of Sciences and Engineering

of

Fatih University

in partial fulfillment of the requirements for the degree of

Master of Science

in

Industrial Engineering

July 2014
Istanbul, Turkey

APPROVAL PAGE

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

_____

Assoc. Prof. Dr. Ali TÜRKYILMAZ
Head of Department

This is to certify that I have read this thesis and that in my opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

_____

Assist. Prof. Dr. Özgür UYSAL
Supervisor

Examining Committee Members

Assist. Prof. Dr. Özgür UYSAL _____

Assoc. Prof. Dr. Ali TÜRKYILMAZ _____

Assoc. Prof. Dr. Mehmet ŞEVKLİ _____

Assist. Prof. Dr. Kadir TUFAN _____

Assoc. Prof. Dr. Güven KIYMAZ _____

It is approved that this thesis has been written in compliance with the formatting rules laid down by the Graduate Institute of Sciences and Engineering.

_____

Assoc. Prof. Dr. Nurullah ARSLAN
Director

July 2014

CONTRIBUTION OF ACADEMIC RESOURCES ON INNOVATION AND ENTREPRENEURSHIP: A DEA BASED EVALUATION

İlhan GÜLER

M. S. Thesis – Industrial Engineering
July 2014

Supervisor: Assist. Prof. Dr. Özgür UYSAL

Co-Supervisor: Assoc. Prof.Dr. Ali TÜRKYILMAZ

ABSTRACT

With this study, it is aimed to show innovation and entrepreneurship performance by comparing weekness and powerful sides of universities' entrepreneurial and innovative systems by utilizing existing academic, innovation and entrepreneurship data. The main purpose of innnovation and entrepreneurship oriented performance ranking is to monitor and take into act of required activity plans both in universities and national level by using Data Enveleopment Analysis (DEA). The output factors that are utilized in innovation and performance oriented ranking consists of 5 main daimensions and these 5 dimensions consist of 23 sub-factors. The input foctors that are utilized in academic performance data set comprised of 5 factors and these factors are raw data which have single dimensions.

Keywords: Higher education, data envelopment analysis, efficiency measurement, innovation, entrepreneurship.

AKADEMİK KAYNAKLARIN GİRİŞİMCİLİĞE VE YENİLİKÇİLİĞE KATKISI: VERİ ZARFLAMA ANALİZİ TABANLI DEĞERLENDİRME

İlhan GÜLER

Yüksek Lisans Tezi – Endüstri Mühendisliği
Temmuz 2014

Tez Danışmanı: Yrd. Doç. Dr. Özgür UYSAL

Tez Eş Danışmanı: Doç.Dr. Ali TÜRKYILMAZ

ÖZ

Bu çalışma ile üniversitenin girişimci ve yenilikçi sistemlerinin güçlü ve zayıf tarafları karşılaştırılarak mevcut olan akademik ve yenilikçilik verileri kullanılarak üniversitenin girişimci ve yenilikçi performansının ölçülmesi amaçlanmıştır. Girişimci ve yenilikçi odaklı performans toblosunun genel olarak amacı, girişimci ve yenilikçi performans sürecinin Veri Zarflama Analizi(VZA) kullanılarak zamanla üniversitede takip edilip gerekli eylem planlarının üniversite ve ulusal düzeyde alınabilmesidir. Girişimci ve yenilikçi üniversite performans göstergesinde kullanılan girişimcilik ve yenilikçilik çıktı etkenleri beş ana boyut ve bu boyutlar da 23 farklı göstergeden oluşmaktadır. Akedemik performans göstergesinde kullanılan girdiler tek boyuttan oluşmak üzere toplamda 5 tanedir.

Anahtar kelimeler: Üniversite, Veri zarflama analizi, Verimlilik ölçümü, Yenilikçilik, Girişimcilik

To my parents

ACKNOWLEDGEMENT

I express sincere appreciation to Assist. Prof. Dr. Özgür UYSAL for his guidance and insight throughout the research and I would like to thank my Co-Adviser Assoc. Prof.Dr. Ali TÜRKYILMAZ for his contributions.

Thanks go to the other all faculty members for their valuable suggestions and comments.

I express my thanks and appreciation to my family for their understanding, motivation and patience. Lastly, but in no sense the least, I am thankful to all colleagues and friends who made my stay at the university a memorable and valuable experience.

TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

LIST OF SYMBOLS AND ABBREVIATIONS

ABBREVIATION

A&HCI	:	Arts & Humanities Citation Index
BRICs	:	Countries of Brazil, Russia, India, and China
DPT	:	State Planning Organization
EU	:	European Union
GDP	:	Gross Domestic Product
GERD	:	Gross Domestic Expenditure on R&D
ISI	:	Institute for Scientific Information
KOSGEB	:	Small and Medium Enterprises Development Organization
PPP	:	Purchasing Power Parity
R&D	:	Research and Experimental Development
SCI	:	Science Citation Index
SSCI	:	Social Science Citation Index
STI	:	Science, Technology and Innovation
TOBB	:	Union of Chambers and Commodity Exchanges of Turkey
TPI	:	Turkish Patent Institute
TARAL	:	Turkish Research Area
TTGV	:	Technology Development Foundation of Turkey
TUBITAK	:	The Scientific and Technological Research Council of Turkey

CHAPTER 1

INTRODUCTION

The assessment model for performance of universities in terms of entrepreneurial and innovative competency in Turkey is valuable in view of the long supporting results and concerns that provoke the country's organization of higher education. Particularly, the higher education sector is concerned from outcomes of minor and inequitable approach to higher education; lack of general vision, model, and program for higher education resulting in the existence of dispirited quality universities and institutions, degenerating quality of university education due to poor institution and faculty credentials and since showed by the declining operation of alumni in professional licensure exams; pushing out of individual provision; and nonindustrial institution system. (Preddey and Nuqui 2001, Tan 2011)

A sufficient number of studies have investigated institutions efficiency and came across with several problems. According to Johnes (1993), a critical issue in measuring the efficiency of higher education institutes, is how to aggregate the heterogeneous inputs and outputs, in the absence of market prices. In order to measure the efficiency, performance indicators were developed, each of which measures the input or the output of a homogeneous set of products. The most commonly used performance indicators in the case of universities are the number of publications. (Moed et al. 1984; Harris 1988; Johnes 1990)

Even so, Glass et al. (2006) indicates that performance indicators centering just on one variable, without being able to include the multiple inputs and outputs that are essential in higher education institutes. In addition, performance indicators neglect

aggregating multiple inputs and outputs since they are not capable to offer target weights, which can help to succeed it.

An adequate number of analyzes have looked into institutions' efficiency and attained to various problems. According to Johnes and Johnes (1993), a vital effect in evaluating the efficiency of university and institutes, is how to combine the diversified inputs and outputs. In order to evaluate the efficiency, functioning indicants were prepared, all of which assesses the input or the output from an uniform set of universities. The most typically utilized criteria in the case of universities is the total of publishings. (Moed et al. 1984)

A secondary approach from measuring the efficiency is the econometric way, which specifies an output function and accepts that diversions of it are combined of two conditions, inefficiency and error. The error condition comprises randomness and admits the exogenous elements as well as the econometric fault, which conforms to the normal distribution. Significant characteristics of the approach are the supposal of output. and the exact parametric method (Worthington 2001). This approach has directed to the evolution of the stochastic frontier approach (SFA) and has been utilized by many researchers so as to assess the performance of universities and institutes (Verry and Layard et al. 1975)

A different technique to assess efficiency is the numerical approach and its primary instrument is Data Envelopment Analysis, which is an appropriate instrument because measuring the performance in higher institutions (Bougnol and Dula 2006). DEA assesses the qualifying efficiency of an institution and objectiveness is the most authoritative advantage allowed. The efficiency of all DMU calculated for the ratio from weighted outputs to weighted inputs, where the weights are not appointed analytic simply are measured so as to speculate the DMU at its nigh effective rate comparative to the another DMUs (Johnes 2006). In con to the preceding approach, DEA creates no assumptions concerning the statistical distribution from inefficiencies or the useable form of the output part (Banker, Conrad and Strauss 1986). DEA provides exemption in the extract of the variables, which can be assessed in dissimilar units. A significant advantage is the computation of slack variables (Stiakakis and Fouliras 2009).

Accurately, slack variables are able to specify which efficient Decision Making Unit (DMU) constitutes a benchmark for the inefficient by applying DMU (Johnes and Johnes 1993).

Nevertheless, DEA accepts that deviations of the efficient frontier are the outcome of inefficiency. This may conduct to magnification or understatement from the outcomes since there are no effronteries concerning the exogenous elements or measuring fault. Besides, its nonstochastic nature does not tolerate confidence intervals to represent calculation. Nevertheless this has been undertook by Atkinson and Wilson (1995) and Simar and Wilson (2000) who apply a Monte Carlo methods so as to to advance the distribution and to estimate confidence intervals.

The DEA study applied for universities and institutions in several countries, like China, Germany, United Kingdom, and USA. Our study, by applying DEA study, evaluates the efficiency of Turkish university. Furthermore, this study shows how DEA can be utilized into university efficiency measuring and therefore to find bias righted efficiency approximations and confidence intervals, in counterpoint with the direct applications of DEA techniques.

This study utilizes Data Envelopment Analysis (DEA) to measure the qualifying abstract efficiency of the universities. The assuming inputs are running citations, article score and education resources, since the intellectual property pool, cooperation and interaction, entrepreneurship and innovation culture, the compitence of scientific and technological research, economic contribution and commercialization. The expected advances and super efficiency are calculated for inefficient and efficient factors severally. Additional, binary linear regression is utilized to prepare a relationship between over efficiency and input and output variables.

The research and graduate policy is a significant policy that helps as the model for university, sustain the contemporaries of important research activities and the application of policies to promote research projects and innovative pretends that will transform technological and scientific development to cultural and economical reward.

The help of university faculty fellows and researchers as well as the scholars, graduates and every employees of the university ensure an important function in the performance of the institution.

Research and Development, entrepreneurship and innovation are in the important drivers of university development and accumulation of countries. Since 1996, Fatih University and the organization it returned, have been a significant role of the R&D and entrepreneurship and innovation ambiance in Turkey. With this efficiency measurement it is looked for to increase entrepreneurship and innovation orientad competition and facilitate the university and Turkey to run through its targets for the years to come.

TÜBİTAK rating of the top universities in Turkey started reporting since 2012 and involves what would be the indicators of the University Entrepreneurship and Innovation Index. The index present universities ranking in compliance with their innovation and entrepreneurship success, thus focusing to assist to the advancement of the innovation atmosphere.

Also this index evaluates universitiy under five main dimensions of economic contribution and commercialization, intellectual property pool, cooperation and interaction, culture of entrepreneurship and innovation, and scientific and technological research competence as to 23 indicators. The Rating will be clarified annually lead by the Council for Higher Education, Turkish Statistical Institution, the Ministry of Science and Technology, TPE, Ministry of Development, Turkish Academy of Sciences, TTGV and KOSGEB.

In a conference set up at the Ministry of Science, Industry and Technology, Former Minister Nihat ERGÜN stated the aim and the focus of the The Entrepreneurial and Innovative University Index and that it has been evaluated for the first time in Turkey, 2012. And Prof. Dr. Yücel ALTUNBAŞAK, the President of TUBITAK has also participated the conference and Former Minister ERGÜN stated that the universities not have more than 50 faculty members have not been avaluated in this study set up for creating the entrepreneurial and innovative efforts in universities. Thus, the results of index consist of 126 universities in the aggregate of 168. Former Minister

stated that the index is included in 5 dimensions which composed of 23 indicators in the aggregate.

This Ministry study is applied for the first time in Turkey and will be applied annually. But, beginning from the 2014, this rating will be declared to public prior to the university enrollments are made. This rating study does not mean an educational perspective, but principally focus to encourage entrepreneurial and innovative efforts in the university as to their following mission, besides research and education.

This study led off by together with TUBITAK and The Council of Higher Education, Turkish Statistical Institute, Ministry of Science, Industry and Technology, Ministry of Development, Ministry of Finance, Turkish Patent Institute, Technology Development Foundation of Turkey, Turkish Academy of Sciences and Small and Medium Enterprises Development Organization.

Academic members believe in the function of innovation in increasing the development of nations, enabling economic expansion, leading societal changes and establishing the foundation of a country’s perspective. Entrepreneurs and university members are committed to set up a value added and non partisan resource.

European Commission declared that mostly about the disturbance of composite indicators rating countries' score along policy processes (The Joint Research Centre). Since 2011, The Joint Research Centre romotes the research to keep the aggregate notional and statistical concinnity of the conceptual framework, and apply a stability and sensitivity analysis of the final rankings. The Joint Research Centre has got common on composite indicators and developed it.

The global economic growth is valotile and unstable among from regions to regions. Commonly expected economic forecasts stated by leading international finance institutions forecast a resession of gross domestic product (GDP) improvement during 2012 and an unexpected recovery in 2013. Considering some setbacks, development stay relatively strong in rising market economies. The issue in developed income economies, whereas, is more vulnerable. Unemployment rate is growing in most of these countries. Economic crisis recovery take time, and there are hazards of a new set up of the economic atmosphere resulting in a protracted case of fuzziness. In this state,

the economic precaution discussion is taking the place of importance on set up a convenient precaution structure that promt development and employment at the same time promoting sustainable public economies. As brief, precautions that achive innovation and entrepreneurship and structural precautions prompting longterm expected growth must oncoming clear in these debates. Even though entrepreneurship and innovation cannot recover the urgent economic adversity, it is a main factor of sustainable development. Future expectations measures are expected to show the primary for future welfare.(Daniela BenaVente and Soumitra Dutta,2009)

Nowadays, many debates regarding with Entrepreneurship and innovation and its relation to development and accretion are declined to the adversity made by financial factors in definite regions of the world more than the last few years and the inclosures for the world economy. There is an immediate requirement to expand this debate and to research how entrepreneurship and innovation are not promted and complicated for development but meanwhile how it can make a solution for common problems, declined poverty, and get attain a faster sustainable growth and driven future.

There is also a necessity to expand the vision on the factors and members that are important in encouraging entrepreneurship and innovation. Currently, entrepreneurship and innovation medium is extensive and involves two dimensional and multi dimensional cooperation in scientific and technological research and development, cultural variation, dividing of best experience, innovation challenges, and different types of comnections.

That sort of connections needed, but, activating it and be activated by the entrepreneurial, innovative and creative minds exist in all society and culture. Hereof, India stands as an example. With an intensive population and measurable resource, Indians should innovate to develop, and this is stated in all stage of society, by most party, entrepreneurs and by small, medium, and large companies.

A certain example is current in one of India’s recent achivement story. Mobile revolution. The revolution has provided innovation in other regions by connecting people along the country, assuring the importance for optimization of minds and their regenerations. For instance, connecting Indian village administrations with fiber optic cables with the aim of providing service goal in areas like health, education and

agriculture. This insure an important significance by Indian entrepreneurial and innovative can be adversed. (Confederation of Indian Industry, Chan Drajit Banerjee, 2008)

Universities and institutions are the keystone of growth and economic development in all country. Specified that the academic originations are responsible for the capacity expanding expected for a nations long run programs, the university and institutions particularly, is among the columns a country devolves on to gain its productiveness and therefore efficiently apply its strategical programs. That is to be sure that an effective organization of institutions and higher education is important to supplying the essential profession work force of scientists, engineers, doctors, and teachers. Thus, there is a requirement to measure the efficiency of the educational originations, and whether the advanced cost being dropped with them is worthy. Additionally, it is essential to feature criteria from which every institution can be interviewed through the evaluation of efficiency by utilizing inputs and outputs for which these inputs are expended.

Data Envelopment Analysis (DEA) is a comparatively modern information bound approach for measuring the specialized efficiency of a set of equal entities titled Decision Making Units (DMUs). DEA offers an individual assess and easily administers on binary inputs and binary outputs. Since the DEA method was primary formulated, it get represented commonly utilized to industries as different as health care (Bhat, Verma, Reuben, 2001, Jacobs, Smith, Street, 2006), Banking (Hassan, Sanchez, 2007), and numerous different industries and institutions. Additionally, DEA approach has demonstrated especially useful in subjects where discommercialized inputs or outputs or can't be calculated or checked upon among dissimilar DMUs. In this analyze, DEA is applied to measure the efficiencies of the academic institutions.

CHAPTER 2

LITERATURE REVIEW

2.1 RESOURCE BASED TERMINOLOGY

The primary DEA example that successfully optimised all decision making unit with the aim of estimating a discrete piecewise frontier was suggested from Charnes, Cooper and Rhodes (1978) and was established on the preceding study of Farrell (1957), since referred before. To make the efficient output purpose Farrell began with a recognition from the difficulty in reaching a necessary measure of complete efficiency (p. 255) that comprised the optimum in theory possible efficiency, then continued to identify how a detected criterion of efficiency can be accomplished pragmatically and be sufficient in aim of an inaccessible rank. Then illustrated technically and showed efficiency.

Charnes et al. (1978) configured an example of the CCR model that generalised the individual output and input ratio measurement of efficiency as an individual DMU in terms of a fractional linear-programming formulation transforming the multiple output and input enactment of all DMU to that of an individual realistic output and realistic input. (Charnes et al. 1994, p. 6) They outlined the efficiency from a sample unit i as:

$$Efficiency\ of\ unit\ i = \frac{Weighted\ sum\ of\ unit\ i\ s\ outputs}{Weighted\ sum\ of\ unit\ i\ s\ inputs} \qquad (2.1)$$

A linear programming result is repeated for all DMU under a set of specified restraints. Among there is the value of the weighting components. In reaching the

result no unit is permitted to choose weights that would stimulate that unit to find an efficiency better than 100%. Therefore, the weighted amount of the units and outputs must equal lower than or equal to the weighted amount of the unit inputs. The absolute unit for which the efficiency is measured is generally some generative entity that is selected from the researcher detail on which prospects of the output and input components are of concern. Researchers occasionally mention to this unit as the business firm or in different such forms but the DMU permits for the biggest application altogether with DEA models. This permits the researcher to look into efficiency relationships on the far side conventional aspects, a significant characteristic observable in recent researches.

All DMU is qualified by output and input elements which are of dissenting importance to the better usable efficiency of the unit specified that DEA automatically puts weights to all element to optimise the general efficiency of the unit in the CCR example.

2.1.1 Measuring Strategy and Peer Reviews

Different instruments have been formulated to measure the efficiency of decision making units such as industries and institutions. Coelli (1996) conferred two criteria of efficiency and offered a method about how to work out them proportionally to an efficient frontier, which can be gained either by data envelopment analysis and stochastic frontiers analysis. The main conflict in these two ways consists in the approach utilized. That is to say, the DEA takes numerical programming although the stochastic frotier analysis applies econometric methods.

According to Coelli (1996), the efficiency from a DMU follows from two elements, that is to say, theoretical efficiency and allocative efficiency. Theoretical efficiency mentions to the power of the institution to bring out greatest output applying obtainable inputs. Instead, it is the power by DMUs to apply the lower limit amount of inputs to bring out a specified output grade. But then, allocative efficiency represents the power of a DMU to apply accessible inputs in best dimensions considerately on their individual termses. Once composed, these two criteria speculate the total worldly efficiency of a DMU. Data envelopment analysis looks to be the most suitable way to

apply as covering with DMUs featuring quintuple inputs and outputs (Flegg et al 2003) such that institutios and universities.

DEA is alinear programming method that evaluates the comparative efficiency inefficiency of uniform set of DMUs. In detail, it makes a non parametric (Coelli, 1996 and Talluri, 2000) enclosure frontier across useable input and output information and so it computes the efficiency of DMUs qualifying to the frontier (Flegg et al 2003).

2.1.2 Data and Source Utilization

The selection of input and output entry in studies (Thanassoulis et al.,2009) that measure the efficiency of universities and institutions in another country doesn't change very much since universities and institutions are in common accepted to achieve two outstanding obligations or put up two primary services, that is to say, instruction and research and development. Thanassoulis et al. (2009) remarked on the third charge of universities and institutions, that is, the supply of advice and different services to commercial enterprise, supply of a generator of main notice about national events, and warehousing and conservation of knowledge. However, due to lack of information or absence of a right assessment or at the least, proxy variable, the stated output is frequently dismissed in evaluating employments. Just three outputs are typically studied in the literature and they admit undergraduate education, postgraduate education, and research and development (Flegg et al., 2003). Since universities and institutions are supposed to make individual capital, the amount of undergraduate and postgraduate levels presented is considered as an estimation of the education output (Kempkes and Pohl, 2006). It should be remarked, nevertheless, that this proxy runs out to element in the quality of the levels presented. Additionally, Salerno remarked that the amount of grades awarded doesn't fully appropriate the output of instruction since it runs out to take into account the quantity of scholars having a year’s worth of educational activity at any specified time. In different fields of study (Daghbashyan 2011), the amount of full time equivalent scholars is utilized as proxy for the educational activity output. However, the employment of physical headcounts intrinsically blocks out the movement maintained by universities and institutions in training scholars (Salerno, 2003).

Regarding research and development, universities and institutions are supposed to cooperate with individual companies in leading utilized research and besides, managing

free important research for knowledge organization. Also benefits the society gains from research efforts, universities and institutions also win net worth out of the research awards. (Kempkes and Pohl, 2006) therefore, the profit got from research projects may be utilized as proxy for the measure of output made. All the same, as Kempkes and Pohl remarked, research profit is capable to a univeristy prejudice for several departments like medicine or engineering, incline to have profit from research grants contrary to different departments like languages. Nevertheless, employment of research profit as proxy because research turnout is satisfactory in the absence of yearly information for secondary variables such that as research evaluations and consultancy profit (Flegg et al., 2003).

Occupying input information, the common variables that are applied in DEA analyzes (Kempkes and Pohl, 2006) admit the number of person, the total of undergraduate and postgraduate scholars, and aggregate expendings like including pays and wages, etc. Nevertheless, Salerno set up two measuring problems associated to input information that can falsify approximations of efficiency and they admit:

1- Describing patterns change over institutions and hence, institutions might feature dissimilar method of sorting their consumptions; and

2- Lack of functional method to indicant input quality. Since the aim of the study, the choice of input and output information comes that from Ampit and Cruz (2007). Particularly, the DEA from the 47 universities and institutions (in Turkey which judges the input elements that universities employed to bring about potential outputs and also, information about the total number of registered scholars, total number of alumni, which are every output evalluate (Castano and Cabanda, 2007).

2.1.3 Fundamentals of DEA

Data Envelopment Analysis was primary developed by Charnes, Cooper, and Rhodes. It is an easy even effective technique applied to assess the comparative efficiency from a group of uniform institutions or decision making units. A decision making unit may be specified as an entity obligated for converting inputs into outputs and whose executions are to follow evaluated. The popularity of DEA follows its power

to assess comparative efficiencies of aggregate input and output decision making units without preceding weightings about the inputs and outputs.

Policies, especially in developing economies, take an important role in same extent. Their provisions attract enterprise leaders and generate efficient situation for center development by performing immediate investment, facilitating business and formal transactions, and providing the availability of skills.

Lindsay (1976) indicates that common rules do not assess the rate from a production of its industrial cost, only from its features. Common authorization may measure just the most visible features and this involves that profitable resources are conducted towards them. Contrariwise, individual initiatives assess every the features of an output. Sisk (1981) Implemented Lindsay's hypothesis to academic originations, nevertheless he applied just one input and one output. Ahn et al. (1988) covered Sisk's research through contributing aggregate inputs and outputs and applied a DEA pattern to control the theory that state universities are more effective than private universities. They employed capital and labour for inputs and education and research for outputs, assessed by the total of full time factor elements individually as undergraduate and postgraduate education and the quantity of awards and contracts consequently.

Tomkins and Green (1988) evaluated the efficiency of the specific field of study in English universities through streaming six DEA patterns. Specific involvement faces the inclusion from research postgraduate scholars, including the number of issues as a value for research and the total of academician as a value for instruction. Johnes and Johnes (1993) separated issues into classes: reports in academic issues, letters in academic issues, report in professional issues, reports in favorite issues, authored articles, edited articles, printed authoritative reports and donations to edited studies.

Every researches mentioned until now evaluated the efficiency between corresponding departments of dissimilar universities. Mehrez and Barboy (1994) followed the initials who assessed the efficiency between departments of the one university and accurately at Ben Gurion University. The writers say that while there are several retires in this sort of analysis since DEA accepts that decision making units are undiversified, which is difficult to be the subject, there are a lot of rewards. An easy qualitative analysis can not be sufficient and bears for personal prejudices, although

DEA can offer target quantitative measurements which at any rate signifies that it is an important reciprocal method for the administrator. The similar way is observed from different academicians such as King (1997). According to Johnes (2006), primary advantages of DEA, represents that it computes one elementary grade for all decision making unit which is easily accessible by everyone. The retreat of the fundamental DEA method is that it allows for no indicant whether these elementary scores change statistically important. Bootstrap methods have been prepared in order to defeat this trouble and they are applied to calculate 95% confidence intervals for all decision making units. Furthermore, these methods are utilized to DEA calculators which are predetermined by structure and rule out this prejudice. In 2006, bootstrap methods have been used in universities and institutions by Johnes.

Entrepreneurship and innovation is the cycle by which ideas are created and capitalizing, and entrepreneurship and innovation centers can assist prompting that stage to the level of a diversifying skill. Institutions and companies are satisfied that such skills are main dynamic in the success of an university's, or a nation’s, extensive vision, that is called way to play. A proper diversifying capabilities of organization is rough to advance, but, additionally, it is difficult for others to imitate. Hence it provides a sustainable vying advantage that gives the right to win in the competition.(Mainar Dichief, Global Innovation index, 2013)

The aspiration of the entrepreneurship and innovation scoring is to arrange companies or other organizations and achieving in university and institutions with a gadget for evaluating their skills and performance relevant to entrepreneurship and innovation. In the years to come, this gadget may be updated as an assistant for assessment, or independent analysis, necessitating it to be complement with a research and the arrangement of the operations involved. The processing of this mechanism is familiar to supply to the strategic consideration of the universities and companies, or other operations, on their entrepreneurship and innovation developments, providing for an deep perspective of the other dimensions that maintain such servise of actions and labeling of scopes for potential development.(EIS, 2009)

2.1.4 Productivity

In early years, subjects about increase in opulence indicated that productivity and efficiency are thought basic concepts in an economic system hypothesis. In a event that economic performance is measured overall, outcome and efficiency are important elements for institutions, industry and market term to utilize the resources best. Efficiency shouldn't be just believed earlier or on the outcome process, it should be considered after output process as well in order to sustainable development in the field of studies, provide the inputs and develop new strategies. Additionally, it is now conceived as a significant element both internal and external academic performance and also supply contributions to planning, leading and operate approaches.

Before entering the concept of productivity, there should be brought a few definitions from contrary views. Japanese productivity center specify productivity for performing right things in a profitable method and its aim all of the time is to improve world life.(Z.Akal,2005) This approach takes that nowadays should be more effective than yesterday and yesterday should be more effective than tomorrow (Kaizen). Drucker (1997) also describe productivity as matching economical and social life to changing disciplines, utilizing new techniques and improve quality society.

Furthermore, it needs much attempt for providing and employing the resources, specifying objectives, formulating new strategies at the point of an institution strategy. Productivity is thought as among the most significant performance measuring element for institutions.4. In preceding years productivity specified as ratio between output and input and sustain clear definition today (E.Deliktas,2003). Its possible expression shown as; Productivity=Output/Input

Supported this relationship indicated above, productivity specified as a coefficient executed out from ratio betwen output and input. Thus, if any output unit makes more or better product compared to early flows, it may be observed that productivity is expanded considerably (Z.Akal, 2005). This outcome points an alterance about techniques utilized for production procedure, quantitiy of inputs and outputs. This alterance may be specified as follows:

- Getting more output with the same input
- Getting the same output with less input
- Maximizing output more compared to inputs

As expressed above, single input and output patterns may not be good enough to assess productivity and might execute poor outcomes. In order to get over these unpredicted performances multiple input and output analysis may be applied to get better solutions.

2.1.5 Efficiency

With the view of management, efficiency specified as a performance measures for the institutions away from activities to attain the specified targets. Thus, efficiency is rely on objectives and specify relationship between objectives and outputs. Peter Drucker (1990) specify efficiency in an aspect of management and system as performing appropriate things that measures performance of directors. Hence, it constitutes a capacity that performing the proper things in output procedure.

Meanwhile, efficiency represents a capacity of checking options to fulfill objective approaches and situations (J.A.F.Stoner, 1978, P.Drucker, 1998). In this instance, succesfull directors may be characterized as decision maker and developer of proper tasks and techniques.

According to Knight (1993) efficiency equals a ratio between good output and input and it establishes modern efficiency evaluation. In addition to this, involving each inputs and outputs, it should be worked out what to do additional.

Hicks (R.Fare, S.Grooskopf, C.A.K. Lovell, 1985) who has a report on weight of market for managers expressed that efficiency is an important element in capitalist world and when competency minifies efficiency will decrease too.

Koopmans (1951) outlined theoretical efficiency as maximizing the output technologically without altering different output. Debreu is the eldest student who discovers theoretical efficiency degree on index or a measurement by resource employment coefficient.

Stigler (1985) said that to determine that any institution employing proper variables, constraints or economic objectives may be found by efficiency level. Kopp applied effective model of this concept in steel production for junked decrease and he found out the outcome that efficiency measurement is not right analysis for this concept.

Efficiency and evaluation research disciplines may be expressed as follows: (H.O.Fried, C.A.K.Lovell, S.S.Schmidt, 1993):

- General and best technology applications
- Competititon
- Public or private
- Efficiency and firm scale
- Regulation effects
- Uncertanity

These analyzes generally require econometric and limeted software supported mathematical models. Charnes and Cooper have began linear software analysis in efficiency study (A.charnes, W.W.cooper, 1961). This analyze guide to data envelopment analysis researches. According to Seiford DEA efficiency analysis was initiated by Farrell but Eduardo Rhodes'doctorate thesis was also turning point for the DEA efficiency studies (L.M.Seiford, 1996) Additionally, CCR and BCC pattern have been formulated and applied for efficiency ratings.

2.1.6 Terminological Comparison of Efficiency and Productivity

While, productivity and efficiency generally are comprehended as equivalent word, productivity can be described as total resource valuation, efficiency equals a resource evaluation for each output unit (R.Kok, E.Deliktas, 2003) Efficiency is an important for productivity analysis. This description can be projected as efficiency alterations is an element that can lead with productivity alterations. Hence, unless university or institution are efficient, it is not achievable to be productive in the least.

For the beginning and academic research that shows differences between efficiency and productivity patterns have been initiated by Nishimizu. And by this, it is targeted to state efficiency improvement and apart it into three other levels that are

compilation in the production limit and compilation that are sustaining distant and becoming close to the production limit. This study had an objective to show efficiency constitutes an imagination for productivity. Additionally, analyses centered on efficiency exchanges which conduct to productivity improvement and this had better be simulated to productivity improvement subjects. Among the analyzes that have been executed by Fried, they examined that productivity improvement approach can be profited through efficiency analysis (Lovell, 1993)

Furthermore, a constitution time vary between efficiency and productivity units. Efficiency is a quick time concept only productivity long term type. For example, by utilizing every factor best to turn productive takes a short time process but defeating the problem which costs waste of resources to gain for becoming productive requires a long term process.

2.1.7 Benchmarking Data Envelopment Analysis and Regression Model

Although regression models are quantitatively strong, they are guiding light to let in multiple inputs and outputs hence regression models generally restrict the researchers to one conditional multivariate. Regression models also present just an acception of exemplary success, though providing zero feedback for enhancement theories. In addition, regression models effect a detailed useble work on the data, determining a single function that constitutes a set of theoretical moderate performers.

In Figure. 2.2 it is shown that the difference between regression and DEA. Although regression establishes a moderate draw admitting all decision making units, DEA establishes an efficient frontier that lets in the finest decision making units. Although DMUs above the regression line found to be acting more acceptable than mean, they are not acting as the most satisfactory decision making units or most successful DMUs on the efficient boundary.

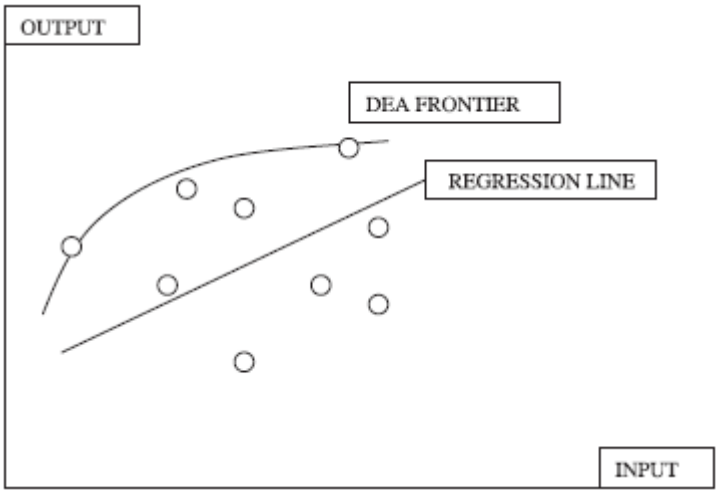

Figure 2.1 Differences between DEA and Regression.

2.1.8 Data Envelopment Models

Data Envelopment Analysis is a linear programming modelling application that issues on comparing of identical decision making units (DMUs) for their inputs and outputs. DEA application remarks whether or not any particular unit is successful and competent based on comparing with separate. In basic pattern of efficiency ratio is found out as follows:

$$Efficiency = \frac{Value\ of\ outputs}{Value\ of\ inputs} \tag{2.2}$$

In the literature, an efficiency score of any specific unit cannot be greater than 1; hence, it must be less than or equal to 1.

$$\frac{Value\ of\ outputs}{Value\ of\ inputs} \leq 1 \tag{2.3}$$

Altering this form into linear phase;

value of outputs $\leq$ value of inputs

$\text{Max } Z = \sum_i^m b_{ih}\, y_{ih}$ for h = 1,2,…,k

m = number of variables

k = number of universities (2.4)

Such that;

$\sum_i^n a_{ih} x_{ih} = 1$ *for h = 1,2,…,k* *n = number of inputs and variables*

$$\sum_i^n \left(\sum_i^n a_{ih} x_{ih} - \sum_1^m b_{ih} y_{ih}\right) \leq 0$$

$Z = Efficiency\ score$

$x_{ih} = observed\ value\ of\ input\ for\ the\ university\ h$

$y_{ih} = observed\ value\ of\ output\ for\ the\ university\ h$

$a_{ih}, b_{ih} = weights\ attached\ to\ inputs\ and\ outputs\ of\ university\ h$ (2.5)

The primary objective of the proposed model is to analyze whether a university is inefficient if the evaluation of the objective function equals 1 the university is efficient, if it is lower than 1, it is inefficient.

The efficiency boundary formed by the preceding CCR model brings out constant return to scale. As a source of CCR DEA exemple, Banker expressed as BCC example, contributes the restraint, $\sum \lambda_r = 1$ as variable returns to scale. The assertion of CRS is accepted that once an addition in complete inputs by 1% effects on growth in complete outputs. Besides, it should be noticed that the traditional DEA examples are separated into two groupings, an input oriented and output oriented.

An input oriented modelling results to the relative decrease of inputs as preserving the actual point of output for an ineffective institution to turn efficient. Contrary to, an output oriented modelling leads to how much growth of output of an ineffective institution is required while preserving the actual point of inputs for it to turn into efficient.

2.2 OVEVIEW FOR DEA MODEL AND INPUT-OUTPUT EVALUATION

Another significant arena for performing a DEA analyze is determining ineffective decision making units in order that they can be designed onto the effective frontier. Fully efficient decision making units lie on this boundary so all others are

uneffective. The measure by which these are uneffective is mapped by their distance from the boundary. To accomplish the boundary, trend must be source searching, for instance input focused, or source exiting, for instace output focused. Both distances could be figured. In case a decision making unit gets closer to the source, and requires to move outward to accomplish efficiency, it is searching to more beneficial utilization of existing resources. More output can be reached by the same inputs thus this technical efficiency constitutes a grade of low accomplishment. For instance, a technological efficiency of 80% indicates that 20% additional output is achievable from the actual inputs.

As the output measures are satisfying and need to be kept, the inefficiency exhibited by a decision making unit is understood as the accomplishment of this output at a cost of inputs greater than efficient decision making units. Therefore efficiency proves how much simplification in inputs is needed for the decision making unit to go efficient. For instance, an efficiency of 70% indicates that inputs can be minimized by 30% for the decision making unit to reach total efficiency compared to different decision making units. This efficiency commonly displays how the decision making unit goes down of accomplishing efficiency due to a deficiency to form input exchanges or reallotments, in other words, to determine more satisfactory efficiency alternatives.

There are three potential ways that may happen in reaching the efficiencies remarked; inwardly centralized, outwardly centralized or both, speculating the utility of reduction of inputs to accomplish the same outputs, reaching more outputs by presented inputs, or managing both.

The input oriented (IO) configuration as pointed in below figure, intents to shorten the numbers of the inputs through the ratio of QP/OP to accomplish technical efficiency. The allocative efficiency is proven through the ratio OR/OQ. The IO representation generally conforms to the figure of the DEA model applied to show this preference. For instance, the model that was widely utilized in early disciplines is the CCR-IO.

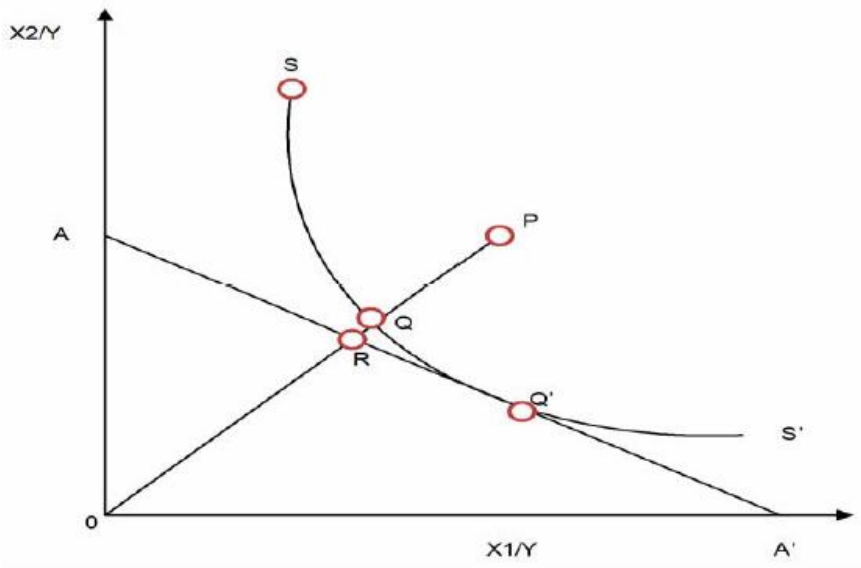

Figure 2.2 Technical and Allocative Efficiency for Input Orientation.

The output oriented configuration is pictured in figure. The purpose is to maximize output grades under considerations where the input intake continues stable. A represents the inefficient decision making unit since it rests under the efficient frontier, thus the distance AB stands for technical inefficiency although TE is expressed as OA/OB. Allocative efficiency equals OB/OC.

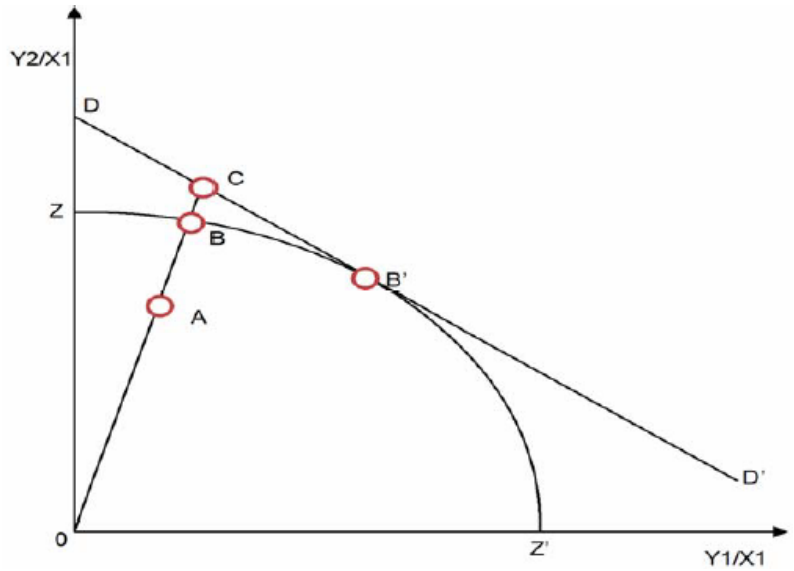

Figure 2.3 Technical and Allocative Efficiency for Output Orientation.

The third feasible scheme is to try to accomplish the input oriented and output oriented targets at the same time. That is, attempt to deal input excesses and control these while at the same time attempting to get more output; minimize inputs and maximize outputs. This is comprised by the linear (AM) (Charnes et al. 1985) and slack based (SBM) methods. The slack based value of efficiency deals the output shortages and input excesses by utilizing the linear method to generate constant scalar quantities that grading from 0 to 1, to comprehend any inefficiency that can be discovered. As the primary function of the DEA is the calculation of overall efficiency grades instead of an analysis of the decision making unit elements responsible for those functioning these Preferences will altogether bring about the equal outcomes. Moreover, input and output oriented steps are equal only if constant returns to scale to be extant.

2.2.1 Limitations of DEA

The specific characteristic of DEA is that it has a reportable utility in examples where another instruments cause unsuccessful since by the complexness and frequently unidentified nature of the relationship between aggregate input and output variable quantity. As a matter of fact this hardiness is established in the power of DEA to function data of progressive cognition to the extent that specified data can be carried in ordinal relations such that more or less than for some decision making units and more conservative tangible information for others. The points of measuring, which are nominal, ordinal interval and ratio for decision making units, can be different but the power to admit them in the information determined controls that the efficiency computation for all decision making unit comes about with the donations of each factors weighted according to their particular influence.

2.2.2 Assumptions and Precautions of DEA

The basic assumption unexpressed in DEA is that for an extreme level technique if one decision making unit is capable of accomplishing 100% efficiency by the accurate ratio of output and input elements optimally adjusted, and so remaining inefficient decision making unit should be capable of performing the equivalent whenever they run efficiently. Unquestioning in this supposal is that the inputs and outputs are uniform, as in fact there can be disagreeing quantities of heterogeneousness not just in the factors of the decision making units but within the decision making units

themselves. Other conditions that takes attention when utilizing DEA have the followings:

- The exception or insufficient selection of input and output data, by choice or skip, can make a preconception in the outcomes.
- Measuring fault in the information may bring about unfair results.
- External environmental elements can affect on effective operations of dissimilar decision making units.
- Efficiencies of decision making units are age group qualified and may be rather dissimilar if thebroader population were enclosed.
- The DEA computing does not surely report for operating conclusions considering management's risk averting or long optimisation strategies.

2.2.3 Strengths and Advantages of DEA

DEA is an effective non parametric instrument because of studying efficiencies of decision making units in the same association by permitting straight companion and assists to grouped associtates comparisons, with the ground of a collection of input and output elements through an instantly different range of modellings. An inferred knowledge or appointment of weights is not essential for the pattern since results are even logical, albeit conceivably conventional. This may be especially important when inputs and outputs are from dissimilar measuring units. There is no demand to have supposals about the usable form of the inputs or outputs and their relative analysis allows for assorted views of efficiency (TE, and EE), showing opportunities for advance. Charnes et al. (1994, p. 8) offer twelve effectivenesses of DEA as stated below.

1) The center of attention is on independent decision making units in counterpoint to population norms.
2) For each DMU accepts a individual collective quantity for the employment of input elements to develop wanted outputs
3) DEA may at the same time apply aggregate outputs and various inputs on all being expressed in another unit of measuring.
4) Alterations may be established for external variables.
5) Categoric dummy variables may be enclosed.

6) Calculations are value free and do not necessitate identification or cognition of an inferred weights of outlays for the inputs or outputs.
7) There is no limitation about the useable pattern of the output correlation.
8) DEA can help assessment when in demand.
9) DEA can bring about particular approximations for wanted modifications in inputs and outputs for designing DMUs under the efficient boundary onto the efficient boundary.
10) Outcomes are pareto optimal.
11) The center of attention is about the discovered top apply boundaries instead of central tendency attributes of boundaries.
12) It fulfills exact equity measures in the comparative rating of all DMU.

2.2.4 Weaknesses of DEA

Because of non parametric nature of DEA, it does not provide the use of constructive statistics and conventional methods such as hypothesis proving, and so on. Because an immoderate level technique it may be importantly determined through outliers and is convincible to the noise such as measuring fault. DEA is effective at calculating comparative efficiencies just insufficient on arbitrary measures. It meets steadily to conclusive efficiency not providing a comparability to the theoretical upper limit and DEA necessitates that all decision making units has an individual simple scheduling expression, hence leading in many linear programming loops. For big problems with a lot of decision making units this may be computationally intense and difficult, and occasionally beyond the capacities of many programs. A different affect is the lack of expressed functional parametric quantities. While there are principles of press that have direction to the application of DEA on that point comes out to be a deficiency of a determinated frontier.

Their solution is trial and error. Judging a little number of input and output items and step by step incrementing the amount and finding the results. Although these failings and restrictions might be unfriendly to the productive use of DEA, it should be known that a realising of their warning and potential affect also signifies that they may be improved for the improvement of the study. There is also the alternative of defeating some weaknesses through using DEA together with different optimisation methods.

2.2.5 Other DEA Models

DEA can be considered as a consistency of conceptions and methodological analysis that has developed since the originative study of Charnes, Cooper and Rhodes (1978). The CCR ratio pattern has been the focal point of this model we want to emphasize the important way of functioning that have prompted the application of DEA. It has generated for target evaluations of efficiencies and hence slacks of decision making units. By bringing out the deficiencies of the unusable units it offers a way for advance. The fault in the primary example yet, was the supposal that efforts toward efficiency constituted at constant returns to scale. The CCR takes a piecewise linear constant returns to scale aspect. CCR case examples, under symmetric efficiency, do not allow input excesses and output deficits, that is, non zero slacks. The slacks based model directed this through utilizing the linear example to establish scalar measurements from 0 to 1 that describe each of the inefficiencies that the example can describe (Cooper, Seiford and Tone 2006, p. 104). The Banker-Charnes-Cooper (BCC) example (1984) described between methodological and range of inefficiencies. It estimated range of processes by measuring the benefits of utilizing minimizing, maximizing or constant returns to scale to increase efficiency.

The BCC model gives a piecewise linear variable RTS envelopment fundamentals. The models used which data is increasing, apply partial linear logarithm or partial Cobb Douglas envelopment rather than the conventional partial linear fundamentals. The cumulative and extended cumulative pattern refers to the CCR model simply comprises Pareto's economical conception and Koopman's newer study. A development of the DEA conception and methodological analysis in the early 15 years of this approximation is elaborated in Charnes et al. (1994, p.12), with different writers observed sooner (Emrouznejad and Thanassoulis 2005; DEAzone 2005) contributing to this broadcast in afterwards.

2.2.6 Reviews for DEA

The consistency of knowledge environing DEA and its use is rising steadily and getting various. It is not supposed that this study can fully search completely the subjects just about supplementary comment can give a view of DEA's pertinency. The newer examples were inherent the impression that additional outputs and fewer inputs

were advantageous achievements, and therefore were studied just about this principle with no preparation for options. In recent times the focal point on useable efficiencies has diversified to let in the affect of these efficiencies on the far side the arrangement. For instance, expanded rich output may be understood positively by academicians, economists, and authorities and society members, even be glowered on from the residential area. Enhanced output might signify enlarged waste, contamination or environmental disaster resulting from acheiving the comprehended affordability of a reduction in the purchasin price per social units or appliances etc.

Bacic DEA examples could not suit for such bad outputs. Therefore, strategies specified charging the inputs or altering outputs to turn inputs, for instance, contamination goes an input cost to repair, were assumed. Unwanted inputs and outputs in variable returns to scale (VRS) envelopment examples have instantly been formulated (Zhu 2003).

DEA studiously outlines the primary application frontier and operation is calculated versus this. It is common to accept more than one decision making unit with the efficient frontier. If each efficient decision making units specify the frontier and take different statuses on it, and so which is the top of the effective decision making unit. Satisfyingly a method of rating efficacious decision making units by a contextdependent analysis appropriates a pattern of initial level, second level and so forth, evacuation till the ‘better of the better’ is departed.

Bottleneck in economic science denotes to states of affairs where step downs in inputs can really increment outputs. For instance, an oversupply of fertiliser can really abbreviate output. The VRS (variable returns to scale) example may be written again to calculate this and to let in the affect of slack in bottleneck.

Supply chain efficiencies, particularly the value adding works that are acquirable by a study of the total supply chain, have been unidentifiable because of the being of multiple and dissimilar amounts that elements of the chain application, and the opposing form of authorized dialogues. Zhu (2003) argues that traditional DEA neglects to correctly qualify the efficiency of the supply chain since the efficient operation of different factors of the chain might not be correctly described. Thus models are presented that can treat this. Non discretional inputs and outputs are those states of

affairs where external factors fix or out of general management responsibility environments affect on potential efficiencies of the decision making units.

Traditional DEA examples accept that each inputs and outputs could be different at the circumspection of direction or different, but non discretional variables not capable of management check might be considerable enough to be let in consideration. These variable quantities can be as different as weather disciplines for piloting a plane, the demographics of a regional client fundaments, the age of warehousing institutions, and so on. A nonverbal handling of the information to minimize the impact of non discretional input excesses or output falloffs is conceivable and has been developed for CCR and BCC examples (Charnes et al. 1994).

When DMU is not efficient and if it is inside the boundary may blame efficient decisio making units on the boundary that operate within its range (or aspect/cone) as purpose models. Therefore, contingent on the size and range of a DMU, each decision making unit will get another set of function models. For instance, in figure. 2.3, the unit A can utilize units C and D as function models to turn efficient. In addition, as to B, units E, F, and G are the more desirable function models. This essentially underlines the detail that the function model for a small retailer store may be dissimilar from the function model for a wide chain such as ones that have many branches.

The length between a DMU and the boundary make for the goals for benchmarking. For instance, in figure. 2.3, unit A can turn efficient through acting towards the boundary through a length X horizontally (minimize input used by X) or by acting towards the boundary by a length Y vertically (maximize output made by Y) or a combining of both. Specified measurable and actionable objectives satisfy the demands of step 2 of the benchmarking method. Furthermore, a decision making unit turns efficient by going towards the boundary. In addition, because productivity is the ratio between output to input, a DMU can be successful by maximizing output or minimizing input. Although this figure example has just one input and just one output for simple graphical denotation, DEA can run with multiple inputs and multiple outputs for productivity measuring and benchmarking.

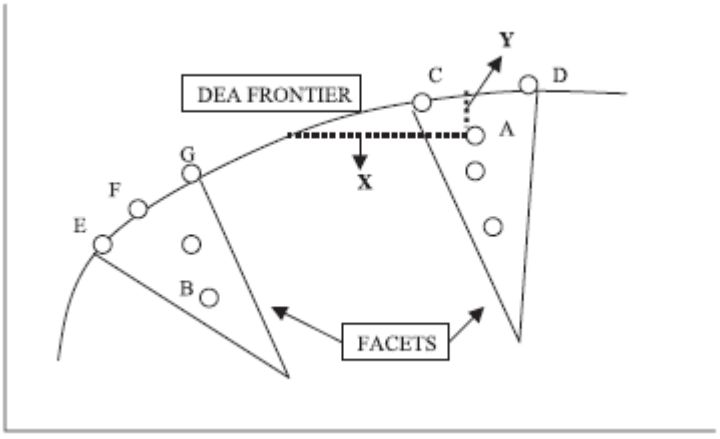

Figure 2.4 DEA Facets.

Benchmarking specialists specify three types of benchmarking: internal, competitive, and generic functional (Spendolini, 1992). Internal benchmarking mentions about a company's attempts to examine most skillful performances within a company's important business units or affairs and try to move them to remaining units of the company. For instance, General Electric can realize that its fiscal analysis, GE Capital, has the most efficient range processing. GE may choose to analyze the process and attempt to utilize it in different analyzes.

Competitive benchmarking includes studying challengers of business exercises and moving them to one's personal company. The basic model of competitive benchmarking is Xerox's achievment in benchmarking Canon's design and manufacturing processes that made Xerox to retrieve its market share in the photocopiers commercialize (Camp, 1995; Dumaine, 1988).

Operational benchmarking mentions about benchmarking exercises comparison for a firm's operation to that of the most satisfactory applies of non competitors in the industry and even out of the firm's industry. For instance, Garanti Bank customer service and Turkish Airlines customer relationship structuring patterns are considered the most suitable and are imitated not just in the hospitality and credit card industries, only in a big range of a different industries as well (Hiebeler et al. 1998).

In the mentioned model examples, DEA can assist GE to examine that GE Capital is the best unit versus which it should benchmark every other GE units. DEA will assist others units as well in specifying goals and contribute a guideline for raising efficiency. Generally, DEA may assist Xerox key out that Canon is the most proper benchmark and supply Xerox the guideline to accomplish efficiency point. The guideline might be supported by identifying inputs that should be minimized or getting outputs that should be maximized.

2.3 ENTREPRENEURSHIP AND INNOVATION COMPETENCY RESOURCED BY ACADEMIC PERFORMANCE

Turkey's power in R&D expenditures is approximately equalized with a power in science, technology and innovation performance. To underline, the development in worldwide, publications and patents, that compose two primary goal indicators of STI administration, can be given as an example. Thus explanation these indicants, the level increases in R&D and activating factors have been refined into levels of growth in STI administration and goals for better STI efficiency.

In the scope of this study model it is intended to give assistance to universities in their entrepreneurship and innovation performance involving their level in acdemic performance that yielded with the foundation of a scoring table previously carried out by TUBITAK and URAP and this rankings are reliable in the references by the related institutions and Ministry. By application this field of studies, the universities will be able to sufficiently describe problems, and can evaluate and try out their academic report together with entrepreneurship and innovation performance and capacity, which will be proven measure for the universities that will guide our country's economical development, those which are further informed of the functions of academic, entrepreneurial and innovative energy in a knowledge sourced worldwide and national growth.

TUBITAK rating of the top universities in Turkey reported in 2012 and involves what would be the indicators of the University Entrepreneurship and Innovation Index. The index presents university ranking in compliance with their innovation and entrepreneurship success, thus, focusing to assist to the advancement of the innovation atmosphere.

Also this index evaluates universitiy under five main dimensions of economic contribution and commercialization, intellectual property pool, cooperation and interaction, culture of entrepreneurship and innovation, and scientific and technological research competence as to 23 indicators. The Rating will be clarified annually lead by the Council for Higher Education, Turkish Statistical Institution, the Ministry of Science and Technology, TPE, Ministry of Development, Turkish Academy of Sciences, TTGV and KOSGEB.

In a conference set up at the Ministry of Science, Industry and Technology, Former Minister Nihat ERGÜN stated the aim and the focus of the The Entrepreneurial and Innovative University Index and that it has been evaluated for the first time in Turkey, 2012. And Prof. Dr. Yücel ALTUNBAŞAK, the President of TUBITAK has also participated the conference and Former Minister ERGÜN stated that the universities not have more than 50 faculty members have not been avaluated in this study set up for creating the entrepreneurial and innovative efforts in universities. Thus, the results of index consist of 126 universities in the aggregate of 168. Former Minister stated that the index is included in 5 dimensions which composed of 23 indicators in the aggregate.

European Commission statted that commonly on the upheaval of composite indicators scoring through provision processes (The Joint Research Centre). From 2011 on, The Joint Research Centre controls the study to keep the gathered notional and statistical consistency of the national system, and a a constancy and sensitivity analysis of the latest rankings. The Joint Research Centre has got common on composite indicators and developed.

According to the 2000 Lisbon strategy to make the EU the most active and vying information based economy in the scope skilled of sustainable economic accretion through more and value added jobs and bigger social integration, a European Innovation Scoreboard (EIS) was established to keep remark on the drivers and throughput of entrepreneurship innovation. An industry case may be generated for other indicators as well.

Conference Board of Canada stated the Exploring Canada’s Innovation Character in 2004 as comparison against global leaders, a research carry out for an institution as

part of the innovation strategy. The conformation generated and applied by the committee in charge of research innovation is very advantageous. It separate innovation into four dimensions; knowledge efficiency; ability performance; innovation atmosphere; and culture of innovation.

Compressing picture of innovation output is insured by the summary innovation index, a composite indicator achieved by a relevant collection of the 23 indicators used for measuring innovation performance. Applied example shows the performance results for the university.

There are types of many models for innovation bases. In all of them we can study, and that many institution authorities that have performed an important role in basic development and performance. Leaders can promt entrepreneurship and innovation centers by providing funds and linkages, by simplfying knowledge form and sharing, and by ensuring a connection for the globalization of ideas.

This point in question focuses to assess the reciprocal affect of academic performance with entrepreneurship and innovation performance on the university view. This assessment can give support, for instance, a delegacy of high quality in terms of feature articles, field of studies, differentiation and liability of development and activities. It also specify the method in which the university see the model and its arrangement in terms of university reputation.

The performing resolution of the university's image and its combination with the presented acedemic factors with entrepreunership and innovation approach outputs are contemplated in the process to this study by refroming the grade of the university's reputation starting from the perception of compatibility regarding its academic performance with entrepreneurial and innovative skill.(Celina Gil, 2009)

2.3.1 Promoting, Innovation, Entrepreneurship and R&D in Universities and Organizations

Assisting innovation, entrepreneurship and scientific innovation resourced disciplines is one of the crucial subject of STI (Science, Technology and Innovation) strategy. The focus constitutes to increase the contribution of the knowlegde and both academic and business enterprise sector in GERD as a part of GDP to 60% by 2013 and

to sustain the knowledge and business enterprise utilities in joint developing powerfully in STI.

Bringing of development to bear, increase and to lead to sustain systematically in entrepreneurship and innovation assessment capability, entrepreneurial culture, and performance of Turkish universities, especially leading by institutions like TUBITAK, Ministry of Industry and Trade, Small and Medium Enterprises Development Organization (KOSGEB), and the Technology Development Fund of Turkey (TTGV) expand strategies that provide funds to the R&D activities of the knowledge and business enterprise utilities. The basic grant program for entrepreneurship and innovation researches of the academic and business enterprise categories including big enterprises and SMEs is managed by TUBITAK-TEYDEB (Technology and Innovation Grant Programs Directorate). The number of entrepreneurs and the number of project propositioned for all of the grant categories of TUBITAK TEYDEB are published between 1998 and 2009 regularly, the agency supplied about 3.4 billion TL in apportionment and give 7 billion TL in R&D in total as the biggest involvements to spark entrepreneurship and innovation and R&D movement of the acedmic and business enterprise institutions.

2.3.2 Promoting Curiosity Driven Academic Research

University and research institutes have a substantial factor in knowledge based development as an important origination of human resources. Thus, organizations like TÜBİTAK and State Planning Organization (DPT) support grants for high quality, goal oriented research, including those to supporting searching driven academic entrepreneurship, innovation and R&D to maintain innovation and entrepreneurship in universities and in Turkey. State Plannig Organization is authoritative for coaching the technological research area investment funds, which involves resources assigned for TARAL under the arrangement of TÜBİTAK plans. DPT’s technological research sector budget from 2003 to 2009 is represented in Figure:

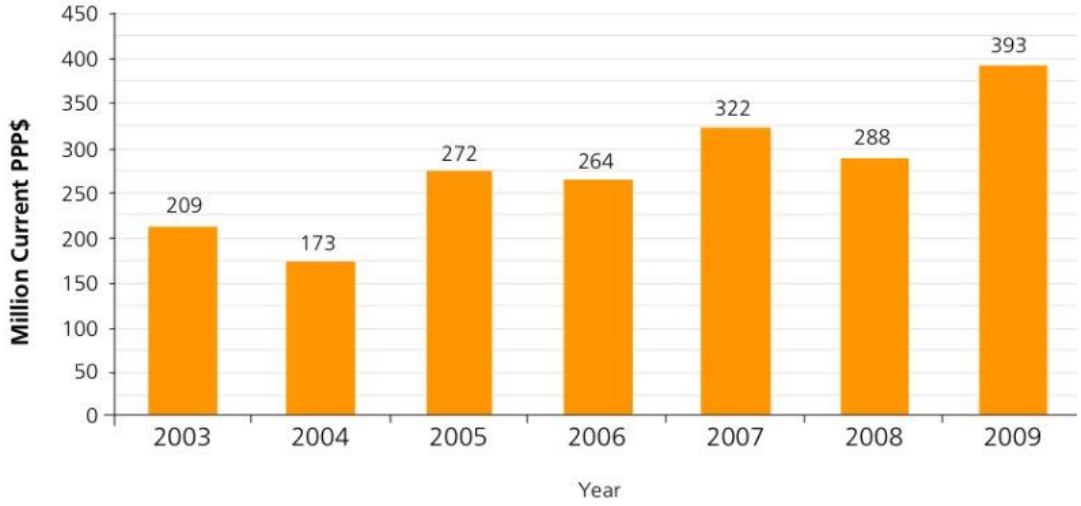

Figure 2.5 Technological Research Sector Investment Budget of DPT (Source: DPT).

2.3.3 Scientific Publications

According to the scientific performance and the ability to transfer or produced know how and international publications is a linking effect in the entrepreneurial and innovation system that can generate new products and transactions. Turkey has displayed a noticible degree of increase in publications, approximately it multiplied five times between 1998 and 2009 according to an exponentially growth approaching 25,264 ISI publications in 2009. With respect to the high population of Turkey, this position represents the amount of scientific publications in accordance with million population at 348 publications in 2009, that shows approximately three times increase according to 1998 publications number. Furthermore indicative increase in the amount of citations from 5 thausand to approximately 169 thousand in the aggregate in 1998 when it comes to 2009.

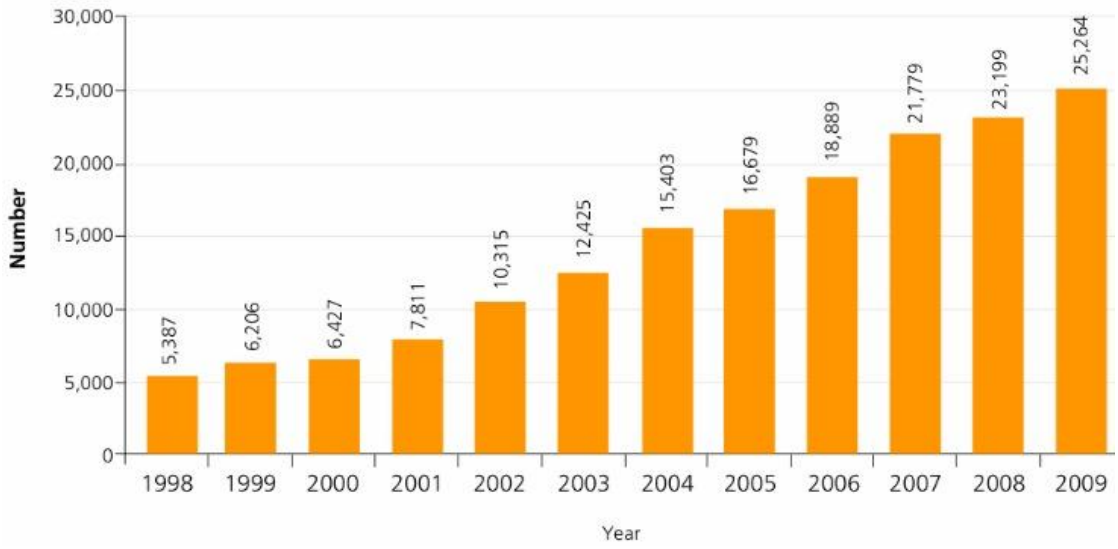

Figure 2.6 Number of scientific publications in Turkey (Source: Thomson's ISI Web of Science) Updated on 09.12.2010.

2.3.4 Patents and Utility Models

As other indicator of the performance from R&D, patents provide to technology spread and supply inspiration for further entrepreneurship and innovation, thus influencing financial performance. From 1998 on, the patent value in the Turkish Patent Institute (TPI) have increased with an exponential amount of increase, extending to total of 5,430 project model and patent applications recorded during 2009, the highest amount ever before, and approximately ten times increase from 1998 to 2009. The larger part of the applications are utility projects which are affordable and effortless than patent applications and are mentioned as inessential patents or innovation patents. Segment of applicants, especially SMEs, choosed to apply for the realistic utility projects even though their revealed projects may be patentable. Especially, in 2009, reaching to 2,842 utility project and 2,588 patent applications, exhibiting a 52% and 48% of the total amount of applications.

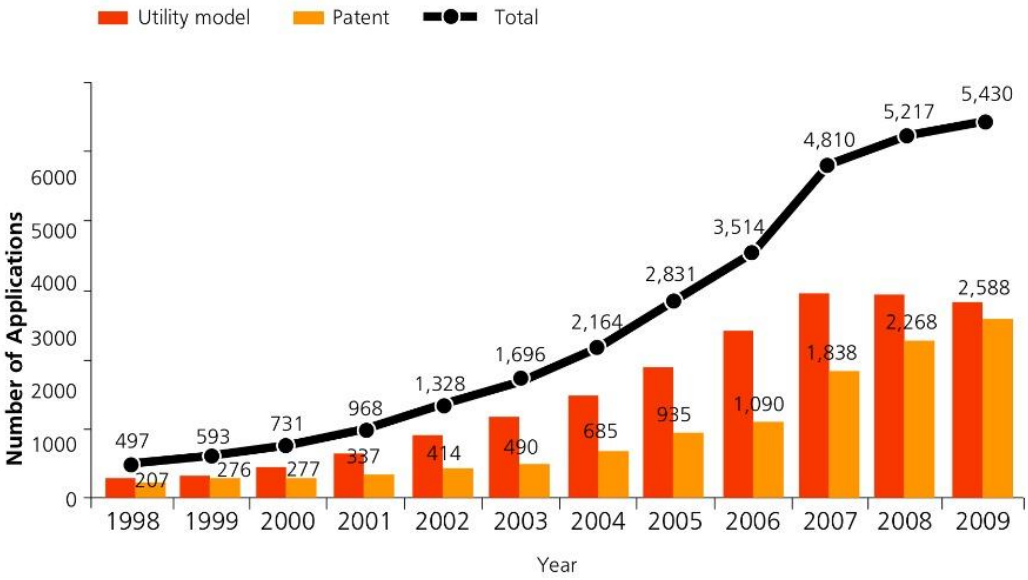

Figure 2.7 Domestic patent and utility model applications, source: TPI.

2.3.5 Innovation and Entrepreneurship in Turkey

Through recent industrial development acceleration and accelerated urbanisation, Turkey has performed a 2.4% annual decline in environmental policy from 2005 on to 2009. The National Food, Water and Energy R&D and Innovation policies planned the period of 2011 to 2016 are carried out by TUBITAK and goal centered assistance mechanisms have been started currently in accordance with policy aiming 2023 The Turkish Energy Efficiency Strategy (OECD science, technology and industry outlook, 2012)

Entrepreneurship and innovation is a vital STI strategy concern. The entrepreneurship grant policies support young entrepreneurs with grants so as to navigate entrepreneurship in the direction of technology and innovation. The related institution department for entrepreneurship was outhorized in 2012 to assist entrepreneurs approaching entry to domestic and foreign funds. Developing Anatolian Venture Capital Fund mamages SMEs funding needs for under developed areas. Scope of the work is also made to support entrepreneurship atmosphere in primary education at the first stage to the higher education.

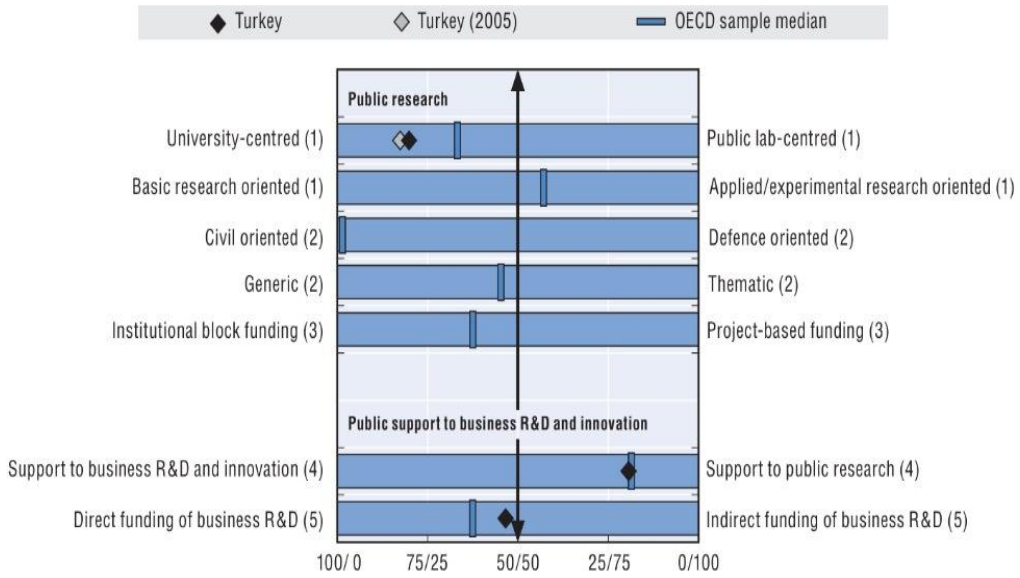

Figure 2.8 Overview of national innovation policy mix, 2010 Global Innovation Index.

From 2011 on, a new Ministry: Science, Industry and Technology (MoSIT) started STI policy arrangement, application and administration of R&D and innovation projects. The Scientific and Technological Research Council of Turkey (TUBITAK) and the Turkish Academy of Science (TUBA) included under the Ministry. Assessment policy was supported and a collaboration board between ministries has been established to audit all R&D, innovation and entrepreneurship reinforcement strategies carried out by the administration of TUBITAK.

Summary of national innovation policy, 2010:

- Equity in allocation of the sum of Higher Education Expenditures on R&D and gross domestic expenditure on R&D.
- Equity in allocation of total Government Budget Appropriations on R&D.
- Equity in allocation of total funding to activators.
- Equity in allocation of the sum of Higher Education Expenditures on R&D and gross domestic expenditure on R&D funded by authority and higher education and components

- Equity in allocation of the sum of unintended funding of business R&D and innovation through R&D tax supports and direct funding of Business Enterprise Expenditures on R&D through grants, contracts and loans. (OECD,2012)

2.3.6 Entrepreneurial and Innovation Index of TUBITAK

TUBITAK index is not:

- An educational activity ranking
- A concept for best university ranking

The purpose of this index is:

- To promote the entrepreneurship and innovation oriented contention between the institutions.
- To assess the performance of universities considering the entrepreneurship and innovation.
- To lead the evolution of entrepreneurship and innovation diffusely.

Below is the main and sub indicators of outputs of the proposed model in this study used by TUBİTAK for entrepreneurial and innovative university index:

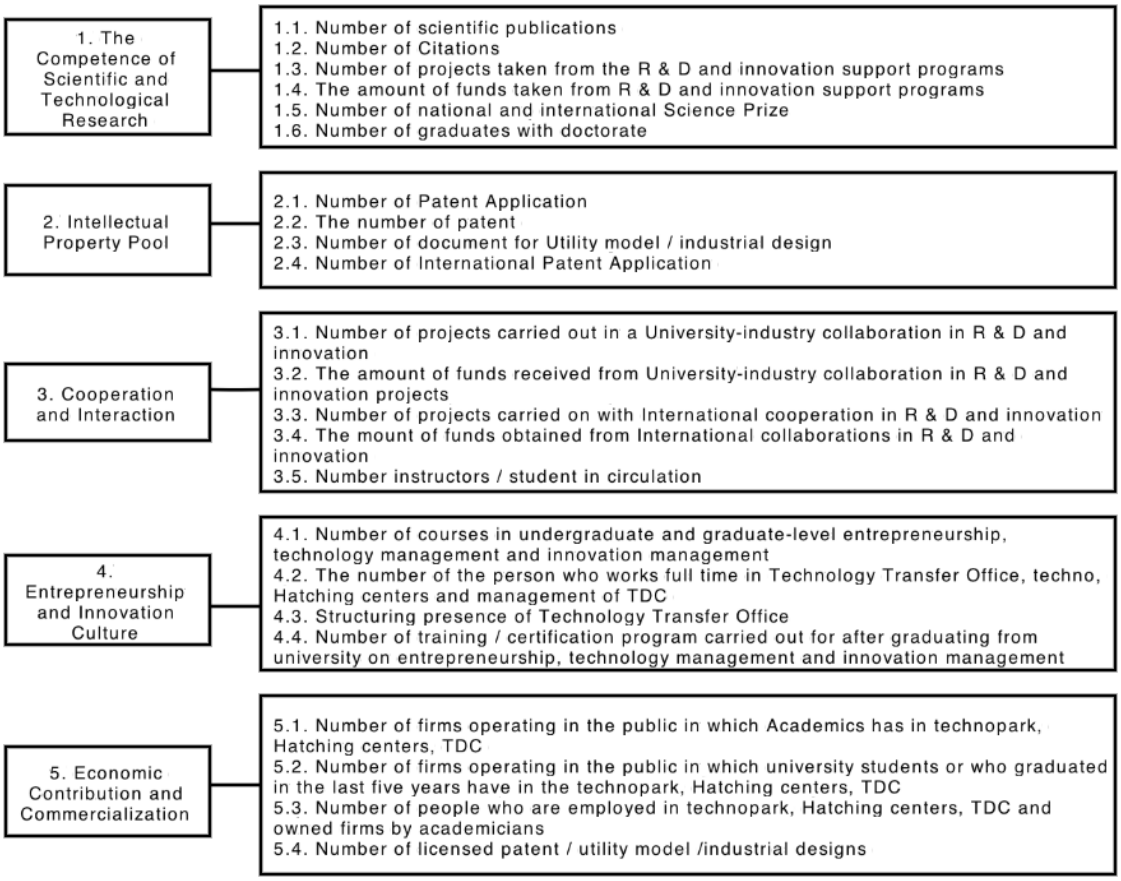

Figure 2.9 The main and sub indicators of TUBITAK ranking.

2.3.7 University Ranking Table, 2013 TUBITAK

Rating of the top universities in Turkey reported in 2013 and in what would be the indicators of the University Entrepreneurship and Innovation Index. The index present universities ranking in compliance with their innovation and entrepreneurship success, thus focusing to assist to the advancement of the innovation atmosphere.

Table 2.1 Ministry of Science, Industry and Technology, Entrepreneurial and Innovative University Ranking, 2013.

Sıra	Üniversite	Toplam Puan
1	ORTA DOĞU TEKNİK ÜNİVERSİTESİ	86 , 0
2	SABANCI ÜNİVERSİTESİ	85 , 8
3	İHSAN DOĞRAMACI BİLKENT ÜNİVERSİTESİ	82 , 7
4	BOĞAZİÇİ ÜNİVERSİTESİ	76 , 3
5	İSTANBUL TEKNİK ÜNİVERSİTESİ	72 , 5
6	İZMİR YÜKSEK TEKNOLOJİ ENSTİTÜSÜ	68 , 1
7	ÖZYEĞİN ÜNİVERSİTESİ	67 , 4
8	KOÇ ÜNİVERSİTESİ	61 , 7
9	TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ	57 , 0
10	HACETTEPE ÜNİVERSİTESİ	56 , 7
11	SELÇUK ÜNİVERSİTESİ	55 , 2
12	GAZİ ÜNİVERSİTESİ	54 , 9
13	GEBZE YÜKSEK TEKNOLOJİ ENSTİTÜSÜ	54 , 7
14	EGE ÜNİVERSİTESİ	53 , 0
15	YILDIZ TEKNİK ÜNİVERSİTESİ	49 , 6
16	ANADOLU ÜNİVERSİTESİ	47 , 9
17	ÇUKUROVA ÜNİVERSİTESİ	46 , 9
18	YEDİTEPE ÜNİVERSİTESİ	45 , 9
19	ÇANKAYA ÜNİVERSİTESİ	45 , 8
20	ATILIM ÜNİVERSİTESİ	44 , 6
21	ERCİYES ÜNİVERSİTESİ	44 , 5
22	SÜLEYMAN DEMİREL ÜNİVERSİTESİ	44 , 5
23	KOCAELİ ÜNİVERSİTESİ	44 , 0
24	BAHÇEŞEHİR ÜNİVERSİTESİ	42 , 5
25	AKDENİZ ÜNİVERSİTESİ	42 , 0
26	ANKARA ÜNİVERSİTESİ	41 , 8

27	MERSİN ÜNİVERSİTESİ	41 , 8
28	GAZİANTEP ÜNİVERSİTESİ	41 , 7
29	ULUDAĞ ÜNİVERSİTESİ	39 , 9
30	KARADENİZ TEKNİK ÜNİVERSİTESİ	39 , 7
31	DÜZCE ÜNİVERSİTESİ	38 , 4
32	DOKUZ EYLÜL ÜNİVERSİTESİ	38 , 3
33	KAHRAMANMARAŞ SÜTÇÜ İMAM ÜNİVERSİTESİ	37 , 7
34	FIRAT ÜNİVERSİTESİ	33 , 3
35	İZMİR EKONOMİ ÜNİVERSİTESİ	32 , 6
36	İSTANBUL ÜNİVERSİTESİ	32 , 4
37	ATATÜRK ÜNİVERSİTESİ	32 , 3
38	NİĞDE ÜNİVERSİTESİ	30 , 9
39	FATİH ÜNİVERSİTESİ	30 , 8
40	MELİKŞAH ÜNİVERSİTESİ	30 , 2
41	OKAN ÜNİVERSİTESİ	30 , 0
42	PAMUKKALE ÜNİVERSİTESİ	29 , 8
43	IŞIK ÜNİVERSİTESİ	28 , 9
44	ONDOKUZ MAYIS ÜNİVERSİTESİ	28 , 8
45	KADİR HAS ÜNİVERSİTESİ	28 , 7
46	AFYON KOCATEPE ÜNİVERSİTESİ	27 , 6
47	GAZİOSMANPAŞA ÜNİVERSİTESİ	27 , 6
48	BAŞKENT ÜNİVERSİTESİ	26 , 8
49	ESKİŞEHİR OSMANGAZİ ÜNİVERSİTESİ	26 , 7
50	İSTANBUL ŞEHİR ÜNİVERSİTESİ	26 , 7

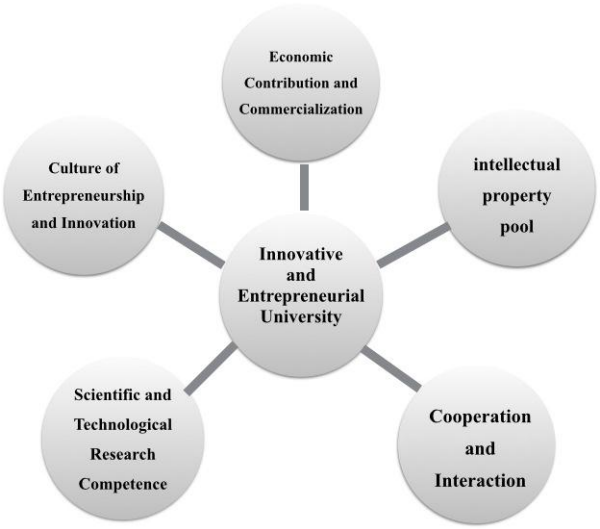

Figure 2.10 Dimensions of Entrepreneurial and Innovative University Index.

Calculating normalised scores for all indicators as follows:

Yi = ((Xi - smallest X for all indicators) / (largest X for all indicators – smallest X for all indicators)

Such that all normalised scores are between 0 and 1. (Cf. Tarantola, S. 2008)

2.4 OVERVIEW OF OTHER UNIVERSITY RANKING INSTITUTIONS

2.4.1 National and International Ranking Indicators of URAP

URAP 2013 ranking of best 2000 international universities is established on 6 theoretical performance indicants. Because of URAP is an academic performance oriented ranking, publishings comprise the foundation of the methodological analysis of rating. Both character and amount of publishings and worldwide research participation performance are employed as factor units.

Besides, URAP utilize different indicators from the above purposed model, but since we aplly a model for national universities we utilize national university ranking

indicators. And also complete definition for all indicators of URAP world university ranking are explained below:

Number of Articles(Score): represents the value of actual scientific ouput which lets in articles issued in 2013 and listed by Web of Science. The weight of this factor unit over the general grading is %21. This indicator applied both in national and international ranking.

Citation(Score): represents the value from research impact and graded agreeing to the overall quantity of citations accepted in 2013 for the articles issued between 2009 and 2013 and includen in the list by Web of Science. Self citations are left out. The weight of citation upon the general grading is %21. This indicator applied both in national and international ranking.

PhD Candidate (Score): Number of Ph.D. students in 2012-2013 academic year. This indicator is applied for national ranking.

Academicians per Student (Score): Number of students per faculty in 2012-2013 academic year. This indicator is applied for national ranking.

Total Document (Score): represents the value of sustainability and persistence of scientific outcome and submitted by overall document numeration which reports all academic literature letting in conference reports, critiques, letters, discourses, books in addition to journal reports issued in 2012. Data is held from Web of Science and the weight of this factor in the general grading is %10. This indicator applied both in national and international ranking.

Journal Impact Total (Score): represents a value of scientific affect which is calculated through combining the affect elements of journals in which a university released reports between 2009 and 2013. The affect element values for the journals are received from the 2013 version of the Journal Citation Reports. The effect of this indicator in general grading is %18. This indicator is applied for international ranking.

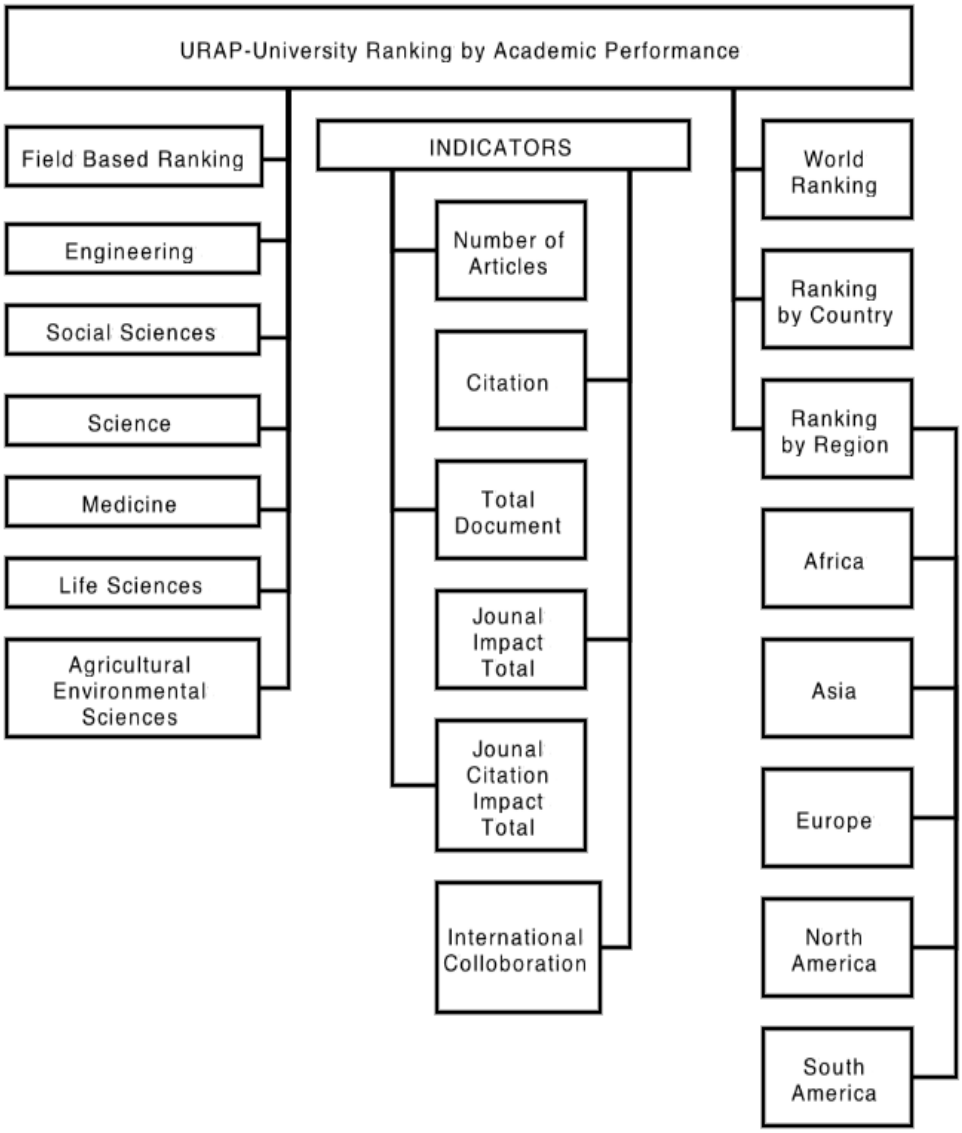

Figure 2.11 Ranking system of URAP.

Journal Citation Impact Total (Score): represents the value of obtained citation quality which is established on the affect elements of journals where the citing reports are issued. The affect element rates for the journals are received from the 2013 version of the Journal Citation Reports. The weight of this factor to the general grading is %15. This indicator is applied for international ranking.

International Collaboration (Score): Represents a value of worldwide acceptation of a university. International collaboration information, which is supported the overall quantity of publishings established in collaboration with international universities, is

received from the Web of Science database between the period 2009 and 2013. The effect of this factor is %15 in the general grading. This indicator is applied for international ranking.

URAP Data Collecting and Scoring: Data is collected from Web of Science and remaining references which supply listings of international universities. 3000 international universities and institutions with high level amount of publishings were at first looked at, and 2000 of overall universites were rated subsequently first data suing. The reliableness of a grading looks generally about the choice of the data utilized. Data cleaning methods were applied to advance the accuracy of the data.

Statistical analysis showed that the natural bibliometric information emphasizing the indicants had extremely inclined distributions. Thus, the indicant values above and below the average are linearly graded in two groupings. The Delphi arrangement was carried on with a group of specialists to specify weighting marks to the indicants. Overall grade of 600 is allotted to all indicant as follows:

- Number of Articles: % 21
- Total Document Count: % 10
- Citation: %21
- Journal Impact Total (Apllied for international ranking): %18
- Journal Citation Impact Total (Apllied for international ranking): %15
- Collaboration (Apllied for international ranking): %15

2.4.2 Times Higher Education World University Ranking and Methodology

The Times Higher Education World University Ranking prepares university performance lists so that measure each of their education, research, knowledge transfer and worldwide prospects of related study fields.(Thomson Reuters, Director of Research Evaluation, 2013)

This rating comprises of 13 in particular performance indicators to bring about the overall and relative analysis that are credit by scholars, academicians, university directors, industry and governments.

Ranking comprised of following indicators:

- Teaching: the learning environment
- Research: volume, income and reputation
- Citations: research influence
- Industry income: innovation
- International outlook: staff, students and research

Table 2.2 Times Higher Education ranking methohology.

SUBJECT RANKINGS METHODOLOGY													
Indicator	Total students/ academic staff	PhD awards/ bachelor	PhD/Academic staff	Reputation Survey (teaching)	Institutional income/ Academic staff	Scholarly papers/ Academic Staff	Research income/ Academic Staff	Reputation Survey (research)	Citations: Research impact	Income from industry/ Academic Staff	Ratio of international to domestic staff	International co-authorship	Ratio of international to domestic students
	Teaching: The learning environment					Research: volume, income and reputation			Citations per paper	Industry income: innovation	International outlook		
ARTS & HUMANITIES													
Group weight	37.5					37.5			15	2.5	7.5		
Indicator weight	3.8	1.9	4.7	25.3	1.9	3.8	3.8	30	15	2.5	2.5	2.5	2.5
CLINICAL, PRE-CLINICAL & HEALTH, LIFE SCIENCES & PHYSICAL SCIENCES													
Group weight	27.5					27.5			35	2.5	7.5		
Indicator weight	2.8	1.4	4.1	17.9	1.4	4.1	4.1	19.3	35	2.5	2.5	2.5	2.5
ENGINEERING & TECHNOLOGY													
Group weight	30					30			27.5	5	7.5		
Indicator weight	3	1.5	4.5	19.5	1.5	4.5	4.5	21	27.5	5	2.5	2.5	2.5
SOCIAL SCIENCE													
Group weight	32.5					32.5			25	2.5	7.5		
Indicator weight	3.3	1.6	4.9	21.1	1.6	4.9	4.9	22.8	25	2.5	2.5	2.5	2.5

Universities which do not have undergraduate programs or teach only a single definite subject or as research output less than a certain number of articles from 2007 to 2011 are excluded from the ranking list.

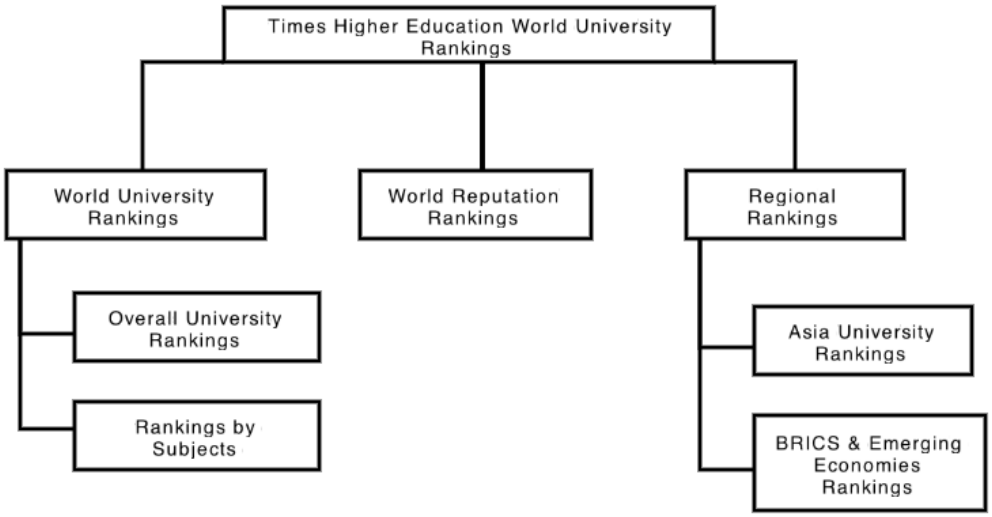

Figure 2.12 Times Higher Education World University Rankings system.

In some extraordinary situations, for instance, faculties that have less than 200 research paper amounts are comprised in the list if institutions or faculty have a limited point of convergence on study areas with mostly low notification and writing amounts, for instance natural sciences or medical sciences.

Z score calculation method is applied for all data sets besides score of the academic reputation survey. Z score calculation standardises various data sets on general order and provide objective correlation between various data sets while connecting different data into a particular ranking.

Every single data is donated a score with its distance from the mean average of all data set, that the ranking is the standard deviation of the data set. After, Z score is reformed into a cumulative probability score to get the final sum of scores.

For instance, assuming an institution has a cumulative probability final of 95, on that occasion a random institution with the same data distribution will go down the institution 95 per cent.

When calculating the reputation survey results, data are remarkably skewed in consideration of a limited number of institutions at the top of the scale, an exponential

component added to upturn differentiation between universities getting down the ranking.

Any institution is not admitted in the general World University Rankings unless it has published a nominal of 200 research reports a year concluded the five years examined.

Just for the six subject ranking, the threshold cuts down to 100 reports a year for fields of studies that give a high intensity of issues and 50 a year in studies such that social sciences where the intensity inclines to be less.

While this ranking apply a few editorial free will and discretion, it is normally expected an institution to possess at least 10 per cent of its faculty members employed in the relevant field of study in order to admit it in the subject ranking.

The general of institutions in database, which constitutes the rankings, supply detailed subject level data. In extraordinary cases where such information are not provided, institutions are either ejected or common references are utilized to obtain approximates.

Beyond the overall rankings of universities, Times has issued rankings by subjects. Different academic fields of studies are classified into six classes which are Arts and Humanities, Clinical, Pre-clinical and Health, Engineering and Technology, Life sciences, Physical sciences and Social sciences, for each one of which presents the status follows after the top 100 institutions, agreeing to the current rankings.(The 2013-2014 Times Higher Education World University Rankings' Clinical, Pre-Clinical and Health table)

2.4.3 Academic Ranking of World Universities (ARWU) and Methodology

ARWU studies all university that owns any Nobel Laureates, Fields Medalists, Highly Cited Researchers, and reports issued in Nature or Science. Additionally, universities with remarkable quantity of document listed by Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI) are enclosed as well. In aggregate, more than 1000 universities are in reality graded and the most skillful 500 are released on the internet.

Table 2.3 ARWU ranking methodology.

Criteria	Indicator	Code	Weight
Quality of Education	Alumni of an institution winning Nobel Prizes and Fields Medals	Alumni	10%
Quality of Faculty	Staff of an institution winning Nobel Prizes and Fields Medals	Award	20%
	Highly cited researchers in 21 broad subject categories	HiCi	20%
Research Output	Papers published in Nature and Science*	N&S	20%
	Papers indexed in Science Citation Index-expanded and Social Science Citation Index	PUB	20%
Per Capita Performance	Per capita academic performance of an institution	PCP	10%
Total			100%
* For institutions specialized in humanities and social sciences such as London School of Economics, N&S is not considered, and the weight of N&S is relocated to other indicators.			

Universities are graded through several indicants of scholarly or research objective, letting in graduates and faculty members having Nobel Prizes and Fields Medals, referred researchers, document issued in Nature and Science, reports listed in leading reference data bases, and the for each person academic performance of an university or an institution. For each indicant, the best characterizing university is assigned a grade of 100, and remaining universities are measured equally a percentage of the maximum grade. The statistical distribution from data for all indicant is analyzed considering any substantial falsifying effect; basic statistical methods are applied to set the indicant if essential. Grades for all index are weighted to reach a final total grade for a university. The best grading university is put a grade of 100, and remaining universities are measured as a percentage of the best grade. A university's grade speculates the list of universities that ranked above it.

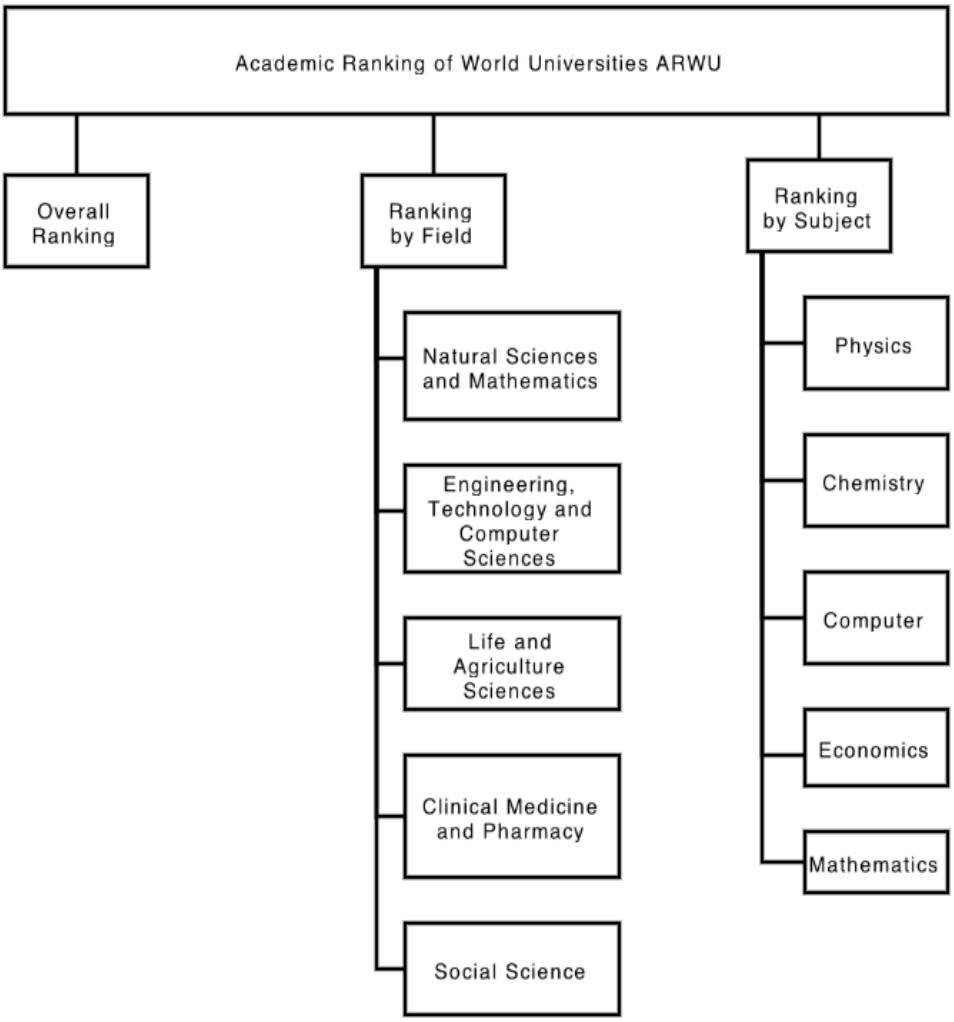

Figure 2.13 ARWU ranking system.

The assessment compares 1200 university and institution all over the world by agreeing to a method that carried by taking into account the Science Citation Index and Social Sciences Citation Index, popular cited researchers in broad subject categories, articles published in the journals Nature and Science, the per capita academic performance of an institution and graduates winning Nobel Prizes and Fields Medals, staff having Nobel Prizes and Fields Medals. The methodology begin in an academic report of its masterminds, N.C. Liu and Y. Cheng.(Higher Education in Europe, Vol.30, No 2)

The methodology utilized by the Shanghai Rankings is totally academic and research based.

University rankings generally have reviewed and thus the ARWU has no omission too. A report published in 2007 in the journal of Scientometrics reported that the outcomes of the Shanghai grading can not be obtained from untreated data utilizing the formula identified from Liu and Cheng.(Irreproducibility of the results of the Shanghai academic ranking of world universities, Răzvan V. Florian, 2007)

In a paper issued in 2009, D. Bouyssou and Ph. Vincke examine how the ARWU runs, applying their perceptivities as professional in Multiple Criteria Decision Making. Their major decisions are that the measures utilized are not applicable; that the assembling methodology causes a number of leading problems; and that is to say, low attention has been given to basic selections of measures.(Denis Bouyssou et Philippe Vincke, 2009)

The ARWU auditors themselves, N.C Liu and Y Cheng, (Academic ranking of world universities, FAQ, 2009) believe that the nature of universities can't be accurately assessed through simple quantities and any grading must be arguable. They indicate that university and institution rating should be utilized with care and their methodological analysis must be comprehended understandably prior to describing or applying the outcomes.

Others have remarked that the ARWU is famous for relying only on research indicants, and the rating is intemperately adjusted towards universities whose faculty or graduates owned Nobel Prizes, so it does not assess the aspect of educational activity or the affection of humanities.(J. Scott Armstrong and Tad Sperry, 1994)

Ioannides et al. indicated that (in familiar with each grading schemes they surveyed), the grading missed conception concern low concordance among the Shanghai and Times ratings. They focused measuring with precision, and clear methodological analysis as significant subjects. (BMC Medicine, 2007)

Similar to the Times Higher Education's rankings, the ARWU has been criticized from the European Commission and also from other EU member countries for preferring old English universities (EU to test new university ranking in 2010). For example, ARWU is frequently criticized in France, where it activates an yearly argument, that is to say that ranking is concentrating on its poorly modified quality of

the French heigher education organization.(Shanghai Academic Ranking: a French Controversy by Marc Goetzmann, 2013)

2.4.4 QS World University Rankings and Methodology

Since initial made up in 2004, the QS World University Rankings have enlarged to rank additional and many universities. In the 2013 and 2014 version, 800 institutions are graded. All the same, furthermore 2000 universities are evaluated.

Once practising any university ranking, it's significant to realize the fundamental methodological analysis. In a different word, what data has been gathered, and how has this been utilized. Determining what the QS World University Rankings actually bring out about the universities ordered, with this ranking study to the methodology.

The best 400 institutions are applied separately grading perspectives, and afterwards this istitutions are ordered inside a group, beginning from 401 or so 410, up to 701 and plus.

The rankings make comparison the top 800 universities across wide areas that are of interest to prospective scholars: research, teaching, employability and international expectation.

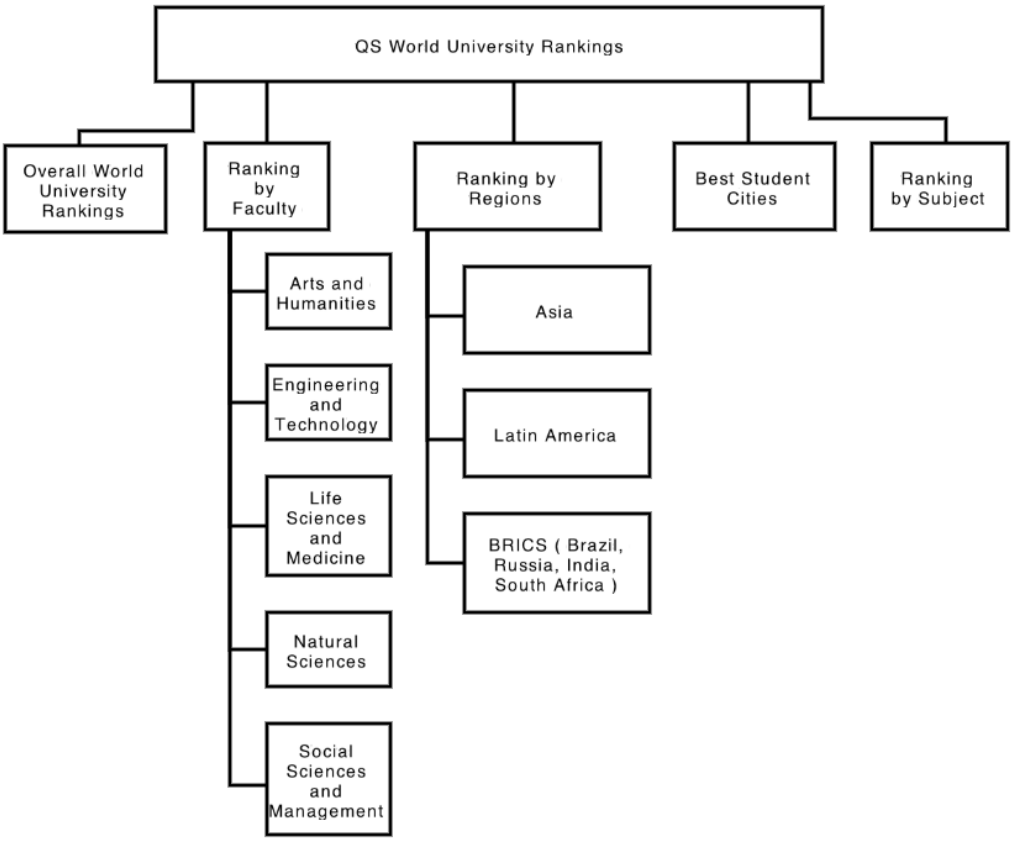

Figure 2.14 QS ranking system.

They are composed of six criteria:

Academic reputation: Academic reputation is assessed thru a worldwide study, requiring academicians to say where the most effective work is presently happening within their area of expertness.

In 2013 the rankings absorbed from more than 62,000 replies from academicians all over the world, collated more than three years. Simply participants' latest answers are in use, and they can't vote for their personal institution. Regional weightings are held to anticipate any variants in response values.

The great advantage of evaluating academic quality in this style is that it brings about a more equivalent weighting to dissimilar subject areas than research citation numbers. Whereas citation grades are right higher in fields of studies suchlike

biomedical sciences than in English literature, for instance, the academic reputation survey weights answers from academicians in another subject areas equally.

Table 2.4 QS Rankings methodology.

Indicator	Weight
Academic Reputation	40%
Employer Reputation	10%
Faculty Student	20%
Citations per Faculty	20%
Proportion of International Students	5%
Proportion of International Faculty	5%

In addition to this, it presents scholars a feel of the consensus of impression one of those who are from definition experts. Academicians might not be advantageously placed to comment about teaching criterias at different institutions, only it is understandably good within their table to have an opinion about where the most important research is presently going on within their field of study.

Employer reputation: The employer reputation index is established on a worldwide survey as well, the last ranking dealing in 27,900 responses. The survey requires graduate employers to describe the universities that in their regard consider the best graduates. It is specific among worldwide university rankings.

The aim of the survey is to present students a more beneficial feeling of how universities are considered in the occupation market. A greater weighting runs to votes for institutions that come from away of their own country, thus it’s important in facilitating to describe universities with a reputation that goes beyond their home borders.

Student to faculty ratio: This is simple assessment of the number of faculty member staff employed for all student recruited. In the absence of a worldwide measure by which to assess education quality, it allows for a perceptiveness into which universities are good fitted to supply small course sizes and a well degree of private supervising.

Citations per faculty: This index takes aim to measure institutions' research output. A citation implies a part of research being cited within a different part of research. Usually, the more frequently a part of research is cited from other people, the more important it is. Thus the more highly referenced research papers an institution publishes, the more effective its research output is believed.

QS gathers this data utilizing Scopus, the world's most tremendous database of research abstractions and references. The last five completed years of information are utilized, and the overall citation number is measured with respect to the number of academicians at the university, in order that bigger universities do not get an unjust advantage.

International faculty ratio and international student ratio: In conclusion, the final two indices concentrate on evaluating how global an institution is, by evaluating the proportionality of worldwide students and academicians with respect to total numbers. From each one of these gives 5% to the general ranking finals.

Though an extremely international student and faculty members is not in itself an evaluation of character, there is a definite correlation between international attendance and success in different fields such for academic reputation and research citations. Universities that merge high grades in the environ with an international prospect run to make up those that have successfully rotated themselves into international focuses of excellence.

Besides the general university rankings, QS also brings out extra information, analyzing the ranking into five wide field of study categories. Leading until the 2012 and 2013 version, these modules area rankings comprised solely on the outcomes of the academic reputation survey. All the same, this is directly aggregated with outcomes of the employer reputation survey and information about research citations.

The best 400 institutions are rated for each of the coming five disciplines:

- Arts and humanities
- Engineering and technology
- Life sciences and medicine

- Natural sciences
- Social sciences and management

The QS subjects assessments have been ignored as untrustworthy from some critics, accepting notably by Brian Leiter, who remarks that programs which are recognized to be for superiority, and which rates highly in the Blackwell rankings assumed invalid in the QS rating since the reasons that are not at entirely definite.(leiterreports.typepad.com, retrieved on 08.12.2013)

In different fields, QS has highly positioned programmes which are not present (theguardian.com. Retrieved on 2013-08-12) for instance in Geography department, in which 5 from the top 10 didn't actually get graduate programmes in geography. In Linguistics, the QS rankings are totally out of measure with the latest NRC(National Research Council) rankings; NRC rates the doctorial programs of the University of MA Amherst and the University of MD at College Park among the actual advisable in America when QS rates them 29th and 49th in the list, respectively.(Chronicle.com, retrieved on 08.12.2013)

2.4.5 Overview and Comparison of Rankings

Before discussing the university ranking methods, it is essential to describe different types of ratings. University rating is a comprehensive term covering academic rating and research rating. Objectives of assessment can include research accomplishments, university organization, education quality, etc. (Hong, 2009). Many OECD countries have started the evaluation of their universities in order to fully infer their performance and service (Staropoli, 1987). Depending on the aims of rating, an evaluation plan can use dramatically various measures and indicators.

Besides existing literature frequently run out to clearly determine and distinguish the levels of evaluation. While academic rating covers the judgement of academic activities, accomplishment, consequence of research investing, research rating comprises even more specified than academic valuation.

Table 2.5 Ranking list comparison between four institutions.

University (2013-2014)	QS Ranking	THE Ranking	ARWU Ranking	URAP Ranking
Massachusetts Institute of Technology	1	5	4	14
Harvard University	2	2	1	1
University of Cambridge	3	7	5	10
University College London	4	21	21	19
Imperial College London	5	10	24	16
University of Oxford	6	2	10	6
Stanford University	7	4	2	4
Yale University	8	11	11	18
University of Chicago	9	9	9	42
California Institute of Technology	10	1	6	49
Princeton University	10	6	7	86
Swiss Federal Institute of Technology in Zurich (ETH Zurich)	12	14	20	48
University of Pennsylvania	13	16	15	13
Columbia University	14	13	8	17
Cornell University	15	19	13	21
Johns Hopkins University	16	15	17	2
University of Edinburgh	17	39	51	47
University of Toronto	17	20	28	3
Swiss Federal Institute of Technology in Lausanne (EPFL)	19	37	118	128
King's College London	19	38	67	61

Table broadcasts the top 20 universities distinguished by the four ranking systems. All of the four rankings show the high quality of the U.S. universities in research project. Each four rankings clearly viewed Harvard University the most skillful university in the world. The superior position of the U.S. colleges in the world looks accepted from this comparing. One important difference is that although ARWU found the Princeton University at 7th rank, URAP found it 86th rank, and others involve it in top 20 as well.

The comparings in this regard showed that ranking outcomes can change, sometimes dramatically, but it is caused by methodologies and weights of varied

criteria. Peer reviews may be impressionistic in favour for specific universities and bring about results seriously contrasting from numeric observational rankings.

Conclusively, the three ranking methods assuming dissimilar criteria and indicants thus make assorted ranking outcomes. THE and QS, emphasizing on ongoing research performance, establishes more respectable ranking than ARWU and THE and QS showing consideration of universities with long chronicles, ARWU emphasize on university performance in research with exceptional achievement, while THE and QS studying both quality and extent of universities and they are considering peer reviews in these ranking methods. Thus, reviewers had better acknowledge dissimilar measures and indicants applying in ranking method to clarify the ranking properly.

2.4.6 Difference between Evaluation and Ranking

Evaluation and ranking are two disparate only related concepts. They take issue in their functions and outcome. Evaluation is not match to ranking. Evaluation prepares a benchmark in opposition to which a university performance in definite expressions may be appraised. The object is to find out if a university qualifyings the appraisal, standing for it has accomplished at or exceeded a essential level of demands. Evaluation outcomes do not have to be numerical. Descriptive evaluation serves in many evaluation conditions, and many evaluation solutions suggest just net conclusions such as pass or fail to pass.

Ranking classifies a grouping of universities by quantitative indicants. Ranking presents a university’s comparative strength and weakness when compared to its match institutions in the fields corresponded by the indicants. It understandably suggests a university’s comparative position at a scale mapping its strength in the calculated expression. Also the quantitative nature of ranking simplifies comparabilities.

Ranking is an effective, favorable, and well understandable evaluation technique, despite the fact that some has debated about the equity of numerical comparabilities of universities where all university is specific and depart from the others in many prospects. Ranking using assesses comprises many indicants may to definite extent solve the conceivable problems.

2.4.7 Innovation and Entrepreneurship

Innovation specifies to find an improved method of managing something. Innovation may be considered as the application of more favourable solutions that satisfy new demands, in formulated demands, or existent any sector demands.(Maranville, 1992) This is carried out by better productions, techniques, services, engineering science, or approximations that are promptly accessible to sectors, authoritieses and society. The term innovation may be specified as something primary and, as a result, modern, that gets into the sector or company. A definition agreeable with these views would comprise that an innovation is something primary, brand new, and significant in any area that gets in to a sector or company.(Frankelius, 2009)

Innovation is different from invention since innovation relates to the utilization of an improved and, as a consequence, new approximation or technique, while invention relates much straight to the creation of the thought or technique itself.

Entrepreneurship specify the way of analyzing and beginning a unique line of work ,sourcing and coordinating the needed resources, while accepting both the chances and advantages related with the venture.

The potential and compliance to modernize, coordinate and supervise a business venture by whatever of its chances in order to gain a net worth. The most visible model of entrepreneurship is the initiating of new jobs. In economic science, entrepreneurship composed with estate, project, natural resources and capital may create net worth. Entrepreneurial look is defined as innovation and risk taking, and is an important function of a nation's power to come through in a dynamic and more and more competitory worldwide sectors.

CHAPTER 3

DATA ENVELOPMENT MODEL FOR UNIVERSITY PERFORMANCE

3.1 THE PROPOSED DEA MODEL

In suggested model; we applied output oriented CCR model as our aim is to increase efficiency through increasing output grades. Input factors are academic resource based indicators as article score, citation score, total document score, PhD candidate score, and academicians per student score. Output factors are innovation and entrepreneurship resource based combination of components indicators as; competence of scientific and technological research, intellectual property pool, cooperation and interaction, entrepreneurship and innovation culture, and economic contribution and commercialization.

Looking at the model, one side is the inputs that constituted from academic resources and academic activities and academic dynamics of universities. And the outcome of the model in the other side is innovation and entrepreneurship targets. And together with inputs and outputs the model tests the contribution of academic resources on innovation and entrepreneurship by using existing data of each decision making units.

The primary objective of the suggested model is to analyze whether or not a university is efficient in case the value of the objective function is 1, other case, if it is lower than 1, it is inefficient. The prepared model and descriptive information obout universities are shown as follows:

Table 3.8 Descriptive information about universities.

					STUDENTS IN 2013-2014 ACEDEMIC YEAR				
UNIVERSITY	**REGION**	**CITY**	**EST.**	**AGE**	**ASSC.**	**UNDERG.**	**GRAD.**	**PHD**	**TOTAL**
AFYON KOCATEPE UNIVERSITY	AEGEAN	AFYON	1992	22	16224	19974	1967	252	38417
MEDITERRANEAN UNIVERSITY	MEDITERRANEAN	ANTALYA	1982	32	17361	24254	2255	743	44613
ANADOLU UNIVERSITY	CENTRAL ANATOLIA	ESKİŞEHİR	1973	41	902368	1568666	3183	1262	2475479
ANKARA UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1946	68	5369	39667	11170	5316	61522
ATATÜRK UNIVERSITY	EASTERN ANATOLIA	ERZURUM	1957	57	41213	52664	6951	2967	103795
ATILIM UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1997	17	37	5027	1753	258	7075
BAHÇEŞEHİR UNIVERSITY	MARMARA	İSTANBUL	1998	16	468	8888	3985	196	13537
BAŞKENT UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1994	20	937	6348	779	217	8281
BOĞAZİÇİ UNIVERSITY	MARMARA	İSTANBUL	1971	43	0	10743	2681	1144	14568
ÇANKAYA UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1997	17	221	4605	1204	64	6094
ÇUKUROVA UNIVERSITY	MEDITERRANEAN	ADANA	1973	41	11908	28365	2576	1259	44108
DOKUZ EYLÜL UNIVERSITY	AEGEAN	İZMİR	1982	32	10195	42345	7092	1571	61203
DÜZCE UNIVERSITY	BLACK SEA	DÜZCE	2006	8	8757	6449	981	124	16311
AEGEAN UNIVERSITY	AEGEAN	İZMİR	1955	59	13163	35261	4820	2728	55972
ERCİYES UNIVERSITY	CENTRAL ANATOLIA	KAYSERİ	1978	36	9555	34576	4662	1149	49942
ESKİŞEHİR OSMANGAZİ UNIVERSITY	CENTRAL ANATOLIA	ESKİŞEHİR	1993	21	1355	20625	3003	736	25719
FATİH UNIVERSITY	MARMARA	İSTANBUL	1996	18	1626	8836	3655	436	14553
FIRAT UNIVERSITY	EASTERN ANATOLIA	ELAZIĞ	1975	39	6914	24002	2514	619	34049
GAZİ UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1982	32	9276	47997	13900	4015	75188
GAZİANTEP UNIVERSITY	SOUTHEASTERN	GAZİANTEP	1987	27	12001	16127	19	13	28160
GAZİOSMANPAŞA UNIVERSITY	BLACK SEA	TOKAT	1992	22	9486	13184	2161	314	25145
GEBZE HIGH TECHNOLOGY INSTITUTE	MARMARA	KOCAELİ	1992	22	0	1988	2230	627	4845
HACETTEPE UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1967	47	3189	29017	3876	4943	41025
IŞIK UNIVERSITY	MARMARA	İSTANBUL	1996	18	325	3588	417	55	4385
İ.D.BİLKENT UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1985	29	29	10350	749	544	11672
İSTANBUL TECHNIC UNIVERSITY	MARMARA	İSTANBUL	1944	70	80	21675	8591	2937	33283
İSTANBUL UNIVERSITY	MARMARA	İSTANBUL	1924	90	10445	98719	13207	6285	128656
İZMİR EKONOMİ UNIVERSITY	AEGEAN	İZMİR	2001	13	435	5934	434	56	6859
İZMİR HIGH TECHNOLOGY INSTITUTE	AEGEAN	İZMİR	1992	22	0	2566	866	351	3783
KADİR HAS UNIVERSITY	MARMARA	İSTANBUL	1997	17	684	4236	391	182	5493
K.MARAŞ S.İ. UNIVERSITY	MEDITERRANEAN	MARAŞ	1992	22	10392	12201	3344	323	26260
BLACK SEA TECHNIC UNIVERSITY	BLACK SEA	TRABZON	1955	59	10121	37530	4437	1240	53328
KOCAELİ UNIVERSITY	MARMARA	KOCAELİ	1992	22	27985	34811	2424	529	65749
KOÇ UNIVERSITY	MARMARA	İSTANBUL	1992	22	0	4882	621	341	5844
MERSİN UNIVERSITY	MEDITERRANEAN	İÇEL	1992	22	14500	13088	0	0	27588
NİĞDE UNIVERSITY	CENTRAL ANATOLIA	NİĞDE	1992	22	5665	9895	1491	125	17176
OKAN UNIVERSITY	MARMARA	İSTANBUL	1999	15	2646	7974	4705	136	15461
ORTA DOĞU TECHNIC UNIVERSITY	CENTRAL ANATOLIA	ANKARA	1959	55	102	18981	4652	2943	26678
ÖZYEĞİN UNIVERSITY	MARMARA	İSTANBUL	2007	7	0	3755	392	98	4245
PAMUKKALE UNIVERSITY	AEGEAN	DENİZLİ	1992	22	12748	26242	2483	392	41865
SABANCI UNIVERSITY	MARMARA	İSTANBUL	1996	18	0	2933	456	263	3652
SELÇUK UNIVERSITY	CENTRAL ANATOLIA	KONYA	1975	39	24967	37637	8157	1738	72499
SÜLEYMAN DEMİREL UNIVERSITY	AEGEAN	ISPARTA	1992	22	24158	28905	6803	1149	61015
TOBB UNIVERSITY	CENTRAL ANATOLIA	ANKARA	2003	11	0	4213	372	105	4690
ULUDAĞ UNIVERSITY	MARMARA	BURSA	1975	39	14738	36042	2378	1024	54182
YEDİTEPE UNIVERSITY	MARMARA	İSTANBUL	1996	18	0	16268	3141	1032	20441
YILDIZ TECHNIC UNIVERSITY	MARMARA	İSTANBUL	1982	32	2429	23829	5533	1587	33378
TOTAL					1718101	3323235	278232	70333	5389901

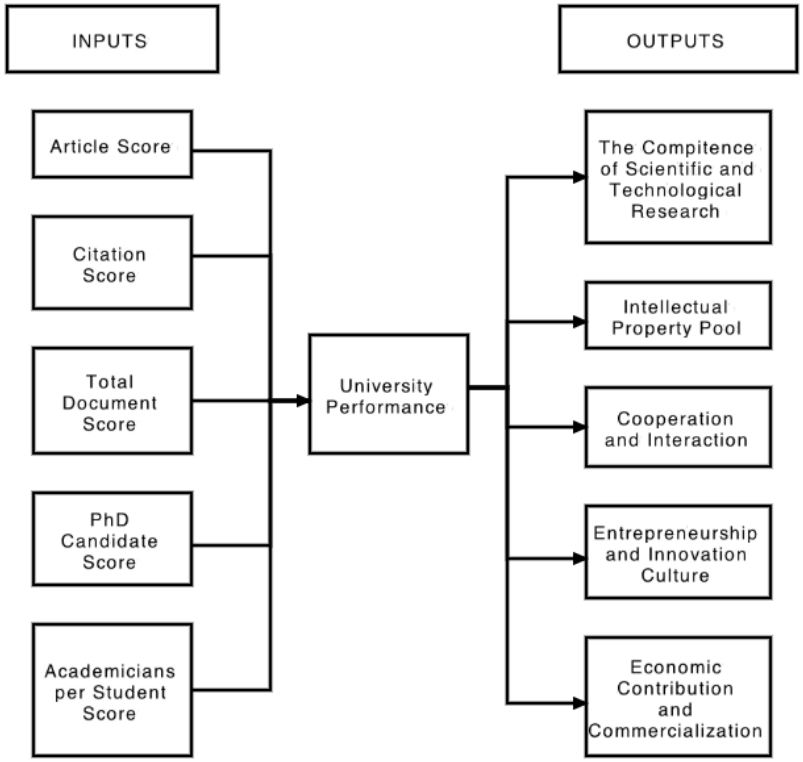

Figure 3.1 DEA Model for University Performance.

Hypothesis 1a: The article factor has direct effect on innovation and entrepreneurship performance.

Hypothesis 1b: The citation factor has direct effect on innovation and entrepreneurship performance.

Hypothesis 1c: The total document factor has direct effect on innovation and entrepreneurship performance.

Hypothesis 1d: The Phd candidate factor has direct effect on innovation and entrepreneurship performance.

Hypothesis 1e: The academicians per student factor has direct effect on innovation and entrepreneurship performance.

3.1.1 Data Reliability and Descriptive Analysis

As found in Table 3.8, the correlations between each variables are significant. Nevertheless, as covered in several early analyzes, the correlation measures between input and output variables are discovered to be substantially poor as well. To run the quality from measuring data, reliability and content validity analyzes is accomplished whether the internal consistency is achieved for the study. The early research analyzes about competitive priorities utilized in this analyze supply prove of the validity of the scales. Reliability analysis allows for characteristics of measurement scales and the items which represent the scales. Internal consistency is assessed with reference to value of Cronbach's α and the balance of the mean inter-item covariance to the mean item variance. Diogonal values in the table are Cronbach's α values. Examining the standardised all data utilized for common analysis of universitys' efficiency, results pointed that Cronbach's a value rate between 0.739 and 0.825 which stands for internal consistency is existed.

The results shows that each item have significant donation to the α value. Besides, to accomplish the reliability analysis for all universities' data individually, a values are checked. For the analyses, a values observed as >0.80 which stands for data and scales utilized in the analysis have internal consistency. The model reliability Cronbach's α score is 0.818. Citation factor is important because if Citation item is deleted Cronbach's α value decrease to 0.739 and also Total Document item is important since in case of deleting the item, Cronbach's α decrease to 0.743. And if Article Score item is deleted, Cronbach's α value decrease to 0.746, therefore Article Score is important for the item reliability. Intellectual Property Pool item is the least effect on item reliabilty at value 0.825, because the overall score of decision making units in Intellectual Property Pool score is the least score.

Table 3.1 Correlations coefficients and items' reliability.

	Variables	I	II	III	IV	V	VI	VII	VIII	IX	X
I	Article Score	0,746									
II	Citation	,945**	0,739								
III	Total Document	,931**	,928**	0,743							
IV	PhD Candidate Score	,572**	,646**	,658**	0,807						
V	Number of Academicians per Student Score	,330*	,341*	,385**	,201	0,817					
VI	Scientific and Technological Research Competence	,652**	,676**	,596**	,484**	,356*	0,818				
VII	Cooperation and Interaction	,417**	,392**	,296*	,243	,250	,782**	0,821			
VIII	Culture of Entrepreneurship and Innovation	,417**	,370*	,364*	,505**	,054	,372**	,424**	0,822		
IX	Economic Contribution and Commercialization	,472**	,482**	,371*	,203	,255	,523**	,491**	,359*	0,821	
X	Intellectual Property Pool	,273	,327*	,245	,272	,051	,464**	,599**	,457**	,435**	0,825

* Correlation is significant at the 0.05 level (2-tailed) ** Correlation is significant at the 0.01 level (2-tailed)

A generally recognized guideline for naming internal consistency is as follows: (George, D., & Mallery, P., 2003)

Table 3.2 Internal consistency intervals.

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

3.2 DEA EFFICIENCY RESULTS BASED ON THE MODEL

In our study, resource based view has been followed out for the universities and it is purposed to help considering of how the evolution of academic resources and inputs and capabilities in universites can contribute origins of competitive advantages and raise their academic performance regarding to main objective of entrepreneurial and innavation perpective in the developing area. For this purpose CCR output oriented model is purposed and was run the for the purposed DEA model.

Table 3.3 List of efficient universities from the proposed model.

DMU	Score
TOBB Economy And Technology University	1
Sabanci University	1
Özyeğin University	1
Middle East Technical University	1
Okan University	1
Kocaeli University	1
Atilim University	1
Bahçeşehir University	1
Kadir Has University	1
İzmir High Technology Institute	1
Çankaya University	1
İhsan Doğramaci Bilkent University	1
Işik University	1

Table 3.4 DEA efficiency reference sets for Universities.

DMU	Score	Rank	Reference set									
U1	0,770	31	U10	0,006	U25	0,186	U37	0,147	U39	0,148	U44	0,327
U2	0,674	39	U25	0,095	U29	0,283	U30	0,243	U37	0,284	U39	0,315
U3	0,917	19	U33	0,442	U37	0,534	U38	0,016	U39	0,296		
U4	0,619	44	U25	0,799	U30	0,262	U37	0,361				
U5	0,660	41	U25	0,543	U30	0,056	U39	0,336				
U6	1,000	1	U6	1,000								
U7	1,000	1	U7	1,000								
U8	0,539	46	U24	0,025	U37	0,530	U39	0,973				
U9	0,916	20	U25	0,778	U30	0,402	U39	0,145				
U10	1,000	1	U10	1,000								
U11	0,770	30	U7	0,159	U25	0,774	U39	0,004				
U12	0,655	42	U7	0,071	U25	0,302	U30	0,102	U39	0,525		
U13	0,663	40	U10	0,157	U37	0,212	U39	0,822				
U14	0,746	33	U33	0,038	U38	0,359	U39	0,830				
U15	0,726	36	U25	0,702	U39	0,244						
U16	0,705	38	U24	0,345	U25	0,337	U30	0,449	U39	0,049		
U17	0,794	28	U25	0,314	U33	0,471	U39	0,173				
U18	0,734	35	U25	0,392	U37	0,112	U39	0,560				
U19	0,816	27	U33	0,610	U37	0,392	U38	0,309	U39	0,099		
U20	0,837	25	U25	0,022	U33	0,192	U38	0,337	U39	0,243		
U21	0,775	29	U25	0,499	U39	0,283	U44	0,155				
U22	0,866	22	U24	0,281	U25	0,578	U30	0,509	U39	0,140		
U23	0,631	43	U25	0,934	U30	0,371	U37	0,281				
U24	1,000	1	U24	1,000								
U25	1,000	1	U25	1,000								
U26	0,920	18	U25	0,655	U37	0,042	U39	0,468				
U27	0,503	47	U25	0,376	U38	0,186	U39	0,559				
U28	0,978	14	U37	0,068	U39	0,684						
U29	1,000	1	U29	1,000								
U30	1,000	1	U30	1,000								
U31	0,838	24	U7	0,371	U25	0,310	U37	0,034	U39	0,229		
U32	0,739	34	U25	0,540	U38	0,103	U39	0,159				
U33	1,000	1	U33	1,000								
U34	0,922	17	U7	0,141	U24	0,011	U25	0,584	U39	0,472		
U35	0,939	16	U37	0,059	U39	0,997						
U36	0,709	37	U24	0,221	U25	0,094	U37	0,074	U39	0,433	U44	0,083
U37	1,000	1	U37	1,000								
U38	1,000	1	U38	1,000								
U39	1,000	1	U39	1,000								
U40	0,592	45	U24	0,324	U25	0,509	U30	0,018	U39	0,047		
U41	1,000	1	U41	1,000								
U42	0,897	21	U37	0,196	U38	0,692						
U43	0,839	23	U25	0,517	U37	0,009	U39	0,373				
U44	1,000	1	U44	1,000								
U45	0,751	32	U7	0,495	U25	0,507						
U46	0,947	15	U25	0,355	U37	0,631	U38	0,154				
U47	0,829	26	U25	0,473	U30	0,152	U37	0,044	U39	0,311		

3.3 DEA EFFICIENCY RESULTS BETWEEN UNIVERSITIES

Taking a consideration on all 47 universities and making overall analysis resulted that universities distributed to have different efficiency scores. As shown on the figure 4.1 there are 3 universities having an efficiency score below 0,6. Nine have a score of below 0,7 and twenty of them have a score of below 0,8. There are 11 universities

located between 0,7 and 0,8 efficiency score. And also second largest university scores showed up in between 0,8 and 0,9 efficiency score. Thirty four universities have a score of below 1 which are inefficient. And thirteen universities seemed to be an efficient with the score 1, in all universities.

Table 3.5 Descriptive statistics of the model inidicators.

I/O	INPUTS AND OUTPUTS	Average	SD	Min	Max
I	**Article Score**	123,969	33,339	18,690	183,440
I	**Citation**	128,897	36,720	19,930	195,950
I	**Total Document**	128,495	31,883	37,890	195,100
I	**PhD Candidate Score**	116,530	44,827	40,650	199,000
I	**Number of Academicians per Student Score**	55,898	13,135	33,630	95,940
O	**Scientific and Technological Research Competence**	11,594	3,974	2,200	20,000
O	**Cooperation and Interaction**	13,877	5,173	4,100	25,000
O	**Culture of Entrepreneurship and Innovation**	7,121	3,505	0,800	15,000
O	**Economic Contribution and Commercialization**	9,534	4,880	0,000	18,800
O	**Intellectual Property Pool**	3,996	2,990	0,000	11,200

Through the projection analysis provided from DEA, all inefficient universities is able to detect the necessary change for converting to be efficient unit. It assists university's director to guide the academicians in an efficient way and assign them in such a direction to make them utilize the resources in a appropriate way. Thus, utilizing resources and understanding capabilities of the universities in an effective and efficient method can allow universities to get a successful view of direction. In this though, competitiveness turns key factor to be came through and for being a successful university by running the resources in an efficient way. Thus, supported this aspect, taking averages for all variables into an account and working with the software some testimonials have been reached on the results of the analysis. Thus, depend on the average values of these variables inefficient universities were found and suggestions can be made and shown in the table 3.7.

3.3.1 Analyzing Results and Sample Inefficient University of U27

Decision making units involves 47 universities for the DEA analysis. In the result of efficiency analysis, there are 13 universities appeared comparatively efficient best practice university (score = 1) and 34 inefficient companies (score <1) observed. The distribution of inefficient university over efficiency scores range from 0.502 to 0.978, the relatively most inefficient university was Istanbul University. The average efficiency score overall is 0.8344.

In Table 3.2 the determined value that is related with each member of the efficiency reference set (i.e. 0.376 for U25, 0.186 for U38, and 0.558 for U39) presents the relative weight appointed to efficient unit in calculating the efficiency rate for U27.(Istabul University)

Besides to the identification of inefficient universities and their efficiency reference set, DEA provides additional comprehension about the degree of inefficiency for the inefficient universities. The degree of inefficiency is given by the degree excess resources and deficient outputs produced by inefficient universities. Excess resources (inputs) or deficient outputs are computed by subtracting the actual input/output values of a given universities from the optimum values of the best university.

Table 3.6 Computation of best reference set for University U27.

INPUT& OUTPUT	WEIGHT	U25	WEIGHT	U38	WEIGHT	U39	BEST VALUE
X1	0,376	159,01	0,186	183,4	0,558	108,4	154,41
X2		169,46		196		91,14	151,01
X3		161,27		181,4		63,16	129,61
X4		133,72		186		54,22	115,12
X5		48,33		52,35		62,33	62,68
Y1		19,9		19,2		11,9	17,69
Y2		23,3		21,9		20,8	24,44
Y3		11,9		15		13,7	14,90
Y4		18		18,8		17,1	19,80
Y5		9,6		11,2		3,8	7,81

Table 3.3 shows the computation of the input/output variables' values for the best practice university and the degree of inefficiency for the least inefficient university U27. The best practice university is defined from the weighted average of university U25, U38 and U39. Universsity U27's comparative efficiency score of 0.502 illustrates the expand to which the efficiency of university U27 is lacking in comparison to the efficiency of its reference subset universities.

Table 3.7 Computation of excess inputs and deficient outputs for University U27.

INPUT&OUTPUT	BEST UNIVERSITY	U27	EXCESS INPUTS	DEFICIENT OUTPUTS
X1	154,41	154,54	-0,12	
X2	151,01	160,6	-9,58	
X3	129,61	163,77	-34,15	
X4	115,12	199	-83,87	
X5	62,68	62,75	-0,06	
Y1	17,69	8,9		8,79
Y2	24,44	10,5		13,94
Y3	14,90	7,5		7,40
Y4	19,80	5,1		14,70
Y5	7,81	0,4		7,41

Table 3.4 indicates the values of excess inputs and deficient outputs that is present in U27. In a case of excess in inputs variables values are shown for each decision making unit and ‘0’stands for using the capacity at the required level. Also for the deficient outputs are standing for positive sign.

Thus, to be efficient university, U27 should better increase the level of outputs such as economic contribution and commercialization score of 5.1 and same increase decision needed to be performed for other outputs as well.

Table 3.8 Projection of the modest university.

DMU I/O	1/Score Data	Projection	Difference	%
U27	1,989711			
Article Score	154,54	154,54	0	0,00%
Citation Score	160,6	151,13	-9,46	-5,89%
Total Document Score	163,77	129,71	-34,05	-20,79%
PhdD Candidate Score	199	115,21	-83,79	-42,11%
Academicians per Student Score	62,75	62,75	0	0,00%
Scientific and Technological Research Competence	8,9	17,70	8,80	98,97%
Cooperation and Interaction	10,5	24,46	13,96	132,98%
Culture of Entrepreneurship and Innovation	7,5	14,92	7,42	98,97%
Economic Contribution and Commercialization	5,1	19,82	14,72	288,72%
Intellectual Property Pool	0,4	7,81	7,41	999,90%

Table 3.9 Suggestion after analysis for the variables as an average point.

DMU I/O	1/Score Data	Projection	Difference
U1	1,2993		
Article Score	98,92	98,92	0
Citation	111,59	100,5986	-10,9914
Total Document	111,76	94,03668	-17,7233
PhD Candidate Score	60,38	60,38	0
Number of Academicians per Student Score	46,69	46,69	0
Scientific and Technological Research Competence	8,7	11,30409	2,604088
Cooperation and Interaction	9,3	14,98181	5,681809
Culture of Entrepreneurship and Innovation	4,6	5,976874	1,376874
Economic Contribution and Commercialization	1,3	11,79143	10,49143
Intellectual Property Pool	3,6	4,677554	1,077554
U2	1,483		
Article Score	107,01	107,01	0
Citation	115,44	105,7752	-9,6648
Total Document	121,64	103,7461	-17,8939
PhD Candidate Score	110,73	110,73	0
Number of Academicians per Student Score	69,72	69,72	0
Scientific and Technological Research Competence	9,9	14,68156	4,781564
Cooperation and Interaction	12,5	19,92442	7,424425
Culture of Entrepreneurship and Innovation	6,9	10,23261	3,332605
Economic Contribution and Commercialization	9,4	13,94007	4,540071
Intellectual Property Pool	3,2	5,204764	2,004764

As it is observed in above table running the DEA with average points of variables for each universities resulted that universities which are U27 and U8 seemed to be an inefficient universities out of total number of 47 universities. The values of the variables for these two universities are altered to become efficient unit. For instance as a output variable, Cooperation and Interaction level of U1 University should be increased from 9,3 to 14,98. And also one of the output variable which is Culture of Entrepreneurship and Innovation of U2 should be increased from 6,9 to 10,13 and Economic Contribution and Commercialization level should be raised up to 13,94 from 9,4.

Excess inputs and shortage outputs have been determined considering the results gathered through factor analyze that is displayed in both table 3.4 and 3.5. The model utilized was firstly targeted to figure out shortage outputs that cause inefficiency, without altering input variables because it is output oriented. Then, secondly excess inputs are computed.

CONCLUSION

Consequently, DEA is a substantial and effectual way to measure efficiency of multiple inputs and multiple outputs for Universities in Turkey. DEA efficiency analysis is really functional tool in strategic direction for Universities. In this research, five important factors and five objective factors such as Intellectual Property Pool, Economic Contribution and Commercialization and Scientific and Technological Research Competence were used for the model. The least efficient university was determined and compared with the best practice university using output maximization model. The output oriented method brings information about how much performance of a university can be improved or balanced utilizing the same resources. In spite of DEA provides no information about the resource needs of universities, it provides information about resource utilization. DEA offers lots of opportunities for an inefficient universities to turn up efficient based on its reference set of efficient units.

In addition to general analysis it can also be executed for all of the 47 universities to perform a ranking according to their subject areas and departments. There is a possible claim that there is no homogeneity among the decision making units. At least, in this study we used 10 criteria instead of using only one from ouput values. In our view, this model allow for credible and realistic ranking based on efficiency analysis in terms of innonation and entrepreneurial competencies. Following the general analysis, the same step was applied to the 47 universities for more homogeneity that figured out the efficient universities and their rankings in general.

In theory it seems accomplishable to hold up with the output values and make these universities more efficient without altering input values. In practice, however, except for a few funiversity it is imposible to have neccessary conditions in short term. Therefore, we recommend that inefficient universities improve their entrepreneurial and

innovation capabilities so that they will be able to enhance their overall entrepreneurial and innovation performances compering to their academic performance.

The analyzed data discovered clearly that 47 universities efficiently performed in general perspective. Moreover, in the analysis, universities were ranked and identified as efficient among the factors and assigned to be compered with their innovation and entrepreneurial competencies.

The outcomes of the analysis also showed that the inputs and outputs leading to efficiency also the magnitudes of excesses and shortages. For instance, citation which is the level of the acdemic document of the university was used as input in this research. It is fundamental that it may not be proper decreasing citation to increase efficiency and to bring down total document may not be suitable since it is primary milestone for academic research activities. Therefore, we can suggest that universities get rid of the problems including the outputs to enhance efficiency.

Universties and Institutions are the key factor for innovative and developing economies. Universities should stay competitive and produce high quality outputs, it is that the implication not only at the macro level but also to larger organizations. That is to say, universities are usually sources of innovation and entrepreneurial activities and services to larger establishments and without entrepeneurial and innovative competencies it would adversely affect the developing and competitive ability of the universities and thus development of strong country.

Since research and developments are limited with resource and technology utilization, value added inventions and innovations are not at the satisfaction level. To change this, universities need to use their resources effectively and should be instructed to use high technology for generating entrepreneurail and innovative environment.

Overall, all universities involves multi sided resources, which bond to give the university its capabilities such as innovations etc., and there is only way to become in the upper level for universities just by using their capabilities in an efficient method that provide them competitive advantages in the developing and changing world.

As for the recommendations, by using numeric data in DEA provides meaningful conclusions. Thus, it is critical that analysis to be showed by considering the constraints

because of the university and country specific conditions. For example, it is not accurate to evaluate technical and technology intensive universities and instituions on the same criteria and not just suggests action concerning the technological force. Parallel to this view, one needs to be careful when suggesting actions to increase efficiency while evaluating the results of this research.

Gradually, blurring the lines between the disciplines forces universities to renew their education and research structures. Research is largely transdisciplinary or interdisciplinary. All of these changes have been also affecting the Turkish higher education. Turkish higher education institution (YÖK) have been performing some new projects in order to keep up with changes and to bring it into line with our international partners. However, when we analyze the academic and administrative organization of higher education in Turkey and the status of the knowledge produced in universities, we could say that the universities are still under the influence of the second generation universities. To change this situation, we should create some mechanisms that transform the knowledge into product and technology. Supplying academic, financial and administrative autonomy in universities lead the way to the innovation and creativity. The private sector co-operation between universities and research institutions should be supported. Providing interdisciplinary collaboration of universities should allow them to turn into technology producing institutions. Turkish higher education system, taking into account these new developments, should move towards to create the third generation universities.

Step by step, confusing the channels between the fields of study effects universities to regenerate their teaching and research format. Research represents mostly transdisciplinary or integration. Every from these transfers have been impacting the Turkish higher education as well. Nevertheless, once we analyse the scholarly and administrative system of higher education in Turkey and the condition of the knowledge acquired in universities, we may state that the universities are yet below the work of the 2nd generation universities. To convert this place, we had better make more instruments that convert the cognition into production and applied science. Providing scholarly, fiscal and administrative self-sufficiency in universities guide the direction to the innovation and creativity. The partnership between private sector and universities had better be subsidized. Offering interdisciplinary partnership of universities had better

tolerate them to become applied science developing institutions. Turkish higher education organization, accepting these modern evolutions, had better affect towards to create the third generation universities.

REFERENCES

Afuah, A. Innovation Management: Strategies, Implementation, and Profits (2nd ed.). New York: Oxford University Press, 2003.

Ahmed, P. K. Culture and climate for innovation. *European Journal of Innovation Management*, 1(1): 30-43, 1998.

Archibugi, D., Cesaratto, S., & Sirilli, G. Innovative activity, R&D and patenting: The evidence of the survey of innovation diffusion in Italy. STI Review: 135-150, 1987.

Armbruster H., Bikvalvi A., Kinkel S. and Lay G., Organisational Innovation: The challenge of measuring non-technological innovation in large-scale surveys. Technovation 28, pp. 644-657, 2008.

Arundel, A. and Hollanders, H., European Innovation Scoreboard - EXIS: An Exploratory Approach to Innovation Scoreboards. European Commission, Brussels, 2004.

Arundel, A. and Hollanders, H., European Innovation Scoreboard - EXIS: An Exploratory Approach to Innovation Scoreboards. European Commission, Brussels, 2004.

Arundel, A., Why Innovation Measurement Matters. In: Arundel, A., Garrelfs, R. (eds.): Innovation Measurement and Policies. Luxemburg, EU, EIMS 94/197, 1997.

Arundel, A., Bordoy, C. and Kanerva, M., Neglected Innovators: How Do Innovative Firms That Do Not Perform R&D Innovate? Results of an analysis of the Innobarometer 2007 survey No. 215. INNO- Metrics Thematic Paper, 2008.

Barber, J., New Economic Ground for Innovation Policy. Position Paper, 2009.

Barnard, C. J., The Functions of the Executive (Thirtieth Anniversary Edition). Harvard University Press, Cambridge, MA, 1968.

Barney, J. B. and E. J. Zajac, 'Competitive organizational behavior: Toward an organizationally based theory of competitive advantage', *Strategic Management Journal*, Winter Special Issue, 15, pp.5–10, 1994.

Barney, J.B., Firm resources and sustained competitive advantage. *Journal of Management* 17 (1), 99–120, 1991.

Battisti, G. and Stoneman, P., How Innovative are UK Firms? Evidence from the Fourth UK Community Innovation Survey on Synergies between Technological and Organisational Innovations. *British Journal of Management* 21, pp. 187–206, 2010.

BDDK, Finansal Piyasalar Raporu, Haziran 2007.

Becker, M. C., & Knudsen, M. P., Intra and inter-organizational knowledge transfer processes: Identifying the missing links, DRUID Working Paper No. 06-32, 2006.

Bender, G., Jacobson, D. and Robertson, P.L., Non-Research-Intensive Industries in the Knowledge Economy. Perspectives on Economic, Political and Social Integration. Special Issue I, Catholic University Lublin, 2005

Bharadwaj, S.G., Vardarajan, P.R., and Fahy, J., Sustainable Competitive Advantage in Service Industries: A Conceptual Model and Research Propositions, *Journal of Marketing*, Vol.57, No.4, pp.83-99, 1993.

Black, J.A. and Boal, K.B., Strategic Resources: Traits, Configurations and Paths to Sustainable Competitive Advantage, *Strategic Management Journal*, Vol.15 (Special Issue), pp.131-148, 1994.

Boles James S, Donthu Naveen, Lohtia Ritu. Salesperson evaluation using relative performance efficiency: the application of data envelopment analysis. J Pers Sell Sales Manage 15-31-49, 1995.

Borrás, S., The Widening and Deepening of Innovation Policy: What Conditions Provide for Effective Governance? Lund, CIRCLE Electronic Working Paper Series, Paper 02-2009.

Brophey, G. and S. Brown, Innovation practices within small to medium-sized mechanically based manufacturers. Innovation: Management, Policy & Practice, 11(3): p. 327-340, 2009.

Bulak, M.E., Türkyılmaz, A. Performance assessment of manufacturing SMEs: a frontier approach. Vol. 114 No. 5, pp. 797-816, 2014

C. Romero, Extended lexicographic goal programming: A unifying approach, Omega 29, 63–71, 2001.

Camison, C. and Villar-Lopez, A., Organisational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, 2012.

Camp Robert C. Business process benchmarking. Milwaukee (WI)7 ASQ Quality Press; 1995.

Capron, L. and Hulland J., Redeployment of Brands, Sales Forces, and General Marketing Expertise Following Horizontal Acquisitions: A Resource Based View, *Journal of Marketing*, Vol.63 No.2, pp. 41-54, 1999.

Cassiman, B., & Veugelers, R., In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. Management Science, 52(1): 68-82, 2006.

Charnes A, Cooper WW, Rhodes E. Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2:429–44,1978.

Charnes, A., Cooper, W.W., Lewin, A.Y., Seiford, L.M., Data Envelopment Analysis. Theory, Methodology and Applications. Kluwer Academic Publishers, Boston, 1994.

Chen, E.T.K., Feng, W. and Liou, Knowledge management capability and firm performance: an empirical investigation. Paper presented at the 10th Americas Conference on Information Systems, New York, NY, August 5-8, 2004.

Coase, R. H., 'The nature of the firm', Economica, 4, pp. 386–405, 1937.

Collis, D.J. and Montogomery, C.A., competing on Resources: Strategy in the 1990s, Harvard Business Review, Vol.73, No.4, pp. 118-128, 1995.

COOK, Paul, "Finance and Small and Medium-sized Enterprise in Developing Countries", *Journal of Developmental Entrepreneurship*, April 2001.

Cooper WW, Seiford LM, Tone K. Data envelopment analysis: a comprehensive text with models, applications, references and DEA-Solver software. Boston: Kluwer Academic Publishers; 2000.

Coyne, K.P. Sustainable Competitive Advantage- What It is, What It isn't, Business Horizons, Vol. 29 Issue 1, pp. 54-61, 1986.

Cozzarin, B. and Percival, J., Complementarities between organisational strategies and innovation. Economics of Innovation and New Technology 15, pp. 195-217, 2006.

Damanpour, F., Szabat, K.A. and Evan, W. M., The relationship between types of innovation and organisational performance. *Journal of Management Studies* 26(6), pp. 587-601, 1989.

Denison, D. R. What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. Academy of Management Review, 21(3): 619-654, 1996.

Dierickx, I. and Cool, K., Asset Stock Accumulation and Sustainability of Competitive Advantage, Management Science, Vol. 35, No. 12, pp.1504-1513, 1989.

DPT, Sanayi Politikası Dokümanı, 2004.

Drejer, I., Identifying innovation in surveys of services: a Schumpeterian perspective. Research Policy 33, pp. 551-562, 2004.

Dumaine Brian. Corporate spies snoop to conquer. Fortune, November 7, 2009.

Edquist, C., Design of innovation policy through diagnostic analysis: identification of systemic problems (or failures). Industrial and Corporate Change 20 (6), pp. 1725–1753, 2011.

European Commission, 2010. Europe 2020 Flagship Initiative, Innovation Union. COM(2010) 546 final, October 6th, Brussels, 2010.

Fahy, J., A Resource Based Analysis of Sustainable Competitive Advantage in a Global Enviroment, International Business Review, Vol. 11, Iss. 1, pp. 57-78, 2002.

George, D., & Mallery, P. SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon, 2003.

Gemünden, H. Strategic Management of Innovation. Lecture slides: Ambidextrous Organisations, Berlin: Technology and Innovation Management, TU Berlin, pp.4-13, 2011.

Grant, R.M., The Resource Based Theory of Competitive Advantage: Implications for Strategy Formulation, California Management Review, Vol. 33 Iss.3, pp. 114-135, 1991.

Hafeez, K., Z. YanBing, and N. Malak, Core competence for sustainable competitive advantage: a structured methodology for identifying core competence. Engineering Management, IEEE Transactions on, pp. 28-35, 2002.

Hayes, R.H. and G.P. Pisano, Beyond World-Class: The New Manufacturing Strategy. (cover story). Harvard Business Review, pp. 77-87, 1994.

Henderson, R., Mitchell, W., The interactions of organizational and competitive influences on strategy and performance. *Strategic Management Journal* 18, 5–14, 1997.

Hoenack, S. A. Economic Behavior Within Organizations. Cambridge University Press, New York, 1983.

Itami, H. Mobilizing Invisible Assets. Harvard University Press, Cambridge, MA, 1987.

Johnes J., Yu L., Measuring The Research Performance Of Chinese Higher Education Institutions Using Data Envelopment Analysis, China Economic Review 679–696, 2008.

Juhasz, Andrew Anthony, Jr. "The Pattern of Innovation Exhibited in the Develop- ment of the Tractor Shovel." SM thesis, Sloan School of Management, MIT, Cambridge, Mass., 1975.

Kaldor, N. 'The equilibrium of the firm', *Economic Journal*, 54, pp. 60–76, 1934.

Kamakura Wagner A., Ratchford Brian T, Agrawal Jagdish. Measuring market efficiency and welfare loss. J Consum Res 15(December):289– 302, 1988.

Kingston, William. Innovation: The Creative Impulse in Human Progress. London: John Calder, 1977.

Laranja, M., Uyarra, E. and Flanagan, K., Policies for science, technology and innovation: Translating rationales into regional policies in a multi-level setting. Research Policy 37, pp. 823–835, 2008.

Lippman, S.A. and Rumelt, R.P. Uncertain Imitability, *Bell Journal of Economics*, Vol.13 , pp. 418-438, 1982.

Lööf, H. and Heshmati, A., On the Relationship Between Innovation and Performance: A sensitivity, 2006.

M. Tamiz, D. Jones, C. Romero, Goal programming for decision making: An overview of the current state-of-the-art, *European Journal of Operational Research* 111, 567–581, 1988.

Mahoney, J.T. and Pandian, J.R., *The Resource Based View Within the Conversation of Strategic Management Journal*, Vol.13 No.5 pp. 363-380,1992.

Maijoor, S. and Witteloostuijn, A.V. , An emprical Test of the Resource Based Theory Strategic Regulation in the Dutch Audit Industry, *Strategic Management Journal*, Vol.17 No.7, pp.549-569, 1996.

Mainar Dichief, global innovation index 2013

Malmgren, H. B. 'Information expectations and the theory of the firm', *Quarterly Journal of Economics*, 75, pp. 399–412, 1961.

Mata, F.J., Fuerst, W.L., Barney, J.B., Information technology and sustained competitive advantage: a resource-based analysis. MIS Quarterly 19 (4), 487–505, 1995.

Moore, J. 'The firm as a collection of assets', European Economic Review, 36, pp. 493–507, 1992.

Myers, Sumner, and Donald G. Marquis. Successful IndustrialInnovations:A Study of Factors Underlying Innovation in Selected Firms. Washington, D.C.: National Science Foundation, NSF 69-17, 1969.

Nelson, R. R. 'Why do firms differ, and how does it matter?', *Strategic Management Journal*, Winter Special Issue, 12, pp. 61–74, 1991.

OECD, Patents and Innovation: Trends and Policy Challenges, 2004.

OECD, <http://www.oecd.org/dataoecd/48/12/24508541.pdf>

OECD, Oslo-Manual: Guidelines for Collecting and Interpreting Innovation Data. 3rd Edition, Paris, OECD Publications, 2005.

OECD, The OECD Innovation Strategy: Getting a head start on tomorrow. OECD Publishing, 2010.

OECD, Science Technology and Industry Outlook: 2012, OECD publishing, 2012.

P.Drucker, Managing the Non-Profit Organisations, Harper Business, New York, p.43, 1990.

P.E.Sink, D.Scutt, D.Tuttle, C.Thomas, Planning and Measurement ın Your Organisation of the Futur, Industrial Engineering and Management Press, Georgia, pp.144, 1989.

P.F. Drucker, Management; An Abridged and Revised Version of Management: Task, Responsibilities, Practices, Pan Books, New York. pp.59, 1997.

Parsons Leonard J. Assessing salesforce performance with data envelopment analysis. Paper presented at TIMS Marketing Science Conference 1990. Urbana7 University of Illinois, 1990.

Penrose, E.T., The Theory of the Growth of the Firm. Wiley, New York, NY, 1959.

Peteraf, M.A. The Cornerstones of Competitive Advantage: A Resource Based View, *Strategic Management Journal*, Vol. 14 No.3 , pp. 179-191, 1993.

Porter, M. E. 'What is strategy?', Harvard Business Review, 74(6), pp. 61–78, 1996.

Porter, M. E. Competitive Strategy: Techniques for Analysing Industries and Competitors. New York, Free Press, 1980.

Prahalad and Hamel The Core Competence of the Corporation, Harvard Business Review, Vol. 68, No. 3, pp.79-91, 1990.

Prahalad, C. K. and Hamel, G. The Core Competence of the Corporation. Harvard Business Review 68(3), pp. 79-91, 1990.

R.Fare, S.Grooskopf, C.A.K.Lovell, The Measurement of efficiency of Production , Kluwer-Nijhoff Publishing, Boston, pp.3, 1985.

R.Kok, E.Deliktas, Endüstri İktisadında Verimlilik Ölçme ve Strateji Geliştirme Teknikleri, D.E.U. İİBF Yayını, İzmir, pp.31, 2003

Rogers, E. M. Diffusion of Innovations.Free Press, 1962.

Rumelt, R.P. Theory, Strategy and Entrepreneurship, in David Teece (ed.) The Competitive Challange : Strategies for Industrial Innovation and Renewal, Ballinger, Cambridge, MA, pp. 137-158, 1987.

Sherman, H.D. and G. Ladino, Managing bank productivity using data envelopment analysis (DEA), Interfaces Vol. 25, No. 2 pp. 60 – 73, 1995.

Skinner, W., Manufacturing Missing Link in Corporate Strategy, Harvard Business Review, 47/July–August: 136–145, 1969.

Spanos, Y.E., Lioukas, S., An examination into the causal logic of rent generation: contrasting Porter's competitive strategy framework and the resource-based perspective. *Strategic Management Journal* 22 (10), 907–934, 2001

STALEY, E., R. MORSE, Modern Small-Scale Industry for Developing Countries, McGraw-Hill, 1965.

T.C.Koopmans, An analysis of Production as an Efficient Combination of Activities, in T.C.Koopmans(ed.), Activity Analysis of Production and Allocation, John Wiley and Sons Inc., New York, 1951.

T.Coelli, A.Estache, S.Perelman, L.Trujillo, A Primer on Efficiency Measurementfor Utilities and Transport Regulators, The World Bank, Wshıngton, D.C.,p.11-12, 2003.

Teece, D.J., Pisano, G., Shuen, A., Dynamic capabilities and strategic management. *Strategic Management Journal* 18 (7), 509–533, 1997.

Tether, B. and Bascavusoglu-Moreau, E., Does collaborating with customers enhance the benefits of R&D and marketing investments for innovation performance? CBS, Copenhagen, Denmark. Druid Society, 2012.

Thanassoulis, E., Setting achievement targets for school children. Education Economics 7 (2), 101–119, 1999.

W. D. Cook and L. M. Seiford, Data Envelopment Analysis (DEA) - *Thirty Years On. European Journal of Operational Research,* pp.192, 1-17, 1997.

Wernerfelt, B. A Resource Based View of the firm, *Strategic Management Journal*, Vol. 5 No.2, pp.171-180, 1984.

Williamson, O. E. 'Strategizing, economizing and economic organization', *Strategic Management Journal*, Winter Special Issue, 12, pp. 75–94, 1991.

Wyner, G., Learn and earn through testing on the internet. Marketing Research 12(3), pp. 37-8, 2000.

Yamakawa, T., Ahmed, S., Kelston, A. The BRICs as drivers of global consumption, Goldman sachs global economics, commodities and strategy research <https://360.gs.com> (06.08.09), 2009.

Yang, B., Watkins, K. and Marsick, V., The Construct of the Learning Organisation: Dimensions, Measurement, and Validation. Human Resources Development Quarterly 15, 2004.

Yeb-Yun, L.C. Success factors of small and medium-sized enterprises in Taiwan: an analysis of cases. *Journal of Small Business Management*, 36, 43–56, 1999.

Yeoh, P. and Roth, K. An empirical Performance of Sustained Advantage in the U.S. Pharmaceutical Industry: Impact of Resources and Capabilities, *Strategic Management Journal*, Vol. 20 No.7, pp.637-653, 1999.

Yin R.K. Case Study Research. Design and Methods. pp. 1-18, 19-56, 83-140, 152-153, 2003.

Yong, L., Liu L., Performance evaluation of bus lines with data envelopment analysis and geographic information systems, Computers, Environment and Urban Systems Vol. 33, pp.247–255, 2009.

Zairi M., Business process management: a boundaryless approach to modern competitivnes, *Business Process Management Journal*, pp. 68-80, 1997.

Zavadsky, J., Turčok, L., Simulation and its purpose in implementing of Business Process Management, Advances in Management, pp. 9-13, 2010.

Z.Akal, İşletmelerde Performans Ölçüm ve Denetimi, Çok Yönlü Performans Göstergeleri, MPM Yayınları, Ankara, pp.93-96, 2005.

Z. Liu. Local Health Department Capacity and Performance in New Jersey. *Journal of Public Health Management and Practice*, pp. 42-50, 2005.

Zhou, H. and Benton, W. Jr."Supply chain practice and information sharings", *Journal of Operation Management*, Vol. 25, pp. 1348–1365, 2007.

APPENDIX A: LIST OF UNIVERSITY CODES IN THE MODEL

No.	DMU
U1	AFYON KOCATEPE UNIVERSITY
U2	AKDENİZ UNIVERSITY
U3	ANADOLU UNIVERSITY
U4	ANKARA UNIVERSITY
U5	ATATÜRK UNIVERSITY
U6	ATILIM UNIVERSITY
U7	BAHÇEŞEHİR UNIVERSITY
U8	BAŞKENT UNIVERSITY
U9	BOĞAZİÇİ UNIVERSITY
U10	ÇANKAYA UNIVERSITY
U11	ÇUKUROVA UNIVERSITY
U12	DOKUZ EYLÜL UNIVERSITY
U13	DÜZCE UNIVERSITY
U14	EGE UNIVERSITY
U15	ERCİYES UNIVERSITY
U16	ESKİŞEHİR OSMANGAZİ UNIVERSITY
U17	FATİH UNIVERSITY
U18	FIRAT UNIVERSITY
U19	GAZİ UNIVERSITY
U20	GAZİANTEP UNIVERSITY
U21	GAZİOSMANPAŞA UNIVERSITY
U22	GEBZE HIGH TECHNOLOGY INSTITUTE
U23	HACETTEPE UNIVERSITY
U24	IŞIK UNIVERSITY
U25	İHSAN DOĞRAMACI BİLKENT UNIVERSITY
U26	İSTANBUL TECHNICAL UNIVERSITY
U27	İSTANBUL UNIVERSITY
U28	İZMİR ECONOMY UNIVERSITY
U29	İZMİR HIGH TECHNOLOGY INSTITUTE
U30	KADİR HAS UNIVERSITY
U31	KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY
U32	KARADENİZ TECHNICAL UNIVERSITY
U33	KOCAELİ UNIVERSITY
U34	KOÇ UNIVERSITY
U35	MERSİN UNIVERSITY
U36	NİĞDE UNIVERSITY
U37	OKAN UNIVERSITY
U38	ORTA DOĞU TECHNICAL UNIVERSITY
U39	ÖZYEĞİN UNIVERSITY
U40	PAMUKKALE UNIVERSITY
U41	SABANCI UNIVERSITY
U42	SELÇUK UNIVERSITY
U43	SÜLEYMAN DEMİREL UNIVERSITY
U44	TOBB ECONOMY VE TECHNOLOGY UNIVERSITY
U45	ULUDAĞ UNIVERSITY
U46	YEDİTEPE UNIVERSITY
U47	YILDIZ TECHNICAL UNIVERSITY