TECHNICAL EFFICIENCY OF COMPREHENSIVE HEALTH CENTERS IN AFGHANISTAN

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ประสิทธิภาพทางเทคนิคของศูนย์สุขภาพชุมชนในประเทศอัฟกานิสถาน

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การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาประสิทธิภาพของ Comprehensive Health Centers ซึ่งเป็น หน่วยสาธารณสุขของประเทศอากานีสถาน เพื่อที่จะค้นพบและประเมินประสิทธิภาพโดยเปรียบเทียบและศึกษาปัจจัยที่ส่งผลที่สมรรถาพการปฏิบัติหน้าที่ของเจ้าหน้าที่ในหน่วยสาธารณสุขในประเทศอาฟกานีสถาน การศึกษาครั้งนี้ใช้การวิเคราะห์ข้อมูลด้วยวิธี Data Envelopment Analysis (DEA) เพื่อวิเคราะห์ประสิทธิภาพดของตัวอย่างจำนวน 304 ตัวอย่าง ผลการศึกษาครั้งนี้พบว่า ผลของการให้บริการก่อนและหลัง การให้กำเนิดโดยผู้เชี่ยวชาญทางสาธารณสุข การให้บริการวางแผนครอบครัว การให้บริการผู้ป่วยนอก การให้บริการทำวัคซีน และการตรวจสอบไวรัสตับอักเสบ TB นอกจากนี้ปัจจัยที่ส่งผลในการศึกษาครั้งนี้รวมถึงคนงานนอกระบบประกัน ผู้ให้บริการทางสาธารณสุข เจ้าหน้าที่ให้บริการทางเภสัชและการตรวจทางสุขภาพ และเจ้าหน้าที่ในหน่วยสนับสนุน

ผลการศึกษาพบว่าคะแนนประสิทธิภาพที่มีขอบเขตที่ดีที่สุดที่อยู่บนพื้นฐานของอัตราการตอบแทนได้แก่ ประสิทธิภาพทางเทคนิคเฉลี่ย และประสิทธิภาพในภาพรวม คิดเป็นร้อยละ 64 และ 59 ตามลำดับในขณะที่ ระดับค่าเฉลี่ยของประสิทธิภาพ คิดเป็นร้อยละ 92 ภายใต้การวิเคราะห์ปัจจัยภายนอกของแบบจำลอง DEA อย่างไรก็ตาม ในส่วนของปัจจัยเข้า ประสิทธิภาพทางเทคนิคเฉลี่ย และประสิทธิภาพในภาพรวม คิดเป็นร้อยละ 66 และ 59 ตามลำดับ ในขณะที่ระดับค่าเฉลี่ยของประสิทธิภาพ คิดเป็นร้อยละ 87 จากการศึกษาครั้งนี้ กว่าร้อยละ 88 หรือ 270 ตัวอย่างของเจ้าหน้าที่ของ CHC พบว่า ไม่มีประสิทฺภาพ และกว่าร้อยละ 70 หรือ 215 ตัวอย่างของ CHC ดำเนินการในระดับที่ต่ำกว่า ประสิทธิภาพทางเทคนิคเฉลี่ย (ร้อยละ 64) และเจ้าหน้าที่จำวน 75 ตัวอย่าง มีการดำเนินการบริการอย่างมีประสิทธิภาพ นอกจากนั้นจากรูปแบบของระดับความไม่มีประสิทธิภาพแสดงถึงจำนวนเจ้าหน้าที่ CHC โดยส่วนใหญ่กว่า 204 ตัวอย่าง มีระดับตอบสนองต่อประสิทธิภาพที่ลดลงภายใต้การวิเคราะห์ในแบบจำลอง DEA

นอกจากนั้น แบบจำลอง Tobit พบว่ามีความสัมพันธ์ในทิศทางเดียวกันระหว่างประชากรและส่งผลต่อนัยสำคัญทางสถิติทางด้านประสิทธิภาพทางเทคนิค ค่าระดับนัยสำคัญ คือ 0.000 ซึ่งหมายความว่าค่าเฉลี่ยประสิทธิภาพโดยเปรียบเทียบของศูนย์สาธารณสุขดังกล่าวอยู่ในระดับสัดส่วนของเจ้าหน้าที่สาธารณสุขและประชาชนในระดับสูง และจากการวิเคราะห์สมการถดถอยพบว่า ในส่วนของ RBF-incentive เท่านั้นที่มีความสัมพันธ์ในทิศทางเดียวกันประสิทธิภาพทางเทคนิค ในขณะที่ปัจจัยอื่นมีความสัมพันธ์ในทิศทางตรงกันข้าม

เมื่อพิจารณาปัจจัยภายนอกภายใต้แบบจำลอง DEA พบว่า การให้บริการทางสาธารณสุขของ CHC อยู่ในช่วงของการลดน้อยถอยลงของอัตราตอบแทน และดังนั้นการลดขนาดของการให้บริการจะส่งผลทำให้เป็นการเพิ่มประสิทธิภาพทางสาธารณสุข

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต ....

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ปีการศึกษา 2556

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KEYWORDS: TECHNICAL EFFICIENCY / DATA ENVELOPMENT ANALYSIS / COMPREHENSIVE HEALTH CENTERS / AFGHANISTAN

NASRATULLAH SAMIMI: TECHNICAL EFFICIENCY OF COMPREHENSIVE HEALTH CENTERS IN AFGHANISTAN. ADVISOR: ASSOC. PROF. PONGSA PORNCHAIWISESKUL, Ph.D., 113 pp.

This study aimed to inspect the issues surrounding efficiency in the Afghanistan public health sector with specific focus on comprehensive health centres (CHC), in order to find out and evaluate the relative efficiency and also to investigate the factors that are affecting the performance of CHCs in Afghanistan. This study applied Data Envelopment Analysis (DEA) approach to observe efficiency scores of 304 sample CHCs'. Outputs of the study include: Antenatal care services, postnatal care services, Skilled birth attendance services, Family planning services, Outpatients services, Vaccination services and Tuberculosis positive case detection. And also the inputs to the study include Outreach health worker, Medical health provider, Ancillary service staff, and supportive staffs.

The results disclosed that there were considerable variations of efficiency scores from the best practice frontier in either of return to scale assumptions. Such as: the mean pure technical efficiency (TEVRS) and overall technical efficiency (TECRS) were 64% and 59%, while mean scale efficiency (SE) was 92% under output oriented DEA model. However, TEVRS and TECRS were 66% and 59% and mean SE was of 87% under input oriented DEA model. According to this study 88%(270) of the CHCs found that were running inefficiently and about 70% (215) comprehensive health centres were found to be operating below their average pure technical efficiency score (64%) and 75 CHCs show scale efficient. In Addition the pattern of scale inefficiency shows that a majority (204) of the CHCs were decreasing return to scale efficiency under output oriented DEA.

In addition, Tobit regression shown that catchment population positively linked and significantly affecting the technical efficiency [P-value = 0.000]. That means relatively efficient health centres are located in high catchment population areas. Furthermore, from the total explanatory variable for regression analysis only RBF-incentive shown positive link with technical efficiency while the rest of variables shown negative correlation except catchment population described before.

In respect to the output oriented DEA model, majority of the CHCs are operating under decreasing return to scale, so reducing the size of those health facilities is recommended to become efficient.

Field of Study:	Health Economics and Health Care Management	Student's Signature	....
		Advisor's Signature	....
Academic Year:	2013		

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List of Abbreviations

ANC	**Antenatal Care**
BHC	Basic Health Centre
BPHS	Basic Package of Health Services
CHC	Comprehensive Health Centre
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DH	District Hospital
DMUs	Decision Making Units
DRS	Decreasing Return to Scale
EPHS	Essential Package of Hospital Services
GCMU	Grant and contract management unit
HMIS	Health Management Information System
HP	Health Post
IRS	Increasing Return to Scale
MDG	Millennium Development Goal
MoPH	Ministry of Public Health
NGO	Non-Government Organization
RBF	Results Based Financing
SBA	Skilled Birth Attendance
SE	Scale Efficiency
SM	Strengthening Mechanism
TB	Tuberculosis
TECRS	Technical Efficiency under Constant Return to Scale
TEVRS	Technical Efficiency under Variable Return to Scale
VRS	Variable Return to Scale
WHO	World Health Organization
WB	The World Bank

CHAPTER 1
INTRODUCTION

1.1. Background of the Study

The health sector problem of least developed countries has generally outlined in three main categories such as: insufficient or inadequate resources on essential and cost-effective programs, inefficiency that result excessive health care spending, and finally inequitable allocation of health sector benefits. (Akin, 1987)

Although most of the countries have committed to increase the basic health care needs to their whole population through a defined goals. Yet, in least developed countries, both public and private spending in the health sector is insufficient and resources are scarce to meet the defined goal of the health sector. In fact, deficiency in health care resources is due to a number of significant factors, some of the key factors are outlined as poor macroeconomic performance, rapid population growth, AIDs epidemic and other communicable diseases. Although, private particularly out of pocket expenditure is substantial, but a smaller share of it goes to basic health care needs such is immunization, health education, simple curative care, referral need, mother and child care that are most cost effective programs in health care. Therefore, basic health care activities are not able to expand sufficient to meet the great need of rapidly growing population for a reasonable quality of healthcare service. (Akin, 1987)

In addition, the constrained ability to meet the basic health care needs is further worsening by wide-ranging of internal inefficiencies in the health care system of least developed countries. According to studies, internal inefficiencies give noticeably rise in underperformance in health care service delivery between what is achievable and what was possible to be achieved with the existing resources. Empirical evidence emerging from various studies such as: (Abbas, 2011), (Kirigia, 2004) and (Marschall, 2009) also indicates the wide prevalence of technical inefficiency in healthcare care provision.

Moreover, Increase in health care service demand that results from a rapid growing population and emerging communicable diseases in least developed countries. The government spends a considerable portion of its scarce resources to provide health service in primary and secondary health care service centers where a large proportion of population lives, such in Afghanistan, therefore, because of the enormous consumption of resources in the health sector especially in rural areas that the efficiency is the centers merits of close attention. (Akin, 1987)

1.2. Statement of Problems and significance

Afghanistan, as result of three decades of civil war and poor economic performance has numerous problems in every sector particularly in health care sector. In fact, the foremost problem related to the health sector has been lack of resources and inefficient utilization of available resources. Therefore; there is huge need to outline how to allocate and distribute the existing resources effectively and efficiently in order to maximize the returns from the outlay in health sector. As a result, this calls for a detailed study in the operations of health facilities especially primary health care facilities that utilize a substantial proportion of the health care resources.

In Afghanistan, each year a considerable proportion of the public health sector budget is allocated for provision basic health care services and significantly increasing each year since 2002. For instance, from total health sector development budget primary health care service centers consume about 70% for providing health care services particularly in rural communities (Ministry of Finance, 2012). The country's Public health sector generally basic health care service is contracted out to multiple Non-Government Organizations (NGOs) in 31 out of 34 provinces for rapid provision of health care service that should be undertaken by the government. Thus the donor agencies such as: World Bank (WB), European Union (EU), United State Agency for International Development (USAID), and other donor agencies provide direct and indirect grants for NGOs to facilitate the recurrent cost of health facilities. Therefore the Health sector is almost entirely dependent for external grants that require an efficient management system. Given the fact that resources for the health care are scarce for both public and private, the policy makers and managers at any level must recognize the importance of efficiently utilizing health care input resources in a manner that derive maximum health benefits to the population. So it should not be in the way that large amount of the health inputs resources (budget, health workforce and etc.) consuming on those activities and those health facilities that have fewer return to the health sector.

Although, Afghanistan has increased health care service delivery to the population through the founding of 57% additional physical health facilities and employing of more health workforce since 2002. Still more work and struggle should be made. As the significant (65%) of the population live more than an hour to any health facilities and substantial proportion (18%) of the entire population has even no access to primary health care services. (Belay, 2010). The achievement of health access needs availability of enough resources for the health sector to expand access and increase quality of health care services and also increase public awareness of the health benefits. Therefore, the issue of efficiency is the central point of view to be observed before strategies for mobilizing additional resources for health sector.

In addition, there are some socio-cultural and health care service providers problems that bring the risk of inefficiencies in health facilities particularly in rural communities such as; poor and disrespectful attitude and behavior of some of health care service providers is a constraint that are documented and discourage the community from acquiring the service in health facilities. In addition lack of awareness among people about the health care knowledge also affects the service utilization adversely, as most of the elders in families have low literacy levels and they do not know about some benefits of health care programs such as vaccination that causes to have their children unvaccinated. Additionally some other socio-cultural barriers that prevent women from using health services further complicate the issue of physical access to health facilities. Afghanistan's culture imposes restrictions on women's mobility and their presence in public places; women need authorization and had to be escorted by men to access the health care facilities. This partly explains why even when health facilities are close by, only a quarter of women use skilled birth attendants and fewer women receive Antenatal and postnatal cares. In addition to these obstacles, insecurity in some part of the country appears to have a significant effect both on the ability of the Ministry of Public Health (MOPH) and its partners to deliver the healthcare services and on users' ability to access services, such as 15% of the women get four antenatal care visits compared to 44 % average in the regional countries. In consequence, increasing coverage and utilization is the single largest challenge in strengthening the BPHS and raising the issue of efficiency. (Singh, 2012)

In conclusion, some of the problems that Afghanistan health sector particularly primary health care facilities has faced are poor utilization of health care services by clients as well as poor utilization of health care resources by health care providers (health facilities), deficiency of medical personnel in rural health centers, lack of physical health infrastructure, finally socio-cultural and economic situation of people in Afghanistan that all affect somehow on performance and operation of health centers and consequently cause the risk of inefficient operation. In addition, there is growing feeling at all levels of public sector agencies should be held responsible for services they provide, and Health sector are not an exception to such demand as the one of the main priorities of Afghanistan public health sector priorities is “Funding for services expansion, addressing inefficiencies in out-sourcing. (World Health Organization, 2014) Therefore, against this background, it is necessary to investigate the levels of technical and scale efficiency at which health facilities in Afghanistan operate.

Indeed, Efficiency is a way of assembling more resources without necessarily looking for extra investment. The fact that resources are misused in an inefficient system means that an improvement in efficiency is similar to an increase in resources that can be used in that system. Although health resources are always scarce and inefficient use of these resources severely restricts the ability of health planners and policy makers to extend health services of acceptable quality to the public.

1.3. Questions of the Study

The study serves to answer the following questions.

General Question:

1. What are the technical and scale efficiency of Comprehensive Health Centers (CHCs) in Afghanistan?

Specific Questions:

2. What are the factors affecting the technical efficiency of CHCs in Afghanistan?
3. What is the difference of technical and scale efficiency among CHCs by province in Afghanistan?

1.4. Objectives of the Study

The principle stimulation of this study is to find out whether the available scarce resources in the Afghanistan health sector are being efficiently utilized. In other words, the general objective of this study is to measure the levels of technical and scale efficiency of Comprehensive Health Centers (CHCs) in Afghanistan.

Meanwhile, the specific objectives are listed as follows:

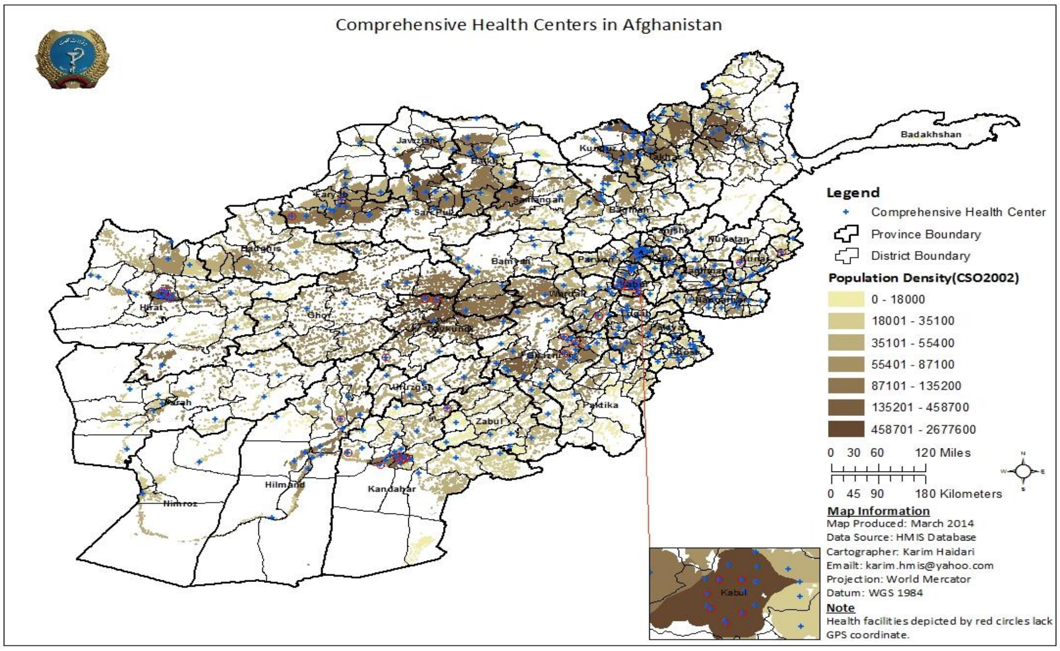
1. To analyze the extent of the inefficiency in inefficient CHCs in Afghanistan.
2. To explore some factors those are probably influence the efficiency of CHCs in Afghanistan.
3. To compare the mean technical and scale efficiency of Comprehensive Health Centers between the provinces in Afghanistan.

1.5. Scope of the study

This study will cover nearly 80 % of the total Comprehensive Health Centers (CHCs) type of community health centers in 34 provinces of Afghanistan. In addition, the study will use secondary source of cross-sectional data of year 1391 (according to 20 March 2012 to 20 March 2013).

Furthermore, CHC is the primary public health facilities that provide basic primary health services to the larger catchment area of 30,000- 100,000 people. Moreover, it is the referral center for basic health centers (BHC) and health sub-centers (SC). The CHCs offers a wider range of service, In addition to assisting normal deliveries, the CHCs can handle certain complications, grave cases of childhood illness, treatment of complicated cases of malaria, and outpatient care for mental health patients. The facility has limited space for inpatient care, but has a laboratory. Health workforce in these centers includes: Medical health care providers; both male and female doctors, male and female nurses, midwives, Ancillary service staff; laboratory and pharmacy technicians, outreach health care workers; community health supervisors and vaccinators, and supportive staff. **(MoPH, 2010)**.

Figure 1: Comprehensive Health Center (CHCs) graphical location



Source: (HIS, 2012)

1.6. Possible Benefit of the study

The study will not only reveal the efficiency profile of whole Comprehensive Health Centers (CHC) as the efficient (as a good model) and inefficient health centers, but also it discloses the factors affecting on the efficiency and performance of CHCs in the country.

Therefore, the possible significance of the study is outlined as follows:

- Policy-makers, Implementers, Managers in the health sector use this information in designing appropriate plan and managerial interventions to improve the inefficient CHCs to more efficient in the right direction in order to avoid waste and to make the most efficient use of available scarce resources to maximize the utilization of health care services.
- This study identifies the health facilities with “best performance.” In future more detailed studies could look at and document their operating practices to establish a guide “best practice” for inefficient health centers to follow.

Therefore, this study gives vital contribution to the field of health economics in Afghanistan. Meanwhile, The CHCs as Primary health centers have been selected due to their influence on the productivity of workers and on total health expenditure.

1.7. Outline of the following chapters

The subsequent chapters of this study organized as follows: The prime purpose of the second chapter is to review of the country's background and health care service delivery system. The third chapter provides comprehensive theoretical and observed studies literature on the conceptualization of efficiency in general and on primary health center efficiency in particular. The fourth chapter presents a description of the data and the methodology used to measure health facility's efficiency and the justification of using that methodology. In chapter five, I estimate the results using Data development analysis (DEA) and regression models followed by the presentation and analysis of results obtained. And finally the dissertation`s conclusions, policy recommendations, suggestions for further research and are contained in chapter six.

CHAPTER II

THE HEALTH CARE SYSTEM IN AFGHANISTAN

2.1. Introduction

This chapter presents the country's context within which the health sector operates, it describe the location, macroeconomic, and the health care service system and its challenges in Afghanistan.

2.2. Afghanistan Background

Afghanistan is a landlocked country in South Asia bounded by Pakistan to the east, Iran to the west, and Turkmenistan, Uzbekistan, and Tajikistan to the north. Afghanistan grades 175th out of 187 countries in the 2012 Human Development Index. It has an area of 652,864 km² and density of settled population is 39/km² with 25.5 million populations, which 12.4 million is female and 13.1 million are male estimated in the year 2012. From total population living in Afghanistan 19.43 million living in rural areas and 6.07 million populations living in urban areas. Afghanistan has an arid to semi-arid climate with cold winters and hot summers. Finally, Afghanistan has separated into 34 provinces and 364 districts administratively. (Yearbook, 2013-2014).

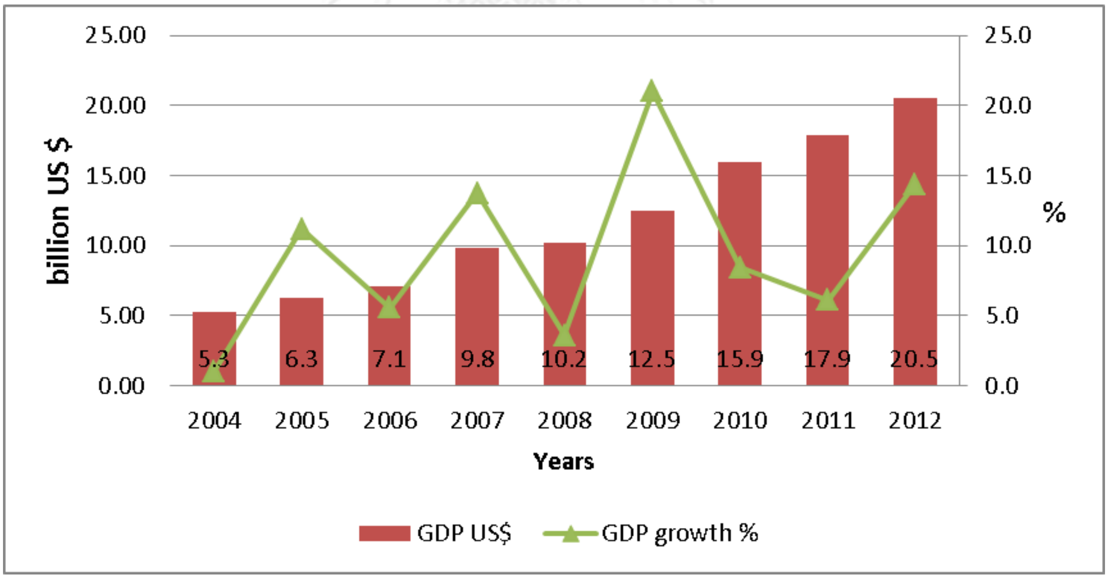
Figure 2: Afghanistan's Map

Source: The World Fact Book: Afghanistan (CIA, 2014)

2.2.1. Afghanistan's Macroeconomic

Afghanistan, after the collapse of Taliban regime in 2001, has continued a high, but unstable gross domestic product (GDP) growth due to the infusion of billions of dollars from international grants and investments. Moreover, the economic development has also been due to impressive growth in agricultural production and the end of a four-year drought in most part of the country. Figure 3 clearly shows that the GDP amount was 20.5 billion dollars in 2012 compared to 5.3 billion dollars in 2004. In addition the real GDP had an average 9.4% growth between 2004 and 2012. In general, an agriculture sector account for 30.3% share of GDP in 2004 and 24.6% share of GDP in 2012 depends on annual outcome. The mining sector, on the other hand, is slowly emerging as a source of growth, the share of mining in GDP has historically been small, as it was only 0.6% in 2010/11. Also, inflation decreased to 7.22% in 2012, down from 10.2% in 2011. The exchange rate depreciated by 8% in 2012, which is likely driven by increased uncertainty over security and the business environment. (World Bank Group, 2012)

Figure 3: GDP (current billion US$) and GDP growth (annual %) in Afghanistan



Source: (World Bank Group, 2012)

2.3. Afghanistan Health care service delivery system

Afghanistan, the recent health care system and its background can be described in two phases; before 2002 and after 2002. Health care system before 2002 attributed with inequalities and low accessibility in health care service. The most remarkable inequalities were between rural and urban population; as the health care facility did not exist in most part of the rural that resulted Afghanistan to have the worst health indicators among the countries. Only few rural health facilities that were existed in rental houses played an insignificant role in promotive and preventive health services with the very poor quality. Thus, hospitals and large numbers of medical health workforce in urban areas dominated health system. Therefore, the majority suffered excess mortality and morbidity in rural a trend that still resonates today. (Strong, 2005)

On the other hand, health care system after year 2002 that is after the collapse of Taliban regime, the government of Afghanistan has become one of the major and leading providers of health care services. Therefore, the government required to restore the inequities in health care that existed before 2002. Thus, the Ministry of public health (MoPH) has initiated to developed policies and strategies to response to the health need of the population. Consequently, two packages have been developed as following: (MoPH, 2011)

1. Basic Package of Health Services (BPHS) :

This package has been developed with the goal to "provide a standardized package of basic services that would form the core of service delivery in primary and secondary health care facilities". Offering services at the six types of health facilities; ranging from outreach by Community health worker at the Health Post (HP), Health Sub-Centers (HSC), Mobile Health Team (MHT), Basic Health Center (BHC), Comprehensive Health Center (CHC) and district Hospitals (DH). (MoPH, 2010)

2. Essential package of Hospital Services (EPHS)

Following to the first package, the second package (EPHS) developed in the year 2005 focusing to establish a framework for the hospitals to get better their facilities, staffing, equipment, training and enhancing the referral between various levels of the health system. The EPHS package offers at the Provincial Hospital (PH) and Regional Hospital (RH). (MoPH, 2011)

The principle objectives in developing these two packages were to expand access and equity in the provision of basic health services to population. Thus, the policy emphasized equity and accessibility "Health for All" (MoPH, 2011) rather than efficiency. Efficiency combined with accessibility and equity eventually became the foremost focus of policy makers.

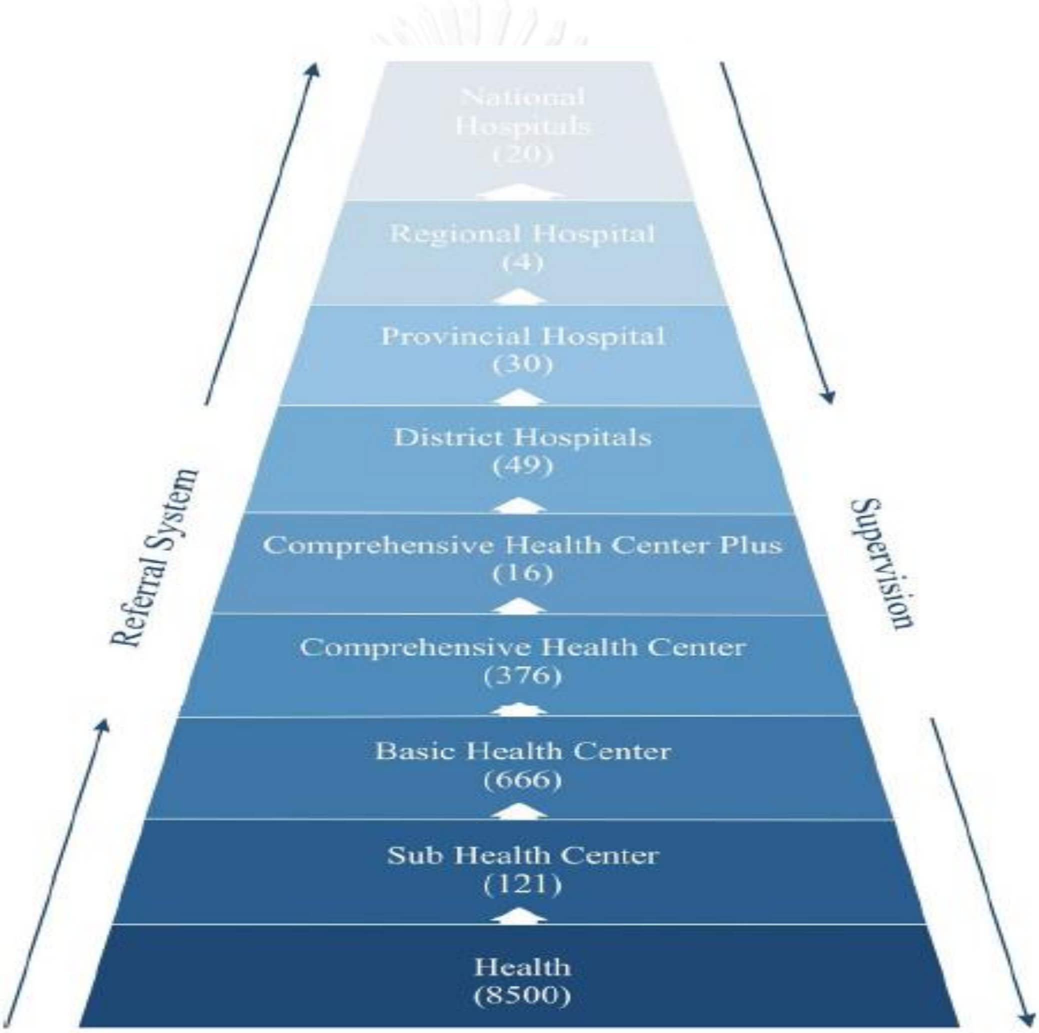
Thus, the government has adopted a health care service approach into a three-tier system; as primary, secondary and tertiary health care services. The primary health care service in the first tier being provided at the health facilities such as: health post to health sub centers, Basic health centers and Comprehensive Health Centers (CHC). Secondary health care services in the next tier being provided at the health facilities such as: district hospitals. And tertiary health care services to following tier being provided at the facilities such as: provincial hospital, regional hospitals, National hospital and teaching hospitals, where service of increasing complexity requiring more specialized personnel and equipment. In principle, patients seeking medical care are not supposed to go directly to higher-level facilities without being referred from a lower level. Due to inefficiencies within the referral system, usually bypassing the lower levels is very common. As a result, central hospitals treat a mix of highly specialized and routine cases that could be treated at lower levels. (MoPH, 2010)

Furthermore, the service delivery in public health sector for provision of BPHS and EPHS packages are organized in two mechanisms; contract-in and contract-out. (Belay, 2010) The contracting-out mechanism which the Ministry of Public Health (MoPH) provides funding to non-Governmental Organizations (NGOs) to deliver BPHS and EPHS package by focusing on primary health intervention need such as immunization, reproductive health, under five age health and basic curative health care service for adults (Sabri, 2007). However, experience of contracting out mechanism shows that health care service delivery can be improved rapidly in a short period of time, particularly in post-conflict situations (Carlson, 2005). This concept of contracting out is widely applied in Afghanistan that 31 out of 34 provinces are contracted out with NGOs for the provision of health care services that cover almost 95% of the country's population. In addition, the system of public health services is funded through several sources; direct grants or budgets from the Ministry of Public Health and donors are the principal source of funds.

Despite the above achievements since 2002, there has been evidence of inefficiencies in the deployment and use of resources within the health care sector.

These inefficiencies have generally been pointed with low utilization of health care services and founding the inappropriate type of physical health facilities in catchment population areas. However, there is potential for efficiency improvement in the use financial and non-financial resources. Therefore, there is a need to encourage a culture of service planning that is focused on improvement to ensure a more rational deployment of resources as well efficiency of their use.

Figure 4: Afghanistan Health System Pyramid

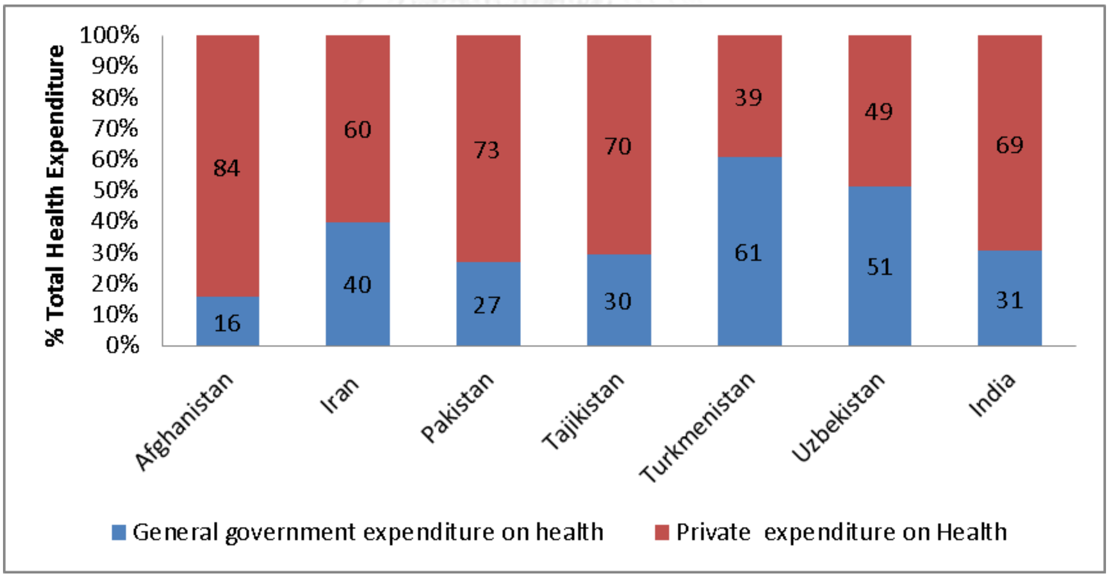


Source: (Health Information System, 2012)

2.3.1. Total Health Expenditure:

Actually, Total health expenditure is the sum both public and private health expenditure. Although, it has been increasing in total public health care expenditure from 7% to 16% between 2002 - 2011 to deliver the basic primary health care services to people that have been in need of health care service and were ignored, but still private sector that is comprised out of pocket expenditure and non-profit organization supports have had an important part in providing and paying for these growing health services. The private sector-especially household has played the leading role in this process. For instance, in 2011, the private sector was accountable for 84% of all health expenditure, including this 94% out of pocket expenditure, and 6% private non-for profit organization contribution. On the other hand, the public sector, which provides 16% of the total health care expenditure, was composed of 10% ministry of public health, 0.5% Ministry of defense, 0.1 % Ministry of Interior, 0.5% Ministry of Higher education, 0.001% Ministry of education and the rest provided by the rest of the world. Meanwhile, Figure 5 shows that Afghanistan compared to its neighbors has the highest share of private out of pocket expenditure in year 2011 in contrast with; Iran 60%, Pakistan 73, Tajikistan 70%, Turkmenistan 39%, Uzbekistan 49%, and India 69%. (WHO, 2012)

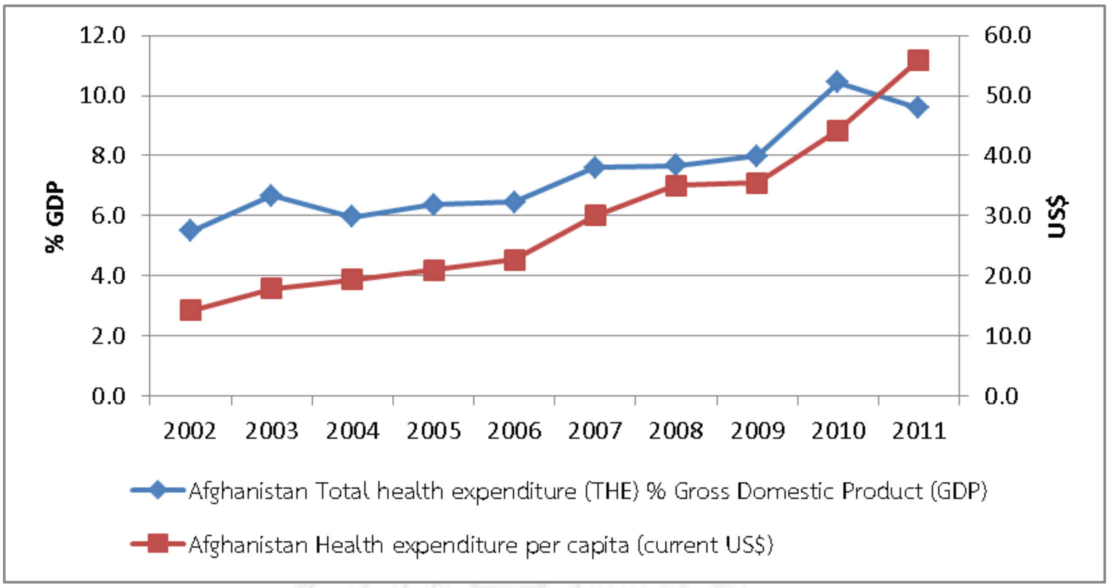
Figure 5: Private and Public Health Expenditure: Afghanistan and Its Neighbors, 2011



Source: (WHO, 2012)

However, in recent years as a result of improving the macroeconomic performance of the country compare with years before 2001, health spending has increased each year. In year 2011 Afghanistan spent over 9.6 % of its GDP in health expenditure compared to 5.5% in 2002, that resulting in per capita health expenditure of US $ 55.9 in 2011. The visual depiction of the trend of health expenditure and its related components are shown in Figure 6 below. (WHO, 2012)

Figure 6: Afghanistan, Total Health Expenditure (THE) as % of Gross Domestic Product (GDP) and Health Expenditure per capita (Current US$), 2002-2011



Source: (WHO, 2012)

Table 1: Afghanistan, Total and per Capita Expenditure on health, 2003-2011

Year	Total Real Expenditure (Million$)	Per Capita Real Expenditure (US $)	Health Expenditure as % of GDP	Public Health Expenditure as % of Gov. Expenditure
2003	413.32	17.88	6.66	Nil
2004	465.11	19.36	5.96	1.85
2005	521.93	20.99	6.37	1.12
2006	581.74	22.70	6.45	1.47
2007	790.08	29.98	7.60	1.38
2008	945.60	34.98	7.68	0.85
2009	983.60	35.50	7.98	3.22
2010	1,254.83	44.19	10.44	3.86
2011	1,628.01	55.93	9.58	3.34

Source (The world Bank, 2012)

2.3.2. **Human Resources in the Health Sector**

Health workforce is the key determinants of success as well as failure of the health system (World Health Organization, 2000), and the performance of health care systems is a function of the availability, knowledge, skills mixes and motivation of personnel delivering the services. (Mercer, 2003)

Afghanistan, like many other post conflict countries, is faced with a serious shortage of skilled and experienced health workers, this shortage has been severe with the highest rate of female doctors, nurse and midwife particularly in rural health facilities, (Belay, 2010).

Actually, there has been a substantial level of investment in health workforce through the establishment of private and public nursing and midwife school, medical universities that outcome a sound growth in the number of health workers employed in the public sector as well as private sector since 2002. (World Health Organization, 2014)

In spite of above achievements and efforts that has been made in response to health workforce problem. Still health sector face with a serious shortage of medical staff, especially female health workers. The ratio of all qualified workers in the health sector, including management/technical support is 22 per 10,000. This includes 2.9 physicians, 3.6 Nursing and Midwifery, 0.1 Dentists, 0.3 Pharmacists, 7.43 volunteer community health workers and rest are the management staff per 10,000 populations, WHO states that the minimum number of doctors, nurses and midwives (combined) required per 10,000 populations is 23, and Afghanistan has one third of this number, Generally, female health workers make up 28% of health sector workforce, apart from 50% community health workers and 100% midwives being female. Only physicians, vaccinators, dentists, and pharmacists have about 20% female and the proportion of health facilities having female physicians, nurses, or midwives from 24.8% to 83%. (MoPH, 2011)

Geographic imbalance, as the large number of health care workers are concentrated in cities, while rural areas still suffer from shortages. There are 16.7 public health workers (including unqualified supportive staff) in rural areas compared with 36 in urban areas. However, 77.4% population lives in rural areas. (MoPH, 2011)

Therefore, mal-distribution of health staff in urban and rural areas, and inadequate management control results of the poor quality of service, high personal expenses and low staff productivity. Since, Health services are so particularly labor intensive, miss-match between needs and the use of available human resources may cause a great negative impact on service performance and efficiency.

2.3.3. Public Health Sector Physical Infrastructure

Afghanistan has made a significant progress, especially in reducing the inequalities in health care services that existed prior 2002. The government of Afghanistan has been extended basic health care to underserved rural areas through establishing; 74 district hospitals (DHs), 384 Comprehensive Health Centers (CHCs), 516 health sub-centers (HSCs), 96 mobile health teams (MHTs), 816 basic health centers (BHCs), and 28 provincial hospital and 6 regional hospital as shown in Table 2. (Health Information System, 2012)

Actually, the basic premise for physical infrastructure development is the need for each province to have a minimum package of infrastructure. The initial criteria for development the physical health facility is catchment population as well as geographic landscape of the area; CHC health center for the population ranging from 30,000 to 100,000, one BHC for the population from 15,000 to 30,000, one district hospital for each district with the population ranging from 100,000 to 300,000, one provincial hospital with specialists' service for each province. However, there is need to address the issue of maintenance. The maintenance and refurbishment of existing facilities have continued to lag behind with some facilities in an advanced stage of dilapidation.

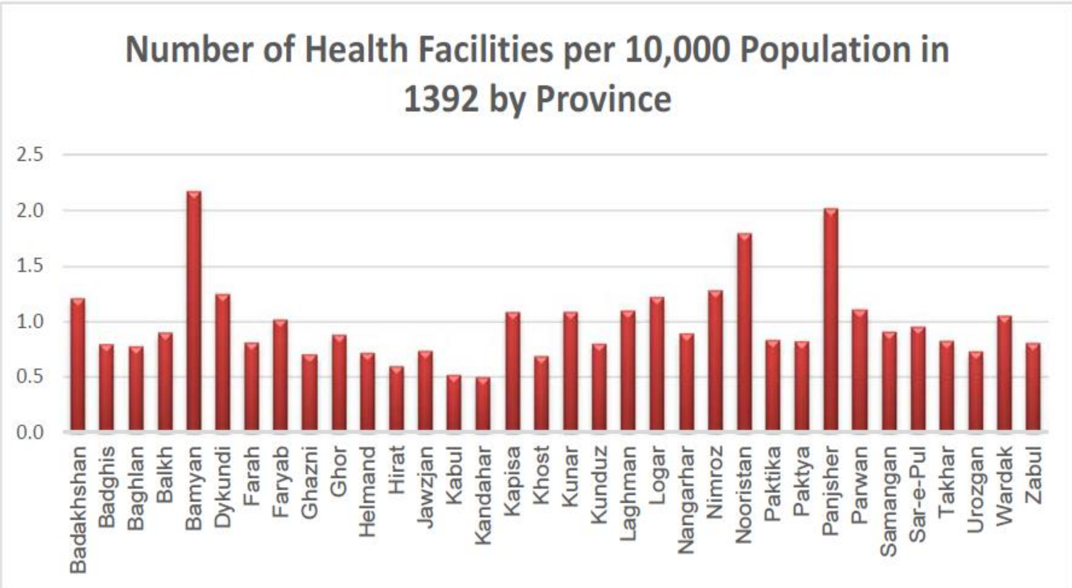
Table 2: Number of Health Centers, 2008-2013

Type of Health center	1385	1386	1387	1388	1389	1390	1391	1392
Basic Health Center (BHC)			766	779	803	809	808	816
Comprehensive Health Center (CHC)			373	377	384	383	382	384
District Hospital (DH)			67	68	72	70	73	74
Mobile Clinic (MC)			49	80	106	102	93	96
Provincial Hospital (PH)			28	28	28	28	28	28
Regional/National hospital (RH)			6	6	6	6	6	6
Specialty Hospital (SH)			22	24	24	24	25	26
Sub Health Center (SC)			281	351	450	472	488	511
Other			75	90	114	122	144	219
Grand Total	1237	1420	1667	1803	1987	2016	2047	2160

Source: (Health Information System, 2012)

However, despite the strategically dispersed location of health centers in the country, location and construction of health centers in the provinces are influenced by politicians (Belay, 2010). In addition the geographic landscape brings the risk of mal-distribution of the health centers. This is an ongoing and serious concern in developing an appropriate infrastructure for service delivery. Hence, this phenomenon raises doubts about the efficiency of health centers. For instance, Comprehensive Health Centers established to cover a catchment area of about 30,000 to 100,000 population, but as evidence shows that most of the CHCs catchment population is less than 20,000 people. Meanwhile the number of health facilities to 10,000 populations is different in each province. As it seems from figure 7 that Panjsher, Bamyan and Nooristan province has the around 2 health facilities per 10,000 populations compare to Kabul, Kandahar which has 1 health facilities for 20,000 populations. So this shows the risk of mal-distribution of health facilities in the provinces

Figure 7: Number of Health Facilities Per thousand Population by Province



Source: (Health Information System, 2013)

2.3.4. Key Health Indicators

The total fertility rate in Afghanistan for the three years preceding the AMS 2010 is 5.1 children per woman. As expected, fertility is higher in rural areas than urban areas. More than nine in ten currently married women in Afghanistan know the method of contraception; more than one-fifth of currently married women use some method of family planning, with the vast majority using a modern method. Maternal and child care are strongly associated with the care received by women during pregnancy and delivery. According to Afghanistan mortality survey (Afghan Public Health Institute, 2010) more than six in ten women in Afghanistan are now receiving ANC services. Around one third of births are now being assisted in the delivery by the SBA. Over a quarter of women are receiving cares from SBA in the postnatal period. The Infant mortality rate in Afghanistan 74 per 1,000 live births and child mortality rate is 97 per 1,000 live births. The maternal mortality rate is 327 per 100,000 live births. Table 3 present a summary of key indicators. (Health Information System, 2012)

Table 3: Afghanistans' Key Health Indicator

No.	Indicator	Value	Year
1	Total population (Million)	25.5	2012
2	Life Expectancy at birth, males (year)	62 -64	2010
3	Total Fertility Rate	5.1	2010
4	Infant Mortality Rate (per 1,000 live births)	74	2010/11
5	Under Five Mortality Rate (per 1000 live births)	102	2010/11
6	Maternal Mortality Ratio (per 1000 live births)	327	2010
7	Contraceptive Prevalence Rate	21	2010/11
8	Skilled Antenatal Care (at least one visit) (%)	48	2010/11
9	Skilled Birth Attendants (%)	39	2010/11
10	Under Weight prevalence under five %	31	2010/11
11	DP3 Coverage (%)	35	2010/11
12	Measles Vaccination Rate (12-23 Month) (%)	44	2010/11
13	HIV Prevalence, Adult (%)	<0.1	2007
14	Tuberculosis positive case detection rate (%)	68	2011
15	Population with sustainable access to improved water source (%)	57	2010/11

Source: (Health Information System, 2012)

2.4. CONCLUSION

This chapter discussed the structure, accomplishment and performance as well as the challenges facing the Afghanistan health sector in terms of its composition and problems that further support the problem discussed in the first chapter. The sector was found to be characterized by poor economic performance and chronic shortages of basic resources such as health workforce and physical health infrastructure as well as having poorer health indicators. These problems are deteriorated by the lack of financial resources and an inefficient use of existing resources.

The subsequent chapter will discuss the literature behind efficiency studies at the level of health care Facilities.

CHAPTER III
LITERATURE REVIEW

3.1. Introduction

This chapter summarizes the literature on two main headings; first, the theoretical part that discuss the conceptualization of efficiency and also two main tools of efficiency measurement: Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). Second the applied section examines studies and observations that have been conducted by different researchers in different countries on health care service sector efficiency.

3.2. Theoretical Literature

3.2.1. Efficiency Measurement Approaches

Prior to discussing the different tools of efficiency in the theoretical part of this section, it is imperative to have a look at the various approaches of efficiency measurement. Actually, there are two approaches to measuring the technical efficiency of a decision making unit (DMUs); either cost based approach or production based approach. The concept of technical efficiency can be defined directly to either of these approaches. In fact, the function to cost and production approach sets abound on the range of possible observation and form the "frontier" as a maximum performance to rest of the observation centers. So the term frontier can be applied to both approaches. For instance, production or outputs of DMUs can take place only below or on the frontier line. Similarly, costs of DMUs of measuring efficiency can be observed above or one the cost frontier line, but not below the frontier because it is impossible to achieve cost lower than the minimum input requirements implied by the production frontier. Therefore, the amounts by which a DMUs lies below its production frontier or the amount of cost by which a DMUs lies above its cost frontier line is considered as a measure of relative efficiency.

3.2.1.1. *The Production function Approach*

Farrell (1957), Farrel and Fielhouse (1962) and Afriat (1972) are the pioneers who treated the production function in their empirical works as a frontier to measure the efficiency of a DMU. Consequently, their approach remains the foundation of modern frontier analysis. Prior to elaborating more about production function, it is better to define the producer or decision making unit; as economic mediator that obtain a set of inputs and converts them into outputs. Actually, this is a general definition that not only includes manufacturing organization but also the service organization. For example, the hospitals, nursing homes, group practices, and other facilities that are evaluated for performance. On the other hand, a production function; function its self is a relationship between inputs and outputs and a production function can be defined as a process of physical transformation in which inputs are combined to generate output.

In addition, the production function has interpreted as an exclusively technical relationship, which defines efficient transformation possibilities, given the set of feasible techniques (technology). In the case of inefficiency, the production function may be written as an inequality:

$$y_i \leq f(X_i;\ \beta)$$

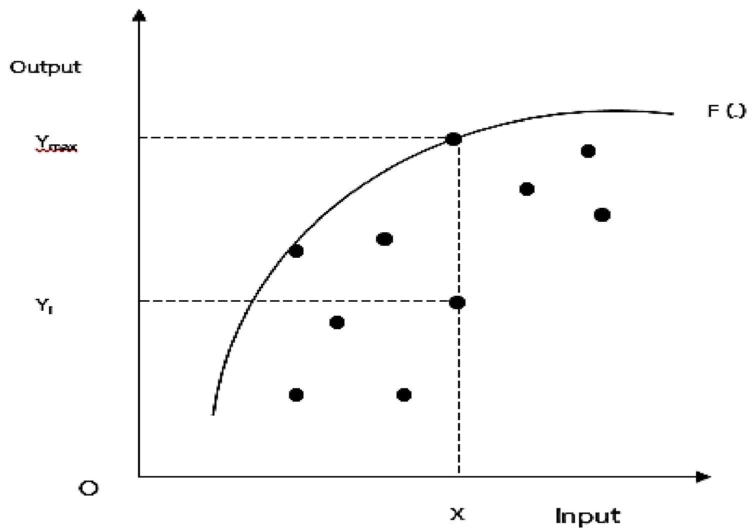
Where, y_i denote the observed outputs, and X_i denoted inputs and the vector of β describe the transformation process. In addition $f(.)$ is the production function. But actually the technical inefficiency examines through the difference between observed and potential outputs that treated as residual in the production function, and denoted in ε_i. Furthermore, at inefficient operations, the observed outputs are less than potential outputs $(y_i > y_{max})$, therefore, the technical inefficiency implies negative $(y_i - y_{max})$. in that case, the above production function rewritten to show the ratio of technical inefficiency.

$$\varepsilon_i \leq \frac{y_i}{f(X_i;\ \beta)}$$

Thus, the residual or ε_i is always negative to ensure that observed outputs cannot exceed potential performance ($y_i > y_{max}$) that is unfeasible.

Figure 8 shows i^{th} decision making units (DMU_i) that is producing outputs Y_i while acquiring the input X. Thus, it seems that the production frontier line lies above Y_i at point Y_{max}. Therefore, the difference between actual (Y_i) and potential outputs (Y_{max}) is negative. As a result, the production at unit Y_i is relatively inefficient. Notice that efficient production implies observed frontier attainments coincide and that the efficiency residual equals zero.

Figure 8: Efficiency and Production frontier



Source (Ganley, 1992)

3.2.1.2. *The Cost function Approach*

A similar interpretation given to the inefficiency in the cost function approach, if excess costs are possible with a firm to output and factor price, then we can write the cost function as follows inequalities:

$$c_i \geq g(z_i ; \alpha)$$

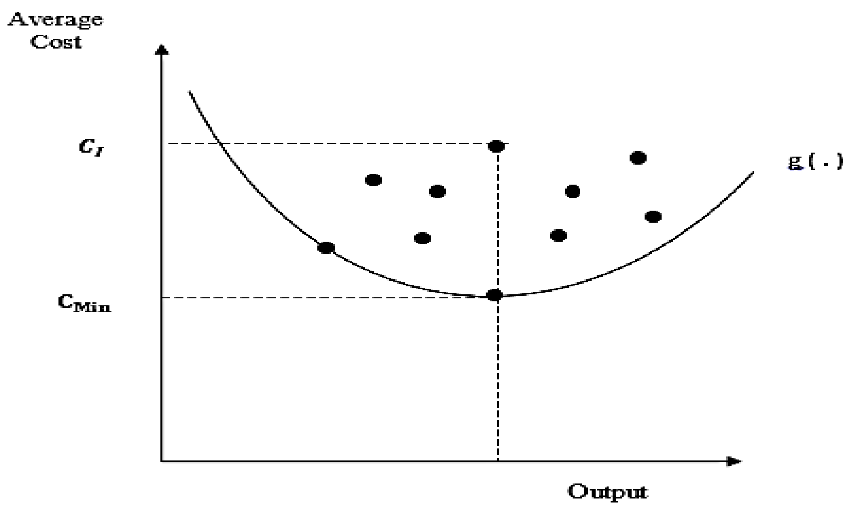
Where, c_i indicate the average cost at DMU *i,* z_i is the determinant of cost at establishment i, α is a vector of parameters. In addition, g (.) represents the cost function denoting minimum cost (c_{min}).

Comparable to production function, the efficiency ratio in the cost function obtains by residual

$$\theta_i = \frac{g(z_i ; \alpha)}{c_i}.$$

By this equation, we can obtain the ratio of average potential and observed cost in the firm. In the existence of inefficient performance the observed cost is greater than the potential cost. It means that residual of efficiency is positive.

Figure 3.2: Efficiency and Cost Frontier



Source (Ganley, 1992)

The figure 3.2 above, shows the DMU i, producing outputs by observed average cost (C_i) that it is far greater than the potential average cost (C_{Min}). As a result, the difference between actual and potential cost spending is positive, therefore the production at unit i represent inefficient performance.

As far as the required outputs are feasible at the minimum cost shows in boundary frontier line, therefore the observed cost cannot fall below the frontier line. Thus, the residuals are always positive. Therefore, this is essential to preserve the frontier interpretation of the cost function and implies that the residuals in the cost function are non-negative:

3.2.2. Concepts and Definitions of Efficiency

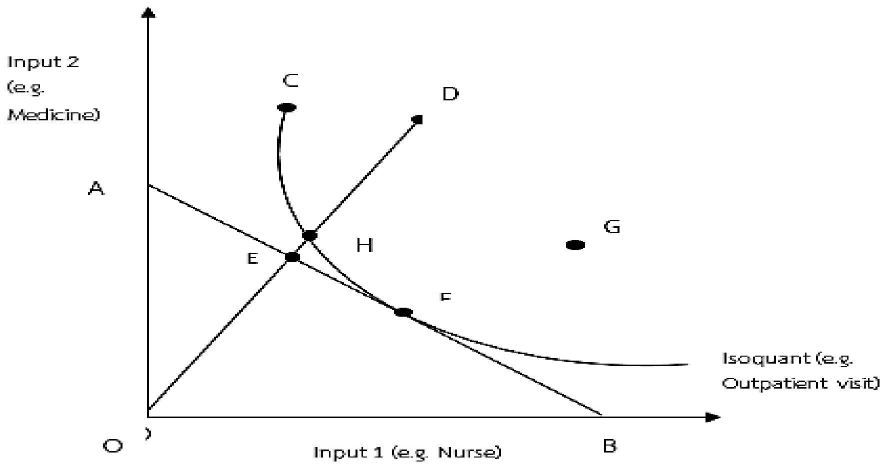
3.2.2.1. *Technical and Allocative Efficiency*

Based on to Farrell (1957) who pioneered most of his work on efficiency measurement, the efficiency of any production unit, including the health sector, has two components; Technical and allocative efficiency (Farrell, 1957). In Farrell's framework, a firm's efficiency is measured relative to the efficiency of all other firms in the industry, subject to the restriction that all firms are at or below the frontier. In the context of health care, WHO (1999) defines Allocative efficiency as when resources are devoted to right activities while technical efficiency is when a given health intervention or health outcome is obtained through few resources.

Chang at all (2008) defined the AQA's efficiency definition a "Healthcare efficiency is a property of a production process that refers to maximizing healthcare outputs produced from a set of health care inputs, holding healthcare output quality constant. For a given set of inputs, greater efficiency implies increased outputs. Less efficiency or inefficiency refers to smaller ratios of outputs to inputs. Likewise, holding outputs and quality of healthcare output constant, using fewer or lower levels of inputs implies greater efficiency". (Hussey, 2009)

An organization is said to be technically efficient (TE) if the inputs such as labor, capital, and equipment are acquired by the organization for that specific production plan produce the highest output that is possible from the given level of inputs. Hence, technical inefficiency is due to excessive inputs utilization. In addition, to employ the term technical efficiency in the health care services organizations, the technical efficiency concerned with the physical relation between input resources (e.g. Labor, medical supplies, etc.) And either intermediate health outputs (number of outpatient visits, number of children immunized and etc) or final health outcomes (lives saved, life years gained, quality adjusted life years) (Palmer, 1999). On the other hand, Allocative efficiency reflects the ability of an organization to utilize these inputs into optimal proportions given their respective prices and the production technology. In other words, allocative efficiency is concerned with choosing between the different technically efficient combinations of inputs used to produce the maximum possible output. And finally, both components are known as producers of economic efficiency.

Figure 9: Farrell efficiency measurement



Source: (Coelli T. J., 1996)

For more clarification, let's consider an example as depicted in figure 9 above. A health facility using combined two inputs: Nurse and Medicine for producing a single output as outpatient visits. According to the technical efficiency definition, potential or maximal performance is defined along the frontier, such as C, H and F. And those health facilities that operate at points D and G are technically inefficient. Thus, as much as the distance between observed outputs or outcomes and frontier are increasing so the technical efficiency ratio falls to zero. Likewise, as performance improves the technical efficiency move toward one. In general, the technical efficiency ratio falls between zero and one ($0 \leq TE \leq 1$). To the hospital operating at point D the technical efficiency can be measured by:

$$TE_D = \frac{OH}{OD}$$

Meanwhile, according to the allocative efficiency definition, the health facility that operator at point C and H are not allocating efficient, but they are technically efficient. The only hospital that operates at point E and F are allocative efficient and only hospital at point F is both technical and allocative efficient that locate tangent to isoquant and isocost line (AB). At point D the allocative $AE_D = \frac{OE}{OH}$ Where AB is the isocost line defined by the ratio of factor prices. Full efficiency or economy, efficiency (e.g. OE=1) and that require the allocative efficiency concurrent to technical efficiency (e.g. AE=TE=1) that can be seen at point F.

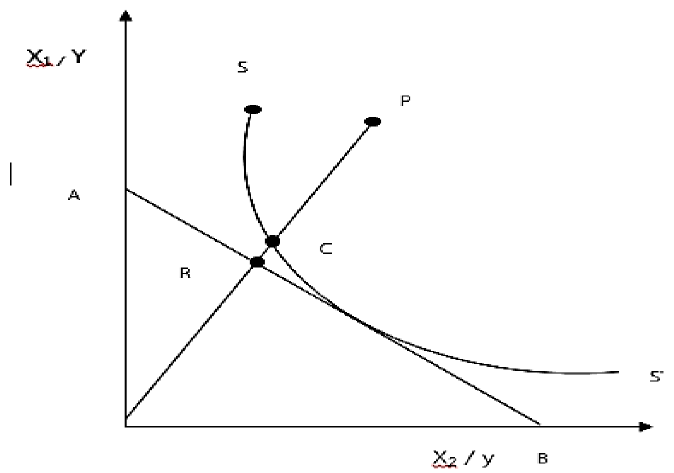
3.2.3. **Input-output efficiency measurement**

3.2.3.1.*Input-oriented measure*

Generally, input oriented model of efficiency measures that by how much an organization can reduce its specific input resources without any effects on either output quantity or output quality. This means that to shift the inefficient organizations into efficient by reducing their inputs and to place them on the frontier line.

Figure 10 depicts graphically the inputs oriented measures by considering two inputs (Nurses denoted by X_1 and Medicine denoted by X_2) with a single output outpatient visits denoted by Y, if the hospital uses the quantity of inputs defined by point P to produce a unit of outpatient. The efficiency of the hospital is represented by SS' with the point C, which represent that the unit of inputs can be reduced from point OP to OC without a reduction in output. So in the technical inefficiency represent by point CP in production inputs oriented measures.

Figure 10: Input oriented measure



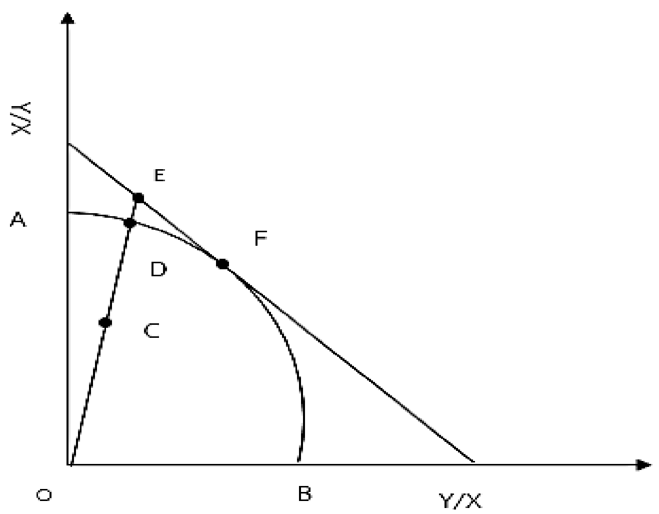
Source:(Coelli T. , 1996)

3.2.3.2. *Output-oriented measure*

Output oriented approach measure by how much output quantities can expand without changing in the quantity of inputs used and quality of output produced, in order to place the inefficient hospital on the frontier line.

Figure 11 represents graphically the output oriented measures by considering the case where production involves outputs Y, and one input X, the line AB is the frontier line, the point C lies below the curve in this case because AB represent the upper bound of production possibilities with efficient point D. Hence, all points inside the curve represent technical inefficient. Therefore, the point C is a technical inefficient point and the resources are utilized inefficiently. The firm can increase output from OC to OD without change in quality and level of inputs. Meanwhile, the magnitude of inefficiency represents by point CD. And the technical efficiency of point C can be obtained from the equation: $TE_S = \frac{OC}{OD}$

Figure 11: Input oriented measure



Source:(Coelli T. , 1996)

3.2.4. **Public Sector Efficiency Measurement**

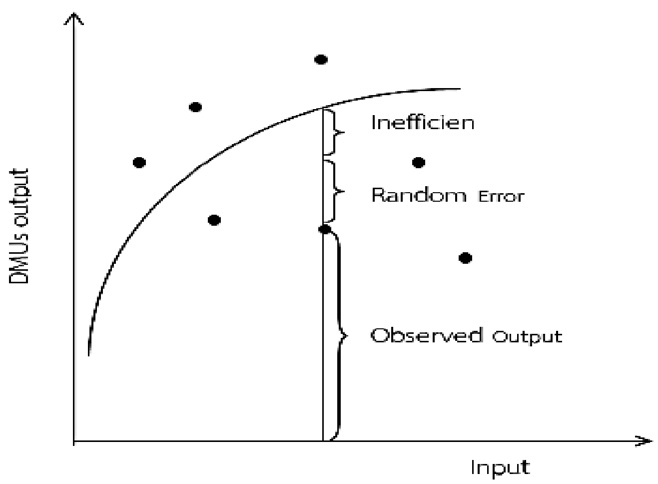
After discussing the theoretical approach of measuring efficiency of a single a firm. This section reviews the various methods used in estimating the efficiency of DMUs. Essentially, there are two methodologies for estimating the efficiency a public sector DMUs: the econometric (or Parametric) and Mathematics or (non-paramedic). These two different techniques use different methods to envelop data.

3.2.4.1.*Parametric Frontier Approach*

Stochastic frontier Approach (SFA) production function is a parametric method to the measurement efficiency of given DMUs which adopt the econometric approach. The original measurement of SFA involved a production function that specified for cross-sectional data, which has two components; one to account for random effects and another to account for inefficiency. The main problem in measuring the inefficiency using SFA is the purely break up of inefficient behavior from the random factors (e.g., Insecurity or external factors) that are beyond the control of the DMU.

Generally, the SFA requires the sample size to be large enough to avoid the problem of degree of freedom. Figure 12 portrayed the illustration of SFA.

Figure 12: Stochastic Frontier (SFA) Approach



Source: (Aigner, 1977)

The biggest advantage of SFA is the measurement of random errors that are beyond the control of the firms and are the exogenous factor that affect the state of efficiency.

3.2.4.2. *Non-Parametric Frontier Approach*

Data Envelopment Analysis (DEA) is a relatively new "data oriented" Mathematical programming approach for evaluating the performance of set firms which convert single or multiple inputs into single or multiple outputs. Usually DEA term is used as a substitute to mathematical term due to the structure of production technology that envelops data as tightly as possible. Meanwhile the DEA does not require a function to build the frontier. Instead, researchers assume that firms which obtain the most output from given input bundles are operating on the production frontier. Researchers then connect the best performers with linear segments, thus creating a curve. Furthermore, DEA is able to measure both Technical and Allocative efficiency. (Coelli T.J, 1996)

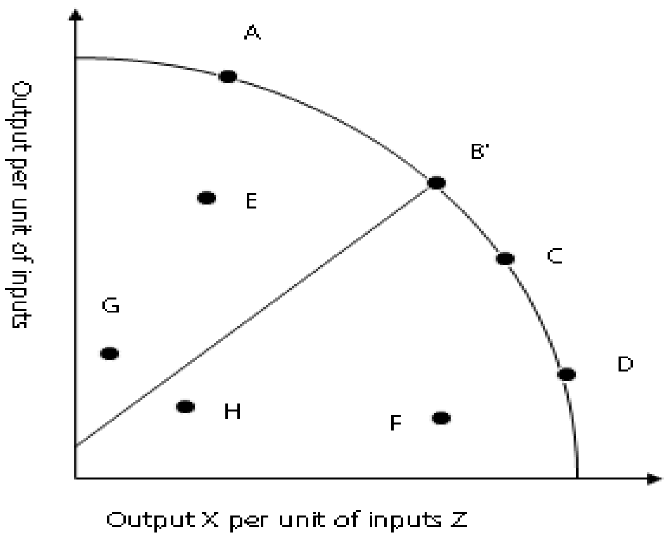
DEA initially developed by Farrell (1957) and later by Charnes, Cooper and Rhodes (1978) to evaluate the efficiency of public sector non-profit organizations. In fact, the original motivation for the development of DEA was to measure the technical efficiency of public (Non-profit) organization, such as hospitals, schools, Universities, where the price information is not available. The recent year has seen a great variety of applications of DEA for use in evaluating the efficiency of any kind of entities for evaluating the performance. (Farrell, 1957)

Actually, DEA can provide an overall performance index (Variable return to scale (VRS) and Constant return to scale (CRS)), which ignore common public sector measurement problems.

By provision of inputs and output data in common forms, DEA can provide the following results:

- The relative efficient health facilities; those are located in frontier line.
- The relative inefficient health facilities; those are located below the frontier line.
- The amounts of resources wasted by the inefficient health facilities, that can be reduce to become efficient facilities.
- The extent of capacity that inefficient firms hold to increase their service outputs to become efficient.

Figure 13: Data envelopment analysis model showing an efficiency frontier



Source:(Farrell, 1957)

Figure 13 shows the DEA model. In the model, firms are classified as efficient and inefficient. Firms such as A, B, C and D firms are classified as efficient firms and located on the frontier line. On the other hand the firms that are located below the frontier line are classified as inefficient firms. For instance, the firm "F" is inefficient and need to move to point B' on the frontier line to become efficient.

The Constant Return to Scale (CRS) DEA Model:

The concept of constant return to scale model of DEA implies that any proportional change in inputs, the output of given that specific DMU increase by the same proportional. For instance, if a health center inputs such as recurrent cost and medicine increase by 10%, the output of this health centers under CRS model increase by 10% also.

The Variable Return to scale (VRS) DEA model:

Actually the CRS approach is applicable when it is all the DMUs operate at optimal scale; in this case CRS is applied. One the other hand, if there is an assumption that DMUs do not operate at optimal scale as result of exogenous and endogenous factors that affect the performance of DMUs, so the VRS approach is used to measure the efficiency.

Scale efficiency:

Decomposing the result obtained from CRS which is also known as overall efficiency score into: pure technical efficiency score (VRS) and Scale efficiency (SE), enable the researcher to find out the cause of inefficiencies. If there is difference in CRS and VRS scores, then it shows that scale inefficiency exist in specific firms. The scale efficiency score obtain from dividing CRS score to VRS score.

3.2.4.3.*Comparing the DEA and SFA Approach*

The following table summarizes the different between DEA and SFA.

Table 4: A Comparison of DEA and SFA Approach

Category	**Data Envelopment Analysis (DEA)**	**Stochastic Frontier Analysis (SFA)**
Description	DEA is a non-parametric, non-stochastic and a mathematical approach of measuring efficiency and DEA does not require function to build frontier.	SFA is a parametric approach that uses econometric methods to estimate the production frontier.
Data need	The data for the DEA are inputs consumed and outputs produced by the firms. In addition, if the inputs and outputs prices are available, DEA can measure the allocative efficiency as well.	

Advantage	DEA can identify a set of peer firms (those firms that are efficient with similar inputs) for each inefficient firm. DEA can handle a set of multiple inputs and outputs at the same time. It does not require the decision maker to express his or her own weighing scheme of inputs and outputs. Meanwhile, it does not require an open functional relation between inputs and output variables. DEA requires only inputs and output data, it does not require the price of inputs and outputs that are difficult to obtain specially from public sector such as hospitals.	SFA can measure magnitude inefficiency that caused by environmental or external factors that are beyond the control of Firms separately from behavioral inefficiency. If there is evidence that certain external factors, which are randomly over time, can partially explain the relationship between actual outputs and maximum achievable outputs, then SFA may be a more appropriate method. By SFA, it is easier to identify outliers. SFA allows carrying out traditional statistical test of the hypothesis.
Disadvantage	DEA can be influenced by noise or random error. DEA requires a large sample size for a strong or consistent estimate. Which some policy makers may not be able to have a large sample size.	The decomposition of the error term into random error and true inefficiency components may be affected by the particular distributional forms specified and by the related assumption that error skewedness is an indication of inefficiency.

3.3. Empirical literature

In this section of the study summarize applied literature review relating to the health sector and exclusively on the performance of primary health care service centers is presented. Furthermore, it is intended to reveal types of hypothesis and methods of study previously considered. Actually, economic studies of health sector performance, especially primary health care are very rare in Afghanistan and the available literatures have developed by external agencies and Few by Ministry of Public Health. However, since developing of DEA, a significant number of researchers have done their studies on public health facilities in developing countries and each study differs in its scope, and definition of DMUs, which are subject to the analysis.

Marshall et al. (2008), assessed the efficiency of rural health centers in Burkina Faso, DEA used to measure the relative efficiency of 20 health centers. The efficiency analysis was restricted to only four appropriate inputs and four outputs, the inputs used were as included: personal cost, HFs building area, depreciation of HFs equipment and vaccination cost. Meanwhile the study used four output measures that indicate the main activities of the HFs: general consultation, deliveries at the maternity ward, immunization and special services like family planning, ANC and PNC consultation. The DEA result revealed that 30% of the Health centers found inefficient and these health centers are not utilizing their full available resources for the existing demand and are relatively efficient. In addition, the study showed that small inputs adjustment could improve relative efficiency. (Marschall, Assessing the efficiency of rural health centres in Burkina Faso: an application of Data Envelopment Analysis, 2009)

Abbas et all (2011) examined Basic Health units (BMUs) efficiency in Sargodha District in Pakistan, the technical efficiency of the health units using DEA non-parametric method. The sampled consist of 116 health facilities. The study had used 4 inputs a variable number of Medical staffs, number of Paramedical staff, number of lady health workers, and a number of other staff was used as inputs variable. While the outputs variable were: number of output door patients, number of child immunized, number of family planning visits and number of fist ANC care visits. The study results indicated that 34.48% BHUs were technically efficient, while the remaining 65.52% were technically inefficient. The average TE score was 0.807 with the standard deviation of 0.21. This implies that on average the inefficient health centers consume 29.5 more resources and can be decreased without reducing the output. On the other hand, out of 116 BHUs 24.13% of was scaled efficient while 75.87% were scale inefficient. The results imply that there is potential to increase the total outputs by about 15.3% by using existing capacity or size of the BHUs. (Abbas, 2011)

Lilongwe (2008), estimated technical efficiency of district hospitals in Malawi, the study used the data from 40 hospitals from 2005 to 2006, DEA was employed to estimate the technical efficiency of the hospitals because it can easily incorporate multiple inputs and multiple outputs that characterized with health service sectors and without the need for another denominators. Output variables were hospital beds, nursing staff FTE, physician FTE. While input variable were outpatient visits and inpatient visits. The study shows that average constant return to scale technical efficiency score for the hospitals studied is 60.4%. Only 9 hospitals out of 40 hospitals were 100% efficient, more than half of the hospitals were only 50% efficient and it implies that without changing the input level there is potential to change the outputs to 40% overall. (Lilongwe, 2008).

Kirigia et al (2004) employed the Data Envelopment Analysis methodology to Measure the Technical Efficiency of Public Health Centers in Kenya, The study conducted in a sample size of 32 health centers used data from the year 1999 To 2000, DEA model used inputs:. Clinical officers, number of beds, non-wages expenditures, Lab and technicians, administrative staffs, Physiotherapist. In addition, the output variables included were immunizations, family planning, and infection prevention. Technical efficiency was ranging from 0% means inefficient to 100% means efficient. The results revealed that out of 32 health centers 14 health centers were efficiently and remaining were technically inefficient, the average technical inefficiency score of inefficient health centers was 65%. In addition, the inefficient health centers can reduce their inputs by 35% without change in outputs level. Meanwhile, out of 32 Health centers analyzed, 19 health centers were scale efficient and the mean scale efficiency score among inefficient Health centers were 70%. (Kirigia, 2004).

Chinarksorn (2010), conducted study to measure technical and scale efficiency of Health centers Bangkok metropolitan area, Thailand. The study used secondary sources of cross-sectional data of 68 sampled health centers from the year 2009-2010. The analysis was consist of stages by using DEA and Tobit, In the first stage DEA employed to find the technical and scale efficiency scores, the DEA model used input and outputs data from the health centers. The second stage a Tobit regression was estimated to identify those factors that may be associated with the efficiency results of health centers. The results discovered that overall technical efficiency was 40.44%, pure technical efficiency 61.76%, while the scale efficiency was 42.65%. Most of the inefficient health centers were ranging from 80-99.9%. Moreover, the regression results revealed the technical efficiency score were differing from in the metropolitan area, which the lowest efficiency score was in the inner city.

Jundendorj (2006) examined Province and district level hospitals in Mongolia. His study evaluates the technical and scale efficiencies. The non-parametric technique of DEA used as powerful tool due to its characteristic such as the DEA can handle multiple inputs and outputs to examine the relationships between inputs and outputs. The sample consisted of 21 Provincials and 10 District Hospitals. The input variables were numbered of patient beds, number of physicians and the number of nurses and total number of patient days and number of outpatient visits used as output variables. Furthermore, Tobit regression also estimated to identify the factors affecting the efficiency state of Health centers. The explanatory variables against technical and scale efficiency scores were: average length of stay, per capita health budget, the number of elderly and urban/rural, and the results of the study indicates that out of the total hospitals under study, 19 hospitals were technically efficient and remaining 12 hospitals were inefficient. Meanwhile, 75% of the total hospitals were scaled, efficient and 15% were scale inefficient.

Akazili et al (2008) determined the technical efficiency of 89 health centers in Ghana for the year 2008, the mode of evaluation employed was non-parametric DEA methodology. The inputs used were non-clinical staff, including laborers, clinical staff, beds and cots, and expenditure on drugs and supplies. While, the outputs were general outpatient plus antenatal care visits, deliveries, children immunized, and family planning visits. The study revealed that 35% of health centers were technically efficient. The inefficient health centers had an average technical efficiency score of 57%. In addition, 21% of health centers where scale efficient and the inefficient health centers had an average scale efficiency score of 86%. (Akazili, 2008).

Kirigia et al. (2011) investigated the levels of efficiency of primary health units in Kailahun and Kenema districts in Sierra Leone by adopting the Data Envelopment Analysis. The study used the cross sectional data of 36 sampled maternal and child health posts (MCHPs), 21 community health posts (CHPs) and 22 community health centers (CHCs). The researcher model consisted of total five variables. Three outputs variables, namely: maternal, child health and family planning visits and two inputs as: the number of community health officers, and the number of support staff. The results indicated that 77.8% of the MCHPs, 59.1% of the CHCs and 66.7% of the CHPs were variable returns to scale technically inefficient. The average variable returns to scale technical efficiency was 68.2%, among the MCHPs, 69.2% among the CHCs and 59% among the CHPs. (Kirigia J. M., 2011).

Phone (2009) examined Technical efficiency of commune health centers in Rural Red River Delta in Vietnam. The study examined a sample of 495 CHCs using non-parametric techniques of DEA. The input variables were No. of rooms, No. Of doctors, total number of obstetric assistants and midwives, total number of assistant physicians and number of nurses. With three outputs such as: pregnancy visits, maternal and child health care visits and others patient visits. The result of the study shows that; variable returns to scale and scale efficiency in the estimated DEA mode indicating the average TE scores that equal to 47.2%, 51.8% and 91.4% respectively. Furthermore the results of the TE, regressed against some explanatory variables, the results of regression revealed that variable ultrasound is insignificant, ratio of medical staff to other staff was also insignificant, ratio of nurse to other staff also insignificant, average age of medical doctor was also insignificant, incentive partial was also insignificant, average salary determined significant at 95% confidence interval.

The common features of the studies reviewed above are; all used DEA approaches to estimate efficiency in any level of the health center, all used most common outputs of health facilities in DEA to measure the efficiency and their results revealed that majority of Health centers were inefficient.

3.4. Conclusion

This chapter has reviewed various concepts of efficiency on both theoretical and impartial views and important areas of efficiency in the health sector are discussed. Actually, the health sector efficiency is selected because of its critical importance of the welfare of the whole society, which consequently has an effect on the economic status of government as well as households and individual. As discussed, the most significant choice in measuring efficiency by using a DEA approach is the careful selection of input and output variables. Furthermore, the quality of the results also depends on the extent variables the affect the performance of the DMUs like; exogenous factor, that are beyond the control of the organization. Meanwhile, it has been discussed that there are two approaches to measure the efficiency; DEA as parametric and SFA as non-parametric methods, and a comparison was made to discuss the advantage and disadvantage of these two methods. At the end, the empirical literature has demonstrated the study of efficiency in health sector.

CHAPTER IV
RESEARCH METHODOLOGY

4.1. Introduction

This chapter discusses the methodology of the study, that contain a brief review of the DEA methodology with the mathematical formulation of the DEA and Tobit regression, various models that can be adopted, also explore and discuss the variables that are applicable to the study and model specification.

4.2. Research design

This is a descriptive study employing econometric and mathematical techniques for its analysis. A cross section with more secondary data is used for Data Envelopment Analysis (DEA) and regression analysis using Tobit regression model.

4.3. Analysis techniques and conceptual framework

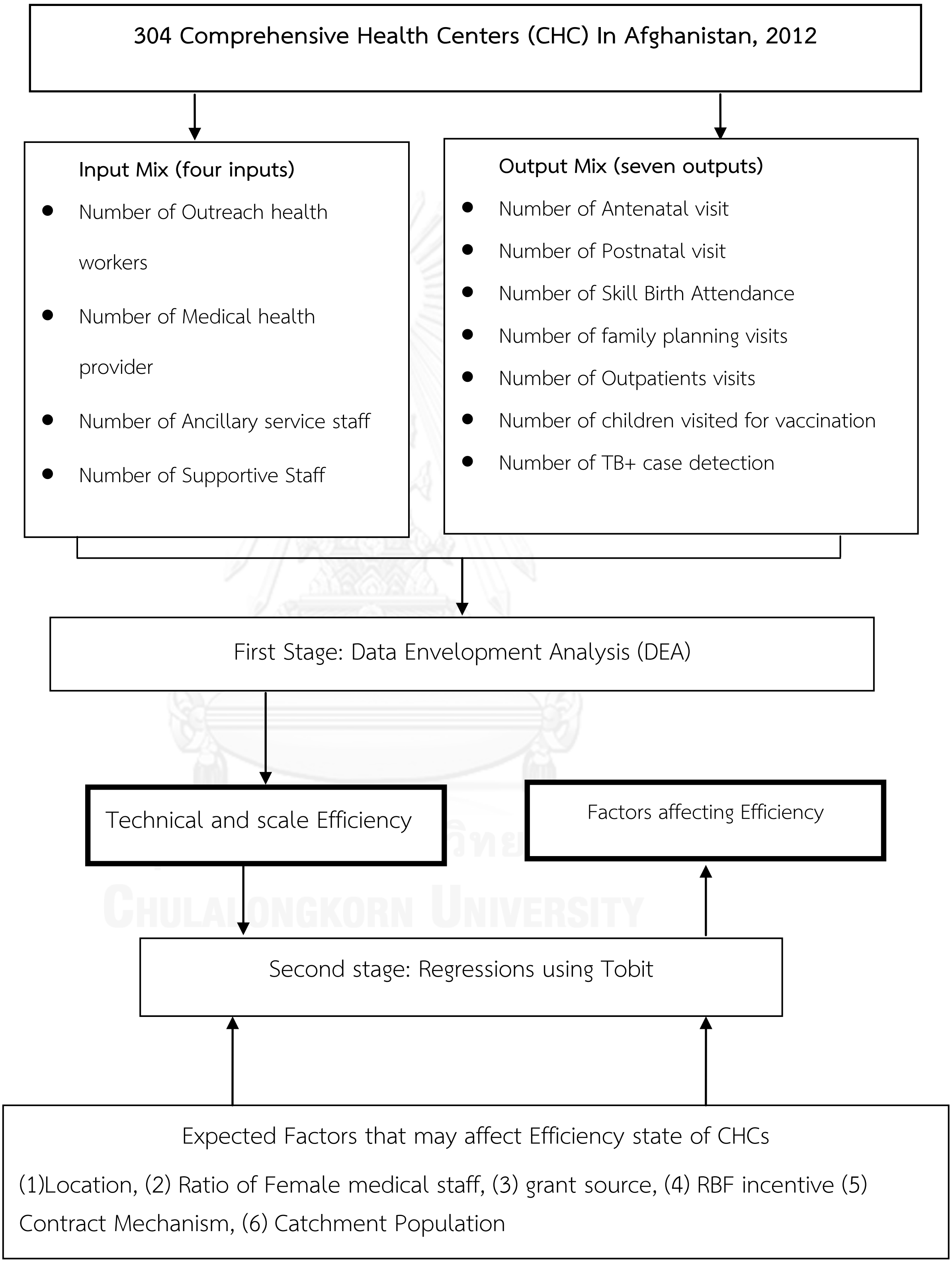
The study applies two stages of analysis:

The first stage is to measure the technical efficiency of Comprehensive Health centers (CHC) with data envelopment analysis (DEA) using input and output orientated models. The results of the DEA will reveal: overall technical efficiency or technical efficiency under a constant return to scale assumption (TECRS) scores, pure technical efficiency or technical efficiency under variable return to scale (TEVRS) scores, scale efficiency (SE) scores, and the patterns of scale inefficiencies which have two patterns of scale inefficiencies that are increasing returns to scale (IRS) and decreasing returns to scale (Drs).

Furthermore, the second stage is to identify the factors affecting the efficiency of comprehensive health center (determinants of CHC efficiency) with regression analysis using the Tobit model. Technical efficiency under variable return to scale assumption (TEVRS) is dependent variables and a set of six independent variable using Stata 11 portable software. This will reveal the extent and direction of factors affecting on the efficiency scores of the comprehensive health centers.

The analyses techniques can be concluded in the conceptual framework as Figure 14 below.

Figure 14: Study Conceptual Framework



4.4. Data and Justification of Variables

4.4.1. Data Sources

This study uses the secondary source of cross sectional data of Comprehensive health centers (CHC) from the entire provinces of the country, covering the year 1391 (according to 20 March 2012 to 20 March 2013). The data were obtained from Central statistical office (CSO), Health Economics and Financing Department (HEFD), Health information system department (HIS), Grants and contract management unit (GCMU) and Non-government organization (NGOs). However, it is important to note that some of the NGOs did not respond to the request of data sent to them, so some CHCs were dropped as a result. But despite that limitation, the quality of the study was not affected, since the sample size of the study was large enough. The sample consists of 304 CHCs, so this sample size represents 80% of all CHCs in Afghanistan.

4.4.2. Input and Output Variables

The input and output variables used in this study consist of variables that support the theory of the DEA and the analysis of the efficiency described in the literature. The input variables the study used are: the Outreach health care workers (Vaccinators and Community Health supervisors), Medical care provider (Physician, Nurse, and Midwifes), Ancillary service provider (Lab technician and Pharmacist) and supportive staff (admin, driver, guard). Meanwhile, this dissertation used Total Antenatal care visits (ANC), Postnatal care visits (PNC), Outpatient visits (OPD), number of children visited for vaccination, number of family planning visits (FP), the number of TB positive case detection (TB+) and skill birth attendance (SBA) that constitute the major output of the comprehensive health centers. The inputs and output variables are measured in their physical units.

The inputs and output variables with their definition are shown in table 5 and 6 as follows:

Table 5: Definitions and description of CHCs' input variables

Input variables	Input category	Abbr.	Operational definition	Units
Number of Medical Health workforce (Clinical staff)	Physicians	Phys.	The number of medical doctors who graduate from any faculty or school of medicine and are licensed or registered to work in the country as a medical doctor, and can apply curative and preventive services. (Both specialist and general medical practitioners.)	Person
	Nurses	Nur.	The number of nurses who have completed the program of nursing, passed the general nursing examination of MoPH, and registered as qualified professional.	Person
	Midwives	Mid.	The number of midwife who have completed the basic Midwifes course or institute and passed the MoPH examination and get the license and able to provide professional Midwifery services	Person
Number of Outreach Health workforce	Vaccinators	Vacc	The number of vaccinators who have worked in health facilities as vaccinator and	Person

			performed outreach services as well.	
	Community health supervisors	CHS	The person who supervises community all health activities. And promote collaboration between health facilities and community.	Person
Number of Ancillary service workforce	Laboratory Technician	LT	The number of laboratory technicians who have completed the basic laboratory technician colleague or institute and passed the MoPH examination and get the license and able to provide professional laboratory services.	
	Pharmacist and Pharmacist Technicians	Pha.	The number of pharmacist and pharmacist technicians who have completed the pharmacy technician, colleague, institute or university and passed the MoPH examination and get the license and able to provide pharmaceutical services	
Number of Supportive Staff	Admin, Guard, driver	Supp.	The number of Admin, cleaner, driver whose work as supportive to the health facility	

NOTE: Abbr. = abbreviations

Table 6: Definitions and description of CHC s' output variables

Aggregated Outputs	Abbr.	Operational definition	Unit
Antenatal care	ANC	The total number of pregnant women, who saw a skilled provider for ANC services in the catchment area of the HF for the reference period of interest (either at a facility or at home).	Visits
Postnatal care	PNC	Total number women in the catchment area of the Health Facility that received PNC visit from a trained attendant (either at the facility or at home) for the reference period of interest.	Visits
Skill birth Attendance	SBA	The total number of pregnant women, who saw a skilled provider (either doctor or midwife), for delivery (either at a facility or at home) in the catchment area of the HF for the reference period of interest.	Cases
TB+ case detection	TB+	Counted for each positive case of Tuberculosis detected by CHC for the reference period of interest.	Cases
Children visits for immunization	C.I	Counted for every visit of children for different type of vaccine in CHCs in year 1392, either at a health facility or by outreach services of CHC's staff.	Visits
Outpatient	OPD	Counted for every visit in the outpatient department of CHC for the reference period of interest. (Excluding ANC, PNC, Delivery, and FP visits)	Visits
Family planning	F.P	Total number of visits for receiving family planning services.	Visits

NOTE: Abbr. = abbreviations

4.5. Mathematical Formulation of DEA

Measuring the performance of an organization's DMUs is vital for any organization, especially health care facilities, which are critically facing scares resource. Typically, DMUs performances are evaluated by an internal comparison between DMUs. Traditionally, health facilities performance measurement was limited by using only two variables, that is, one output and one input and then researcher calculated the efficiency of the DMUs by dividing the output into input for a particular DMU. However, using an approach of the DEA enables the researcher to use non-parametric approach to examine technical efficiency of health centers that employ multiple inputs and outputs. The technique involves a linear programming model in which inputs and output variables are taken from each health facility and then analyzed to examine the "input-output" efficiency for each health center, relative to the other. In other words, DEA plot an efficient frontier line using combination of inputs and outputs from the best performing health facility. Those health facilities that compose the "best performance the best practice frontier" are assigned an efficiency score one (or 100%) and are deemed technically efficient compare with peers. On the other hand, those health facilities that are below the frontier line are measured in terms of distance from the frontier line. In addition, the inefficient health facilities are assigned scores of zero and one. The higher score the higher efficient score.

Taking this analysis a step further, DEA software (DEAP version 2.1; a DEA computer program designed by Coelli Tim applies an internal process of weighting data and ultimately will generate a "ranking" of facilities based on a score in the range of 0-1 (0 being the lowest score and 1 being the highest). Generally, facilities that score as "1" on the technical efficiency scale will be used as a benchmark for ranking the other facilities.

The general mathematical formula for measuring the efficiency is the following equation:

$$Efficiency = \left(\frac{Output}{Input}\right)$$

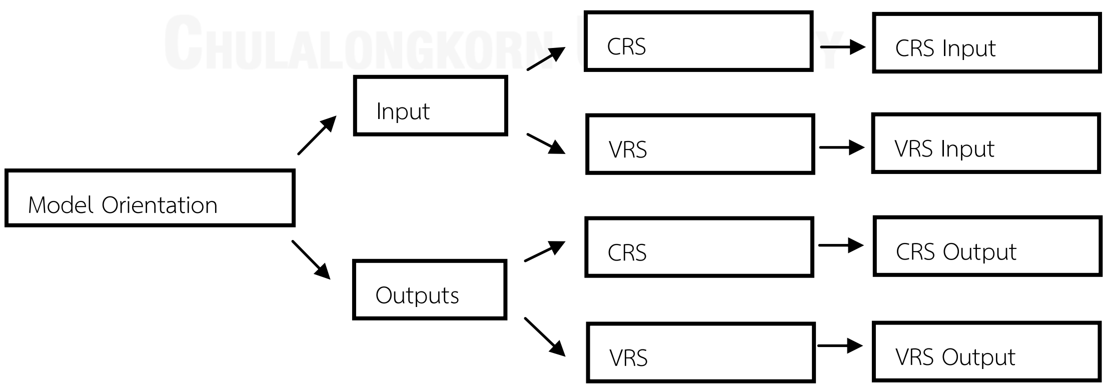
Since, the CHC types of health facility employ multiple inputs to produce multiple outputs; their individual efficiency can be obtained by a weighted sum of outputs divided by a weighted sum of inputs. Hence, the above equation can be rewritten as: $Efficiency = \left(\frac{Weighted\ sum\ of\ Outputs}{Weighted\ sum\ of\ inputs}\right)$

4.5.1. **Model Orientation**

There are different types of DEA model that is suitable for different situations. For instance, if all DMU's are operating at an optimal scale and an increase in the size of the DMU's do not change the economies of scale of the DMU's, then the Constant Return to Scale (CRS) type of DEA is appropriate versus a Variable Return to Scale (VRS) model of DEA. The CRS model is also known as Charnes, Cooper and Rhodes Model (CCR, 1978). In addition, the VRS model is also known as the Charnes and Cooper model (BCC) and it use when it is assumed that DMUs are not working in optimal scale. So in this study the Variable Return to Scale assumption (VRS) model of DEA will be employed.

On the other hand, the two other behavioral measures are used while applying DEA for efficiency analysis: inputs and outputs oriented measures: input oriented measure, is the model that evaluate the minimal use of the inputs while keeping the outputs constant. In addition, it answers the question, by how much the inputs can be reduced without change in outputs, producing by the DMU to get the input oriented ratio the inputs are divided by outputs, that is an input conserving approach. Whereas, the output oriented measure is the model that evaluates the maximal output that can be produced while keeping the inputs constant. The second measurement is generally applicable for those DMUs or health facilities that have no control over their inputs, and somehow they have capacity to maximize the outputs they produce.

Figure 15: Basic DEA model classifications-envelopments model



4.5.1.1. *Output oriented Measurement*

Managers of CHC's health facilities have less control over inputs, especially staffing and medicine. However, they can influence a greater number of people to utilize the health care services at the health facility. For example: people seeking postnatal care, antenatal care, family planning services, birth services, immunization, health education, etc. Through, their public health outreach work among the communities. It is for this reason that we estimated an output-oriented DEA model.

4.5.1.2. *Input oriented Measurement*

Actually the prime purpose of the study was to evaluate the performance of comprehensive health centre and to know the magnitude of relative inefficiency in order to boost up the performance in efficient CHCs. But it is also important to know that how much of the input resources are wasted in the health facility and to decrease the access resource and utilized it in those health facilities that are in need. Thus, in order to have maximum benefit from these scarce resources. Therefore, input oriented DEA model will also be used.

4.6. Preconditions for Application of Data Envelopment Analysis

Data envelopment analysis (DEA) has a set of condition that have to be taken in mind prior to its application for determining the level of efficiency, for the sake of accurate and reliable result. The conditions are as follows:

Positivity property: Generally, the values of input and output variables that are used for DEA requires to be non-negative.

Isotonicity property: This property implies that the correlations between inputs and outputs should be mathematically, this called Isotonicity property. And it means that increase in any of the inputs should affect in an increase in outputs not decrees the outputs.

Number of Decision making units: The Number of decision-making units (DMUs) should be large enough in order to ensure sufficient degree of freedom for a meaning full analysis, small numbers of DMUs have a somehow relative risk that most of the DMUs will be examine efficient.

Homogeneity of DMUs: This property suggests a homogenous set of entities that all DMUs included in the evaluation and application of DEA should have identical inputs and output variables. Like we cannot include Hospital that has different inputs and outputs compared to small health facilities in the DEA application in the same analysis.

4.7. Econometric Analysis of the Determinants of Inefficiency

Studies have shown that institutional factors that are in the control of the organization and beyond the control of the organization are affecting the efficiency of health facilities. After measuring each health facility's efficiency score, the question of correlation between comprehensive health centers' efficiency score and factors affecting the efficiency may be addressed. Tobit regression analysis is conducted using the efficiency score of each health facility as dependent variables and the following variables are regressing as explanatory or independent variables against efficiency score:

Results based financing scheme (BBF) Incentive:

Tobit regression analysis estimated using the TEVRS score as the dependent variable and a number of explanatory variables selected; the first important variable is the incentive. Ministry of public health has initiated a pilot project of Supply side financing or result based financing in a certain number of provinces aim to increase the quality and utilization of health care services by paying an amount of incentive for the frontier health care workers when they perform above their baseline (Results Based Financing Operational Manual). The project has divided the Health center into two groups: Treatment group that receive incentive and Control group that do not receive incentive. Therefore, a dummy variable designed to capture the effect of incentive on the efficiency of each health facility. The expectation in this study is that providing incentive will have positive correlation with efficiency.

Location:

Then next explanatory variable is the location of health facility (CHC). Given that, CHC are located in different geographic areas urban and rural. In-fact the socio-culture characteristic and economic status of people is different in each area. Meanwhile, the facilities such as transportation for accessibility of people to health facilities are limited in rural areas compare to urban areas that people have somehow transportation facility. Thus, a dummy variable is considered to capture the effect of people's economic and social-culture characteristic in term of location of health facilities that might affect the performance and efficiency. This exploratory variable is expected to have a positive relation with performance of health facilities. Meaning that as the health facility located away from the urban areas, the performance of the health facility getting worse.

Female Medical staff Ratio:

The Ratio of female medical staff to Male medical staff is also included as an explanatory variable, these variables seeks to capture the influence of Female medical ratio on efficiency. The assumption behind this variable is that: According to the culture of Afghanistan, especially in rural areas, Females are more sensitive to get health care service from male staff and appear in public facilities. They tend to get health care service from female staff. Therefore, this proportion shows the combination of inputs between female medical staff to other non-female medical staff. Therefore, this explanatory variable is expected to have a positive relation with efficiency scores as dependent variables. As a result, a health facility with lower ratio may exhibit lower efficiency scores.

Grant source:

Another expected determinant of efficiency is the grant source, the health facilities are financed by three major donors: World Bank, USAID and European Union. The theory for inclusion of this variable is that, since the contract management, supplies, and monitoring of each donor different. For instance: the USAID provides fund to NGOs to deliver service to the population, but the cost of drugs is excluding the contract, the donor itself procure and supply the drug to NGOs and Health centers. This may cause sometime health center faces shortage of drugs due to problem by donor procurement. While in the World Bank funded provinces, drugs are procured directly by NGOs. The same monitoring system and contract management also vary, EU directly delivers the fund to NGOs without MOPH inference, in 10 provinces of Afghanistan. Therefore, this sort of funding might affect the efficiency of health centers. This assumption is expected that the World Bank and European Union have a positive relation with performance of health facilities.

Catchment area's population:

One of the most important variables included, as explanatory variables are the catchment population of the health facility. The catchment of health facility is the area and population from which a CHC health facility attracts visitors. This variable seeks to detain the effect of catchment population as a factor that affects the performance of the health facility. The reason behind the inclusion of this variable is that sometime location of health facilities is influenced by politicians. Therefore, community health centers have different catchment population, which affect the efficiency state of health facilities. Therefore, a dummy variable designed to capture the effect of catchment population over the performance and efficiency of the health facility. Thus, a quantitative variable is designed to measure the effect of catchment population size on the health facility efficiency score. In addition, it is expected that health facility with a higher catchment population has a positive relation to efficiency score.

Contract mechanism:

Finally, another determinant of the health facility is contracting mechanism of health service delivery. The Ministry of Public Health (MoPH) provides health care service through contract-in and contract-out mechanism. Contracting-in mechanism provides service through Strengthen Mechanism department of MoPH as a function of MoPH activities. While in contracting-out mechanism, the health care services provides by NGOs in health facilities. The rationale behind selecting this variable as explanatory variable is the management of the health care system. Since in contract out mechanism the NGOs have autonomy to procure the supplies and hire the human workforce for service delivery. While the contracting-in mechanism is centralized and run the health care system through the government procedures, rules and regulations. Therefore, it is expected that contracting-out mechanism of the health care service system is efficient.

Table 7: Explanatory variables for Tobit regression model

Variable	Variable Type	Source	Description
RBF Incentive	Dummy Variable	HMIS/HEFD/NGOs	(1= health facility receive RBF incentive, 0=health facility does not receive RBF incentive)
Location	Dummy Variable	GCMU/HMIS/NGOs	(1=urban or 0=rural)

Ratio of female medical staff	Quantitative Variable	GCMU/HMIS / NGOs	Ratio of female Medical staff to other health workers.
Grant source	Dummy Variable	GCMU	(1=WB, 0=other) (1= USAID, 0=other) & (1=EU, 0=other)
Contract mechanism	Dummy Variable	MoPH/GCMU	(1=Contracted-Out facility, 0=other)
Catchment Population	Quantitative Variable	HMIS	The total population has access to the specific CHC.

Thus, the empirical model (Tobit Regression model relation between TE score and explanatory variable) takes the following form;

$$TEVRS_i = \beta_o + \beta_1 \, RBFinc_i + \beta_2 CM_i + \beta_3 CP_i + \beta_4 FMR_i + \beta_5 WB_I + \beta_6 EU_I + \beta_7 Loc + \epsilon_i$$

$$TEVRS_O = \beta_o + \beta_1 \, RBFinc_i + \beta_2 CM_i + \beta_3 CP_i + \beta_4 FMR_i + \beta_5 WB_I + \beta_6 EU_I + \beta_7 Loc + \epsilon_i$$

Where:

$TEVRS_i$ - Technical Efficiency under variable return to scale generated by input oriented DEA approach.

$TEVRS_o$ - Technical Efficiency under variable return to scale generated by the output oriented approach.

Loc_i - Location of ith CHC

FMR_i - Female Medical Ratio (%) of ith CHC

$RBF\ Inc_i$ - Incentive of ith CHC

GS_i - Grant Source of ith CHC

CM_i - Contract Mechanism of ith CHC

CP_i - Catchment Population of ith CHC

ϵ_i - Error term that captures other possible factors no specified.

4.7.1. **Hypothesis**

H_1: The female medical ratio is expected to have positive correlation on the technical efficiency of the health facility.

H_2: The incentive is expected to have a positive correlation with technical efficiency of the health facility.

H_3: Grant source is expected that the World Bank and EU grants have positive correlation with technical efficiency score of health facilities.

H_4: Contracting-Out Mechanism is expected to have a positive correlation with the technical efficiency score.

H_5: It is expected that urban health facilities have positive correlation with the technical efficiency score.

H_6: Catchment population is expected to have positive correlation with technical efficiency scores.

4.8. Conclusion

This chapter has looked at the methodology and the description of the variables to be employed in this study. The study will apply the output and input oriented model of DEA under Variable Return to scale (VRS) approaches to estimate the relative technical and scale efficiency scores of all the CHC types of health facilities in the sample.

Subsequently, the TE efficiency scores derived are then regressed by a number of environmental and organizational factors to identify those causes influencing performance of the health facilities. Thus, the simple Tobit regression method will be adopted in this study to investigate the significance of the impact of explanatory variables such as: location of health facilities (urban versus rural), RBF incentive, ratio of female medical staff, grant source, contract mechanism (WB, USAID, EU) and catchment population of the facilities on efficiency scores.

The succeeding chapter will run the DEA program discussed in this chapter using the DEAP version 2.1-computer software developed by T. Coelli (1996). The software to be used for Tobit regression analysis is the Stata version 11.

CHAPTER V
RESULTS AND DISCUSSION

5.1. Introduction

The purpose of this chapter is to present the results obtained from Data Envelopment Analysis (DEA) tool and regression analysis of the dataset over a sample of 304 comprehensive health centers. The conceptual framework that is developed in the previous chapter guides the presentation of DEA results. The computation of efficiency scores was undertaken using *DEAP version 2.1* software package developed by T. Coelli (1996). Thus, this chapter organized as follows:

1. Descriptive analysis of the input and output variables of CHCs.
2. The results of input and output oriented measurement DEA.
3. Descriptive statistics of technical and scale efficiency scores
4. The result of regression for both input and output oriented DEA.
5. Discussion

5.2. Descriptive Analysis of the inputs mix and outputs mix of DEA

Analysis was performed on input and output data from 304 CHC type public health facilities. A descriptive statistics of CHCs' input variables that show; the number of CHCs, mean, standard deviation, minimum and maximum are presented in table 8. There are four inputs such as: Outreach health workers (included; vaccinator and community health supervisor), Medical health providers (included; Physician, Nurse, Midwifes), Ancillary service staff (included; Lab Technician, Pharmacist and Pharmacy technicians) and supportive staff (Admin, guard and driver). It seems from Table 8 that Comprehensive Health Centers have a wide variation in terms of resource endowment. It proves that some of the CHCs are understaffed in terms of medical health personnel in year 2012 compare to number of personnel specified in BPHS for CHCs. for example the range for medical care provider is between 0 and 9 people per health facility (mean 4.69 and SD 1.50), also the numbers of outreach health workforce are 0 to 5 people (mean 2.84).

Table 8: Descriptive statistics of CHCs' inputs

Descriptive statistics	Input mix of CHCs (Unit of measurement: Person)			
	Number of Outreach Health Workers	Number of Medical Health Provider	Number of Ancillary service staff	Number of Support staff
Mean	2.84	4.69	1.88	4.03
Standard deviation	0.57	1.50	0.51	1.37
Minimum	0	0	0	0
Maximum	5.00	9.00	7.00	9.00

Similarly, Table 9 depicts descriptive statistics such as; mean, standard deviation, Minimum and Maximum of CHCs' outputs. The result obtained confirm that there are wide variations in the performance of CHCs that measured by the volume of health care services provision such as: Antenatal care, postnatal care, Skill birth attendance, family planning, outpatient, vaccination and tuberculosis positive case detection. For example: The outpatient visits range from 5,876 to 77,489, while the family planning visits fluctuated between 0 and 6,665. Whereas the TB+ case detection varies between 0 and 160.

Table 9: Descriptive statistics of CHCs' outputs

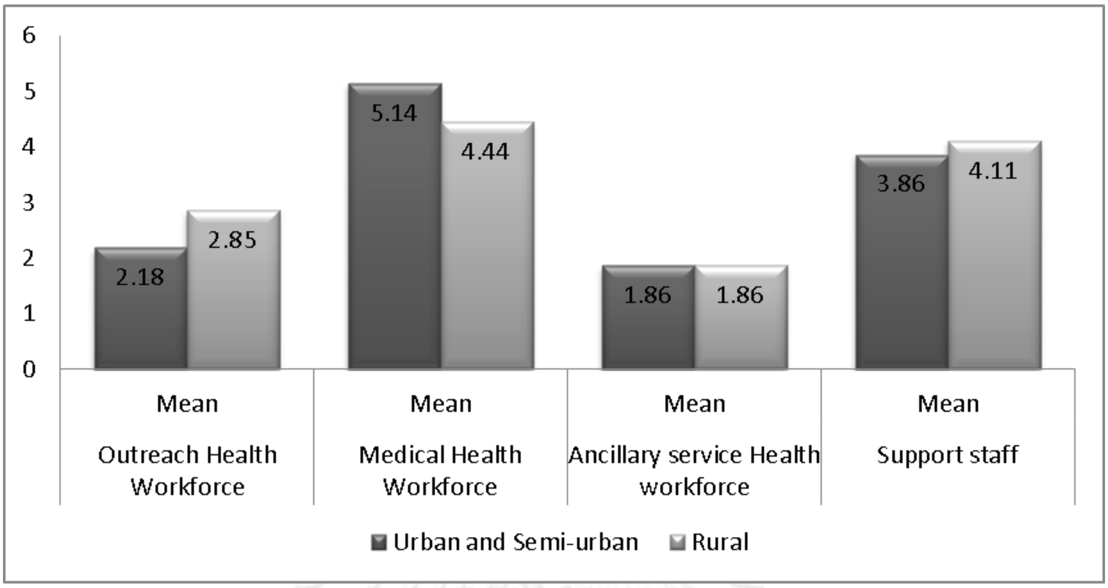
Descriptive statistics	**Output mix CHCs (Unit of Measurements: Number of Visits and Cases)**						
	No. Antenatal care visits	No. Postnatal care visits	No. Skilled Birth Attendance (Cases)	No. Family Planning visits	No. Outpatient visits	No. Vaccination visits	No. TB+ (Case)
Mean	1,182.26	546.49	304.90	854.79	30,951.12	2,219.90	15.39
Std. Dev.	886.09	399.52	266.02	767.88	12,858.41	1,178.35	16.04
Minimum	0	0	0	0	5,876	311	0
Maximum	6,503.00	2,599.00	1,583.00	6,665.00	77,489	7,643	160

In addition, a descriptive analysis of CHCs' inputs computed to compare the resource endowment in rural and urban health centers. The result in table 10 shows that there are considerable variations of inputs endowment in various geographic locations. For example, a substantial deviation existed between medical health workforces, such as the mean of the medical health workforce (Physician, nurse and midwife) in urban health centers was 5.14. While in rural and beyond rural areas mean were 4.44, but the mean of Ancillary service health workforce is same in both geographic areas. While supportive staff are more in rural areas with mean 4.11 than urban with the mean 3.86. Whereas, the mean of outreach health workers are higher in rural areas compare to urban areas. This means that skilled workforce like physicians, nurses and midwifes are more concentrated in urban areas compare to rural. However the non-skilled health workforces like outreach health workforce and supportive staff are more concentrated in rural compare to urban.

Table 10: Descriptive statistics of inputs distribution

Descriptive statistics	**No. Outreach Health Workforce**		**No. Medical Health Workforce**		**No. Ancillary service Health workforce**		**No. Support staff**	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Urban & Semi-urban	2.18	0.06	5.14	0.13	1.86	0.04	3.86	0.15
Rural and beyond	2.85	0.03	4.44	0.10	1.86	0.03	4.11	0.08

Figure 16: Geographical distribution CHCs' of Input variables



Similarly, Table 11 depicts the CHCs' outputs distribution in Urban and Rural areas. It shows that urban CHCs had a higher utilization rate compare to rural. For example: The mean ANC services in urban health centers are 1,388.5 services whereas in rural health centers are 1,070.2. Postnatal care visits, skill birth attendance, family planning visits, outpatients visits, vaccination and TB+ case had mean 564, 338, 1056, 35992, 2375 and 17 respectively compare to 54, 286, 745, 28484, 2135 and 14 respectively in rural areas.

Table 11: Descriptive statistics of CHCs' outputs geographical distribution

CHC geographic location	No. Antenatal care visits		No. Postnatal care visits		No. Skilled Birth Attendance		No. Family Planning visits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Urban & Semi-urban	1,388.5	93.3	564.7	32.8	338.8	28.6	1,056.5	90.4
Rural & beyond	1,070.2	54.4	536.5	30.5	286.4	17.5	745.1	45.2

Continued…

CHC geographic location	No. Outpatient visits		No. Vaccination visits		No. TB+	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Urban & Semi-urban	35492.9	1324.6	2375.8	117.41	17.32	1.83
Rural & beyond	28484.2	832.2	2135.2	82.1	14.3	1.0

Thus, we can understand that utilization of the health care services is more in urban communities compare to rural. So this statistics support the state of problem and challenges in the first and second chapter.

Furthermore Table 12 shows the utilization of input in efficient and inefficient CHCs and also the output produced in efficient and inefficient CHCs. It seems that inefficient CHCs utilize more and produce less service compare to efficient CHCs. For instance, efficient CHCs employ 4.31 medical health providers while inefficient CHCs 4.76. Also efficient CHCs produce 37,763 and inefficient CHCs produce 29,673 Outpatients services.

Table 12: Descriptive Statistics of inputs and outputs in efficient and inefficient CHCs

Variable	**Efficient CHCs**		**Inefficient CHCs**	
	Mean	Std. dev.	Mean	Std. dev.
Input Mix of CHCs				
Outreach Health Workers	2.52	0.14	2.90	0.03
Medical Health Providers	4.31	0.31	4.76	0.08
Ancillary Service Staff	1.60	0.09	1.93	0.03
Support staff	3.44	0.29	4.14	0.07
Output Mix of CHCs				
ANCs (Visits)	1,757.79	196.76	1,074.34	44.91
PNCs (Visits)	857.85	82.55	488.11	20.51
SBA (Cases)	438.73	56.73	279.80	14.20

FP (Visits)	1,403.56	175.71	751.89	37.51
Outpatients (Visits)	37,763.83	2,378.41	29,673.73	728.98
Vaccination services (visits)	2,880.52	233.32	2,096.04	64.67
TB+ Cases	26.52	4.31	13.30	0.67

5.3. Results from DEA

Normally three types of efficiency score are generated via the DEA program; the first, Technical efficiency under a constant return to scale (TECRS) score or overall technical efficiency score. Next, Technical efficiency under variable returns to scale or pure technical efficiency (TEVRS) scores. And last, scale efficiency (SE), which the pattern of scale efficiency is further classified into: Increasing returns to scale (IRS), Decreasing returns to scale (DRS) and scale efficient.

Meanwhile, the results both explore the inputs and output oriented measurement.

5.3.1. The summary results of both input and output oriented DEA model

A summary of the classified efficiency scores of the Comprehensive Health Centers is presented in Table 13. The DEA results revealed that there were substantial differences of efficiency scores from the best practice frontier. The results of pure technical efficiency score (TEVRS) from output oriented DEA shows that out of 304 sample CHCs only 48 CHCs are efficient and the rest are inefficient And the mean efficiency score is 0.64 (64%). Also, the result of TEVRS from input oriented DEA shows that from total sample CHCs only 49 CHCs are efficient and the mean efficiency score is 0.664 or (66.4%). Appendix B contains more information on technical and scale efficiency of the individual CHCs under both input and output oriented DEA. It is essential to evoke the efficiency score ranges from zero (very inefficient) to one (100 % total efficiency). The presence of inefficiencies indicates that a particular inefficient health facility has insufficient outputs or surplus inputs compared to those health facilities on the efficient frontier.

Table 13: Distribution of CHCs' Technical and Scale efficiency scores

Efficiency Range	Output-oriented DEA			Input-oriented DEA		
	TECRS	TEVRS	SE	TECRS	TEVRS	SE
1	34	48	75	34	49	42
0.950-0.999	8	5	85	8	3	87
0.900-0.949	4	9	50	4	9	47
0.850-0.899	10	14	28	10	12	39
0.800-0.849	11	15	25	11	15	16
0.750-0.799	11	12	22	11	9	20
0.700-0.749	11	11	10	11	18	14
0.650-0.699	19	22	7	19	21	11
0.600-0.649	26	23	1	26	26	4
0.550-0.599	25	25	1	25	31	7
Below-0.549	145	120	0	145	111	17
Total CHCs	304	304	304	304	304	304

Figure 17: Distribution of CHCs' TEVRS scores from output oriented DEA model

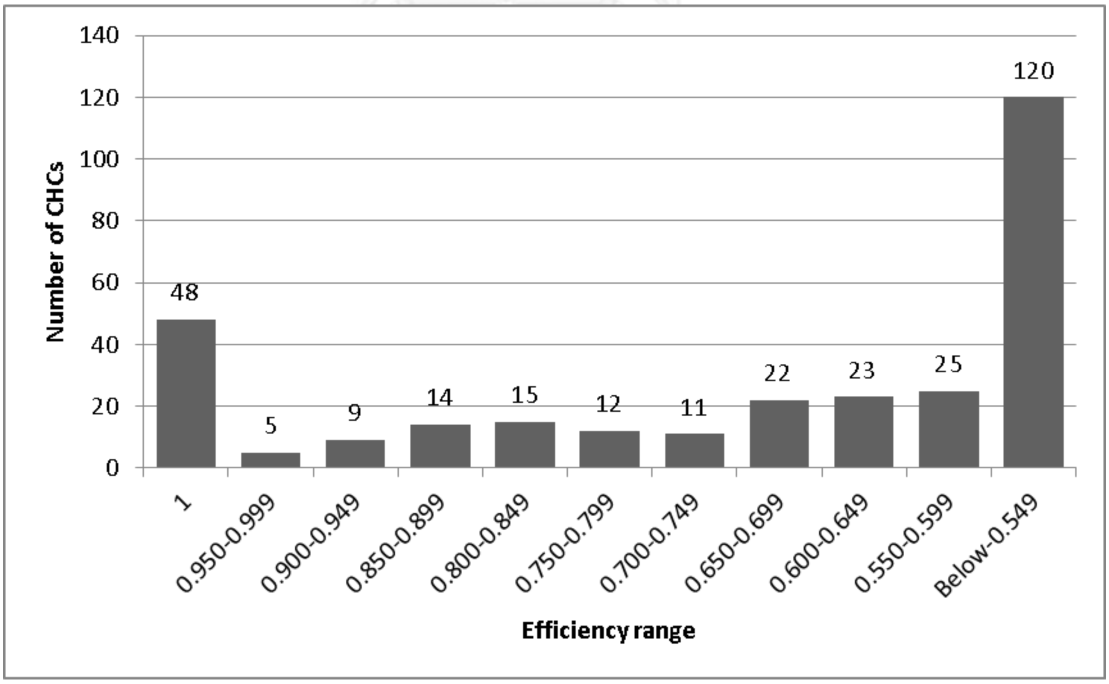
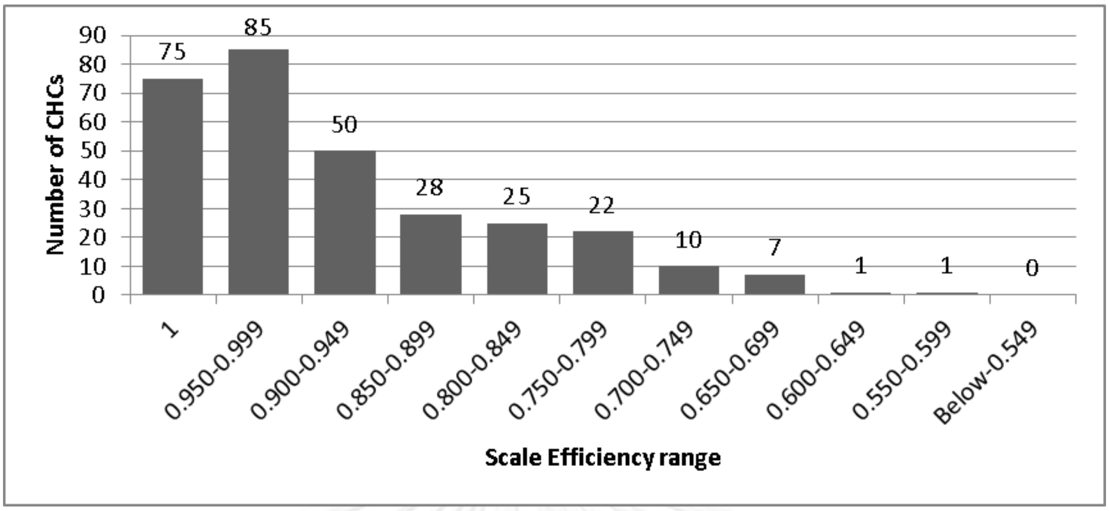


Figure 18: Distribution of scale efficiency scores from output oriented DEA model



5.3.2. **Descriptive statistics of Technical and Scale efficiency scores**

A descriptive statistics of DEA results figured out to verify the central tendency of technical and scale efficiency score of comprehensive health centers. The results shows that average scores for of technical efficiency (CRSTE) from output-oriented DEA is 59.1% (SD=0.013), for VRS technical efficiency (VRSTE) the average score is 64% (SD=0.013) and for scale efficiency (SE) the average score is 92.2% (SD=0.005). The average VRSTE implies that the inefficient CHCs could to increase their output by 36% to become efficient while keep constant the current inputs and quality of services. Furthermore, the minimum TECRS score is 0.121 while the minimum for TEVRS score is 0.127. Table 14 tabulates various efficiencies and their statistics from output oriented DEA model

Table 14 : Descriptive statistics of TE scores from output oriented DEA model

Variable	Mean	Std. Dev.	Min	Max.	Health facilities on frontier
CRS* Technical efficiency score	0.591	0.013	0.121	1.00	34
VRS** Variable efficiency scores	0.640	0.013	0.127	1.00	48
SE Scale efficiency score	0.922	0.005	0.582	1.00	75

*CRS-constant return to scale; VRS**-variable return to scale

On the Other hand, the average scores of constant return to scale technical efficiency (CRSTE) from input-oriented DEA is also 59.1% (SD=0. 013) that similar to output oriented DEA. But variable return to scale technical efficiency (TEVRS) average score is 66.4% (SD=0. 011) that is slightly higher than output oriented. And the average scale efficiency (SE) score is 87.2.2 % (SD=0. 008). The average TEVRS implies that the inefficient CHCs would need to decrease their inputs by 33.6% to become efficient while keep their outputs and quality constant. In addition, the minimum TECRS score is 0.121 while the minimum for TEVRS score is 0.324, Table 15 tabulates various efficiencies and their statistics from Input oriented DEA model

Table 15: Descriptive statistics of TE scores from Input oriented DEA model

Variable	Mean	Std. Dev.	Min	Max.	Health facilities on frontier
CRS* Technical efficiency score	0.591	0.013	0.121	1.00	34
VRS** Variable efficiency scores	0.664	0.011	0.324	1.00	49
SE Scale efficiency score	0.872	0.008	0.214	1.00	42

*CRS-constant return to scale; VRS**-variable return to scale

The result of DEA from overall technical efficiency (TECRS) approach with output oriented model shows that out of 304 CHCs included in the study whose results are tabulated in Table 16; 34 (11%) were technically efficient that is, they were on the frontier, while the remaining 270 (89%) were relatively technically inefficient. Thus, of 270 inefficient CHCs, 170 (56%) of them had a TE score below 59%, 45 (15%) between TE of 60-69%, 22 (7%) were between TE of 70-79%, 21 (7%) were between TE of 80-89%. 12 (4%) were between TE of 90-99%.

Similarly the result from overall technical efficiency (TECRS) approach with input oriented DEA, shows that out of 304 CHCs included in the study whose results are presented in Table 16; 34 (11%) were technically efficient that is, they were on the frontier, while the remaining 270 (89%) were relatively technically inefficient. Thus, of 270 inefficient CHC clinics, 170 (56%) of them had a TE score below 59%, 45 (15%) between TE of 60-69%, 22 (7%) were between TE of 70-79%, 21 (7%) were between TE of 80-89%, 12 (4%) were between TE of 90-99%.

In fact Table 16 shows that the results of TE under CRS approach for both input and output oriented DEA are same.

Table 16: Distribution of Overall Technical Efficiency scores (TECRS)

Overall Technical efficiency scores (CRS)	Percentage of CHCs' output oriented DEA	Percentage of CHCs' Input oriented DEA
0-59	56%	56%
60-69	15%	15%
70-79	7%	7%
80-89	7%	7%
90-99	4%	4%
100	11%	11%

Likewise the result of pure technical efficiency (TEVRS) from output oriented DEA model shows that out of 304 CHC clinics included in the study whose results are shown in table 17; 48 (16%) were technically efficient that is, they were on the frontier, while the remaining 256 (84.3%) CHCs were relatively technical inefficient. Thus, of 256 inefficient CHCs, 145 (48%) of the CHCs had a TE score below 59%, 45 (15%) between TE of 60-69%, 23 (8%) were between TE of 70-79%, 29 (10%) were between TE of 80-89%, 14 (5%) were between TE of 90-99%.

The result of pure technical efficiency (TEVRS) from input oriented DEA, shows that out of 304 CHCs included in the study whose results are tabulated in 17, 49 (16%) were technically efficient that is, they were on the frontier, while the remaining 255 (83.8%) were relatively technical inefficient. Thus, of 256 inefficient CHC clinics, 142 (47%) of the CHCs had a TE score below 59%, 47 (15%) between TE of 60-69%, 27 (9%) were between TE of 70-79%, 12 (4%) were between TE of 80-89%, 49 (16%) were between TE of 90-99%.

Table 17: Distribution of Pure Technical Efficiency score (TEVRS)

Pure technical efficiency scores (VRS)	Percentage of CHC's output oriented DEA	Percentage of CHC's Input oriented DEA
0-59	48%	47%
60-69	15%	15%
70-79	8%	9%
80-89	7%	9%
90-99	5%	4%
100	16%	16%

5.3.3. **Return to Scale Efficiency**

Disintegration of the overall technical efficiency (CRS) into scale efficiency (SE) and pure technical inefficiency (VRS) is essential for the investigation of the source of inefficiencies of Comprehensive Health Centers (CHCs) that are not functioning on the efficient frontier. Actually, the constant return to scale (CRS) presumes that Comprehensive Health Centers are running at the best possible size while variable return to scale (VRS) model decomposes efficiency scores into scale and pure technical efficiency score. Therefore, in order to look at whether the inefficiency was due to scale or pure technical inefficiency, the VRS model had to be run. The scale efficiency analyzed scores of both input and output oriented DEA.

The output-oriented DEA results revealed that 82 (27%) out of 304 CHCs were operated at optimal size, while 222 (73%) were scaled inefficient. The study further disclosed the pattern of scale inefficiencies into both increasing returns to scale (IRS) and decreasing returns to scale (DRS). Among the scale inefficient CHCs, 18 (6%) of the Comprehensive Health Centers had increasing return to scale pattern, while 204 (67%) of comprehensive health centers exhibited decreasing return to scale pattern. Therefore, the result proves that decreasing return to scale CHCs are more than the increasing returns to scale among scale inefficient CHCs. This means that a percentage increase in all inputs is followed by less than a percentage change in outputs. In order to improve the efficiency of the inefficient large CHCs, there is a need to have more health units of a relatively smaller size. (Table 18)

On the other hand, the results of input-oriented of the DEA model demonstrates inverse results from output-oriented, such as the increase return to scale (IRS) exhibited higher than decrease return to scale (Drs). Since, out of 304 CHC, 217 (71%) were operated increasing return to scale, while 45 (15%) shows decreasing return to scale. (Table 19)

Thus, results indicate that a great proportion of CHCs are inefficient in size, that is, they are bigger or smaller than the optimal size.

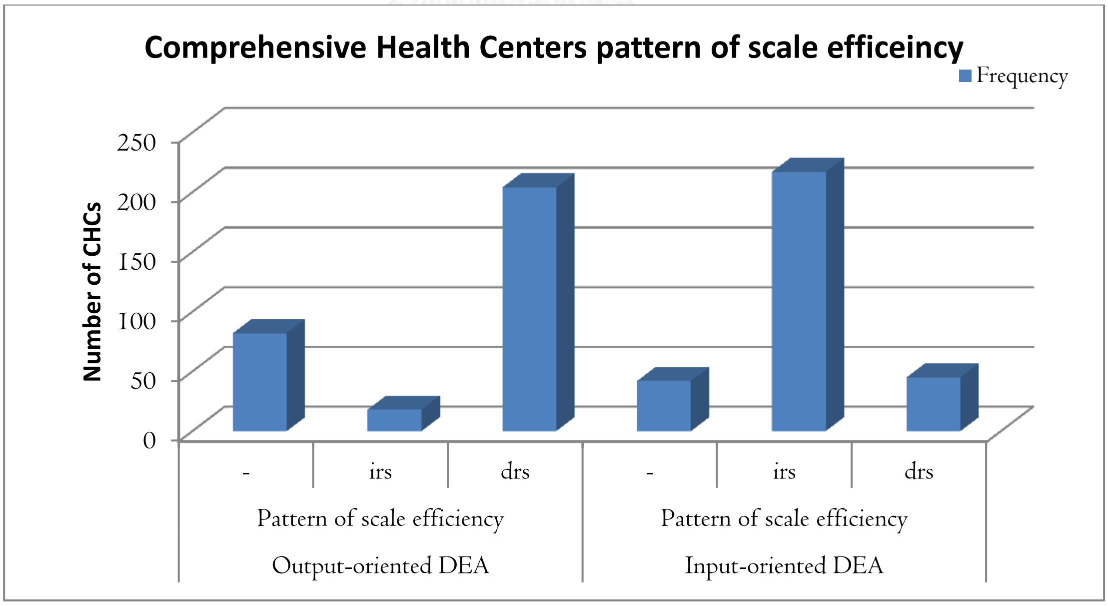
Table 18: Pattern of scale efficiency from Output oriented DEA model

Comprehensive Health Centers (CHCs)	Status of scale efficiency - output-oriented DEA				
	Scale Efficient	Scale Inefficient	Total	Pattern of scale inefficiency	
				IRS	DRS
Frequency	82	222	304	18	204
%	27	73	100	6	67

Table 19: Pattern of scale efficiency from input oriented DEA model

Comprehensive Health Centers (CHCs)	Status of scale efficiency - input-oriented DEA				
	Efficient	Inefficient	Total	Pattern of scale inefficiency	
				IRS	DRS
Frequency	42	262	304	217	45
%	14	86	100	71	15

Figure 19: Return to scale pattern of CHCs



5.3.4. **Capacity to output increase**

The result of output oriented DEA model revealed that inefficient health facilities have the capacity and scope to increase their outputs to become efficient. Thus, the inefficient CHC health facilities combined would need to increase the number of Antenatal care services by 180,366; postnatal care by 31,043; Skill birth attendance 33,877; Family planning 277,865; Outpatient services 418,471; vaccination services 104,654 and tuberculosis positive case detection by 3,776 cases in order to become efficient without increase in amount of inputs and also holding the quality constant. See Table 20.

Table 20: Overall outputs increases needed to make the inefficient CHCs efficient

Variables	Output Mix	
	Actual outputs	Outputs shortage
Antenatal care (ANC)	359,406.00	180,366.54
Postnatal care (PNC)	166,133.00	31,044.77
Skilled Birth Attendance (SBA)	92,689.00	33,879.85
Family Planning (FP) visits	259,855.00	277,869.25
Outpatient (OPD)	9,409,139.00	418,475.52
Vaccination services	674,850.00	104,659.98
TB+ case detection	4,679.00	3,782.83

5.3.5. **Capacity to input decrease**

Similarly to output oriented DEA, the input oriented DEA has also revealed the CHCs that were inefficient due to more utilization of input resource compare to what they could use with the level of output they produced. Thus the result shows that if the CHCs keep the outputs constant there is also a way to become efficient that is to decrease the input consumed by these facilities. Table 21 shows the inputs decrease required to make inefficient CHCs efficient. The inefficient CHCs combined would necessitate decreasing the number of outreach health workforce 26 people, medical health workforce by 65, ancillary service staff by 39 and supportive staff by 290 people in order to become efficient.

Table 21: Overall inputs decrease needed to make the inefficient CHCs efficient.

Variables	Input Mix	
	Actual inputs	surplus inputs
Outreach Health Workforce	863.00	26.06
Medical Health Workforce	1,426.00	65.49
Ancillary service Health workforce	570.00	39.49
Support staff	1,224.00	290.68

5.3.6. **Descriptive Analysis provinces efficiency scores**

Since the input and output variables data are collected from all 34 provinces of the country to measure the relative technical and scale efficiency of comprehensive health centers. So it is noteworthy to know which province had better performance with due consideration of their geographic locations and landscapes. In addition every province's health facilities are operated by different NGOs; each province also has a different population density that can influence the state of performance of the province. Therefore, it is important to look at the mean technical and scale efficiency of Comprehensive Health Centers in each province and to compare which provinces operate better. As a result from the Table 22, we can examine that the mean technical efficiency and scale efficiency of each province are rather different. Under the output orientated model of DEA, only one province (Urozgan province) out of 34-provinces have mean pure TE above 90% which have a superior relative performance. 11 provinces (Badghis, Jawzjan, Faryab, Kabul, Hirat, Kapisa, Kunduz, Khost, Kunar, Nangarhar, Panjshir) have mean pure technical efficiency score between 70-89% as reasonable relative performance provinces, while 22 provinces have mean pure technical efficiency score below 70% as worse performance provinces. Whereas, 26 provinces had mean scale efficiency, greater and equal to 90% and only eight provinces had below than 90% mean scale efficiency. See Table 22.

Table 22: Mean Technical and Scale efficiency scores of CHCs in 34 Provinces

Provinces	Number of CHC	Output oriented DEA		Input Oriented DEA	
		Mean		Mean	
		TEVRS efficiency scores	Scale efficiency	TEVRS efficiency scores	Scale efficiency
Badakhshan	10	0.59	0.90	0.60	0.87
Badghis	2	0.84	0.97	0.83	0.98
Baghlan	12	0.62	0.93	0.62	0.92
Balkh	11	0.64	0.90	0.64	0.87
Bamyan	10	0.35	0.95	0.49	0.66
Dykundi	3	0.43	0.92	0.50	0.80
Farah	9	0.65	0.95	0.67	0.92
Faryab	13	0.73	0.88	0.68	0.95
Ghazni	23	0.50	0.95	0.58	0.80
Ghor	8	0.68	0.90	0.66	0.93
Helmand	15	0.69	0.89	0.72	0.83
Hirat	17	0.81	0.93	0.80	0.94
Jawzjan	6	0.76	0.96	0.77	0.95
Kabul	8	0.80	0.96	0.83	0.93
Kandahar	20	0.51	0.93	0.58	0.81
Kapisa	6	0.88	0.99	0.91	0.95
Khost	12	0.80	0.98	0.83	0.93
Kunar	8	0.77	0.81	0.72	0.87
Kunduz	12	0.73	0.95	0.73	0.95
Laghman	8	0.60	0.74	0.48	0.92
Logar	6	0.53	0.88	0.55	0.88
Nangarhar	18	0.73	0.88	0.69	0.94
Nimroz	2	0.55	0.80	0.48	0.88
Nooristan	2	0.27	0.97	0.46	0.56
Paktika	3	0.65	0.96	0.71	0.86
Paktya	8	0.58	0.95	0.62	0.87
Panjsher	2	0.70	0.86	0.78	0.72
Parwan	8	0.45	0.91	0.53	0.74
Samangan	5	0.67	0.98	0.74	0.86

Sar-e-Pul	8	0.61	0.97	0.63	0.94
Takhar	12	0.69	0.96	0.70	0.95
Urozgan	5	0.92	0.99	0.93	0.98
Wardak	6	0.43	0.91	0.47	0.81
Zabul	6	0.39	0.97	0.65	0.55

5.4. Regression results

The second major potential to do this study was to identify the factors either in control or beyond the control comprehensive health facility that affect the performance of these health centers. As yet the finding has shown that the majorities of the CHCs are not efficient and perform inefficiently. Therefore a regression analysis is conducted to know the factors that have an effect on performance.

The Tobit regression model was used to provide the details of causes (determinants of efficiency) affecting the pure technical efficiency of comprehensive health centers. Variable return to scale assumption (TEVRS) of technical efficiency for both inputs and outputs oriented DEA model is used as dependent variable combined with six explanatory variables to calculate the extent and trend of efficiency relation. Therefore, two equations of Tobit regression for both input and output-oriented DEA using state were constructed.

Table 23: Descriptive statistics of explanatory variables

Variables	Observation	Mean	Std. Dev.	Min.	Max.
TEVRS (Output oriented)	304	0.640	0.013	0.127	1
TEVRS (Input oriented)	304	0.664	0.011	0.324	1
Location $_{(dummy)}$	304	0.351	0.478	0	1
Female Medical Ratio	304	0.338	0.008	0	0.77
Grant Source WB $_{(dummy)}$	304	0.217	0.412	0	1
Grant Source EU $_{(dummy)}$	304	0.217	0.412	0	1
Grant Source USAID $_{(dummy)}$	304	0.565	0.028	0	1
RBF Incentive $_{(dummy)}$	304	0.148	0.355	0	1
Contract Mechanism $_{(dummy)}$	304	0.947	0.223	0	1
Catchment Population	304	24104.1	11571.68	7505	86585

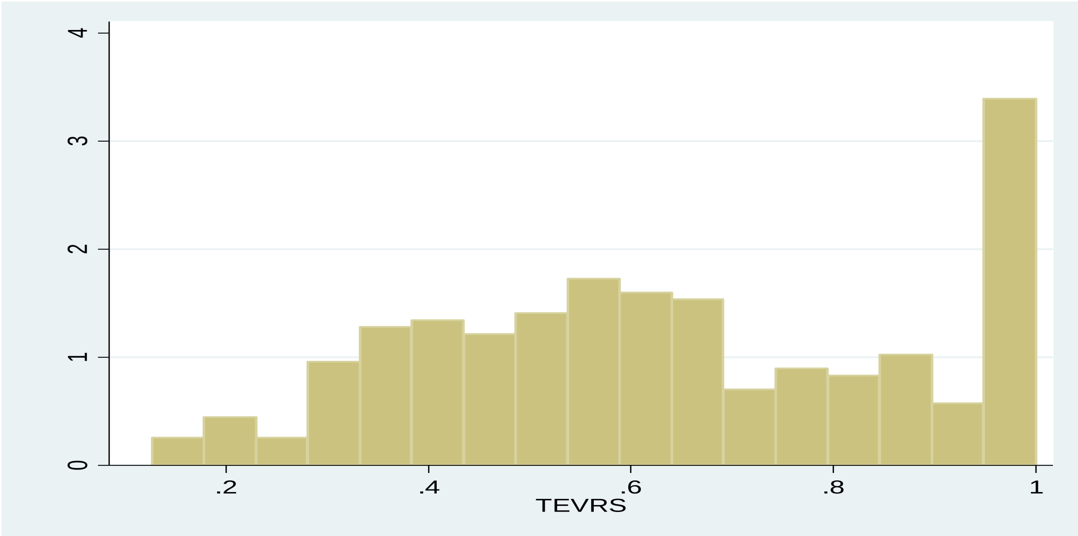


Figure 5.5: Comprehensive Health Centers Technical efficiency Accumulated score

After running the tobit regression equation using the Stata 12, the result revealed the coefficient, standard error, T-statistic and probability of the explanatory variables such as: RBF incentive to the health centers (RBF inc), Location of health center (Loc: urban or rural), Female medical ratio (FMR), Grant source (World Bank, European Union), Contract mechanism (CM) and finally Catchment population (CP). Furthermore, the result shows that only one variable "Location" has significant effects on the technical efficiency score ($TEVRS_O$) since the p-value is less than 0.05 and the rest of the explanatory variables are insignificantly correlated to technical efficiency score due to their P-value is greater than 0.05. As it seem from table 5.16 below.

Table 5.16: Tobit Regression results, dependent variable: TEVRS output oriented model

Explanatory variable	Coefficient	Std. Error	T-statistic	Prob.
Constant/intercept	.347952	.0943703	1.49	0.000
Location (dummy)	.0494813	.0331272	0.19	0.136
Female Medical Ratio	.0203806	.1067724	2.05	0.849
Grant Source WB (dummy)	.0874226	.0427023	1.37	0.042
Grant Source EU (dummy)	.055083	.0401649	-0.83	0.171
RBF Incentive (dummy)	-.0378572	.0456125	0.39	0.407
Contract Mechanism (dummy)	.029935	.0768834	6.68	0.697
Catchment Population	9.81e-06	1.47e-06	6.68	0.000

Number of observation =304, Confidence Interval 95%, LR chi^2=51.04

Likewise, the Tobit regression result using output-oriented technical efficiency score as dependent variable for explanatory variables, still only catchment population of the health centers has significantly effect on technical efficiency scores. And the remaining explanatory variables are insignificant due having P-value greater than 0.005. See table 24

Table 24: Regression results, dependent variable: TEVRS input oriented model

Explanatory variable	Coefficient	Std. Error	T-statistic	Prob.
Constant/intercept	.563559	.0842152	6.69	0.000
Location (dummy)	.0129222	.0296319	0.44	0.663
Female Medical Ratio	-.1235835	.0954272	-1.30	0.196
Grant Source WB (dummy)	.0571011	.0382315	1.49	0.136
Grant Source EU (dummy)	.0031661	.0358736	0.09	0.930
RBF Incentive (dummy)	-.0179987	.0408204	-0.44	0.660
Contract Mechanism (dummy)	-.0269008	.0689391	-0.39	0.697
Catchment Population	7.12e-06	1.28e-06	5.58	0.000

Number of observation =304, Confidence Interval 95%, LR chi^2=35.59,

To measure the effect of CHCs location on TE scores, we have included the variable of location as a dummy variable. It is expected that CHCs located in urban and semi urban areas are relatively more efficient compare to CHCs in rural and beyond rural areas. We found that the Location (Loc.) Coefficient is negative but not significant with technical efficiency score in either of the regression equations (both TEVRS input oriented and output oriented as dependent variable) as it seems that p-value for this variable is greater than 0.05.

We assumed that Female Medical Ration (FMR) will be positively associates with technical efficiency score due to nature of socio-cultural aspects of people in Afghanistan. It means that some time females tend to get the services only from female medical workers. So if the health facility has higher ratio of female medical providers more people tend to get the service consequently health centers have higher performance. Accordingly the result shown that, FMR has positively associated with TE score of Input oriented dependent variable. Whereas it has negative association with TE score of Output oriented dependent variable. But in either of the regression equation this variable is insignificant due to higher P-value than 0.05. It means that current mix of female medical staff to male medical staff is not appropriate to increase the efficiency and performance of CHCs.

Grant source dummy variable is statistically insignificant with CHCs' Technical efficiency. It was expected that CHCs financed by World Bank (WB) and European Union (EU) might be more efficient and have positive coefficient. However the result revealed that this explanatory variable has negative coefficient sign with TE in both regression equations. This may be due to that fact that donors (EU, WB, and USAID) have similar efforts in providing funds, equipment, medicine and other supports direct and indirectly through implementing NGOs to CHCs.

We have included the Results Based Financing Incentive (RBF inc.) variable to measure its effect on the performance of CHCs; we assume that RBF incentive has positive correlation coefficient with TE. Accordingly, the results revealed that RBF Incentive has positive correlation with TE but not significant at 95% confidence interval in either of the regression equation as its p-value is greater than 0.05. This might be due to fact that RBF incentive is not being paid in all CHCs rather few CHCs in some province get incentive.

Contract mechanism as dummy variable has been included to measure the effects of contracting mechanism for provision of basic health care services, it was expected that health centers under contract-out mechanism are more efficient and have positive correlation coefficient compare to contract-in mechanism because in contract-out mechanism the NGOs have autonomy to procure the supplies and hire the human workforce for service delivery. While the contracting-in mechanism is centralized and run the health care system through the government procedures, rules and regulations. Consequently the regression results shows that this variable is not significantly effecting the Technical Efficiency because its p-value is greater than 0.05. However, the sign of coefficient is positive with dependent variable TEVRS input oriented DEA. And has negative correlation with TEVRS output oriented DEA.

The Tobit regression results using both input and output technical efficiency scores (TEVRS) as dependent variables shows that Catchment population (CP) variable at 5% level of significant the variable is significantly different from zero. The result is according to our expectation that CHCs with higher population density has positive correlation with efficiency score and have better performance.

Therefore, the regression analysis concluded that only one variable out of all explanatory variables included in the study affect the performance of comprehensive health center (CHCs). Furthermore the sign of this variable is also consistent with the hypothesis. See table Tables 5.16 and 24.

5.5. Conclusion

In this study, it was attempted to observe the performance of Comprehensive Health Centers by estimating the technical efficiency of 304 Comprehensive health center in all over the country. The central inducement toward this study was to explore how the health facilities in the public health sector perform, while the health sector faces severe lack of resources. The results of the study discovered that the majority of the CHCs are operating at less than optimal level; only 34 Comprehensive Health Centers are operating at the optimal level in either of the DEA model, while the remaining are inefficient. In addition, 145 CHCs are operating at very worst levels. Also, regression part of this chapter presented that only one “catchment population” out of six explanatory variables of the health facility can affect the performance of the health facility.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

In this study, it was attempted to observe the performance of public health service centers with an exclusive focus on determining the technical and scale efficiency of 304 Comprehensive Health Centers (CHCs) in the country as sample. The main stimulus for this study was to explore how the public health facilities in the health sector perform, with due consideration that the majority of these public health facilities' resources are financed by donors and are scarce. Therefore, the government has to obtain the maximum benefit from utilizing the inputs to health facilities. Thus, Data envelopment analysis used to estimate the results and to achieve the general and specific objectives defined via answering the research questions. Consequently, the results of the study uncovered that the majority of the CHCs are operating at the inefficient level; that is the average scores for CRS technical efficiency (CRSTE) using output-oriented DEA was 59.1% (SD=0. 013), for pure technical efficiency (VRSTE) the average score was 64% (SD=0. 013) and for scale efficiency (SE) the average score was 92.2% (SD=0. 005). This result explicitly shows only 34 Comprehensive Health Centers are operating at the desired optimum level, whereas the remaining 270 CHCs are inefficient. Furthermore, among 270 inefficient CHCs, 145 CHCs are operating at very worst levels. In addition, Tobit regression result revealed that only one explanatory variable "catchment population" has positive correlation with health facility and have the capacity to affect its performance.

In fact, with level of efficiency obtained from this study, attaining health care objective that is increasing service provision to all the people of Afghanistan as defined by the Afghanistan health sector strategy are relatively difficult with existing scarce resource.

In addition, this technical and scale efficiency measurement help management at multi levels; policy makers at the central level as well as manager and implementers (NGOs) at secondary level to spot: first, the efficient CHCs whose act can be followed as a role model by the inefficient CHCs. Secondly, CHCs whose performance required to be developed through precise strategy. Thirdly, the output services enhance capacity of inefficient CHCs, and lastly, the magnitude of input resources that are wasted in inefficient CHCs.

6.2. Limitations

During the course of study, the following limitations have been spotted:

1. This is a study aimed to measure the technical and scale efficiency of 386 CHC types of primary health facilities in the country, but due to unavailability and incomplete data, only 304 CHCs were included in the study.
2. Limited numbers of input and output variables were included in this study. Due to unavailability of data and time constraints of the study some variables did not include in the study. However their presence is recognized very important. Such as: CHCs actual cost of drugs utilized weren't available neither with the implementing NGOs nor with Ministry of public health. Meanwhile recurrent costs excluding staff salaries was not available at health facility wise, specifically in the provinces funded by European Union (EU).
3. Data on some explanatory variables that believed to have some sort of effect on performance and efficiency of Comprehensive Health Centers were not available such as, exact security state of the areas that health facility are located were not available.

6.3. Recommendations

The following key recommendation is given after the analysis of the result.

The smaller the CHCs, the more efficient it is. According to Output oriented DEA result, the pattern of scale inefficiencies shown that most of the CHCs were decreasing return to scale. It means they are larger in size than they have to be. Therefore CHCs size needs to be adjusted such as having more health units of a relatively smaller size that is according to the population density of the health centers' service area.

6.4. Suggestion to further study

1. A study of only relative technical efficiency of the health facility with the choice of only limited number of inputs and outputs of Health centers does not indicate the proper performance of the health facility, and or reducing the inputs or increasing the outputs does not guarantee the performance of health facilities. Therefore, this study shows only one side of the performance concern. Thus, in order to boost up the performance of health facilities, further studies have to conducted such as; cost efficiency and analysis on utilization of health care services.
2. As far as the catchment population and socio-culture aspects of the people are different in rural and urban areas. Therefore it is needed to measure separately the technical and scale efficiency of CHCs in these areas. To determine the relative technical and scale efficiency of CHCs located in same areas.
3. There is strictly need in determination of differences in quality of health care services in Comprehensive Health Centers and their effects on utilization of the health care service. In fact, provision of excellence and quality health care service need more input per unit of output. However, Comprehensive Health Centers are identical in size and in the types of services provide, therefore, those health facilities that have high quality service may consume more inputs and provide less outputs compared to those health facilities that have low quality and have high outputs provision.

REFERENCES

Abbas, T. a. (2011). Analyzing the efficiency differences among basic health units in Sargodha District. *Journal of Economics and Behavioral Studies*, 6-8.

Afghan Public Health Institute, H. C. (2010). *Afghanistan Mortality Survey*. Calverton, Maryland, USA: APHI/MoPH, CSO, ICF Macro, IIHMR and WHO/EMRO.

Aigner, D. a. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of econometrics, 6*, 21--37.

Akazili, J. a.-A. (2008). Using data envelopment analysis to measure the extent of technical efficiency of public health centres in Ghana. *BMC international health and human rights, 8*, 11.

Akin, J. S. (1987). *Financing health services in developing countries: an agenda for reform.* Washington D.C: World Bank Publications.

Belay, T. A. (2010). *Building on early gains in Afghanistan's health, nutrition, and population sector: Challenges and options.* World Bank Publications.

Carlson, C. a.-J. (2005). Improving the delivery of health and education services in difficult environments: lessons from case studies. *DFID Health Systems Resource Centre*.

CIA. (2014). *Central Intelligence Agency*. Retrieved December 2001, from https://www.cia.gov/library/publications/the-world-factbook/geos/af.html#Intro

Coelli T.J. (1996). *A Data Envelopment Analysis (Computer) Program. Center for Efficiency and Productivity Analysis.* University of New England.

Coelli, T. (1996). *A Guide to DEAP Version 2.1 A Data Envelopment Analysis Program.* Department of Econometrics, University Of New England.

Coelli, T. J. (1996). *A guide to FRONTIER version 4.1: A computer program for stochastic frontier production and cost function estimation.* CEPA Working papers.

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society. Series A (General)*, 253--290.

Ganley, J. A. (1992). *Public sector efficiency measurement: Applications of data envelopment analysis.* New York: Elsevier Science Inc.

Health Information System. (2012). *Afghanistan Helath Indicator:Fact sheet.* Kabul-Afghanistan: Ministry of Public Health.

Health Information System. (2013). *Provincial profile yearbook.* Kabul-Afghanistan: Ministry of Public Health.

HIS. (2011). *Provincial Profile Book.* Kabul, Afghanistan: Ministry of Public Health.

HIS, H. I. (2012). *Provincial Profile yearbook.* Kabul-Afghanistan: Ministry of Public Health.

Hussey, P. S. (2009). A systematic review of health care efficiency measures. *Health services research, 44*, 784--805.

Kirigia, J. M. (2004). Using data envelopment analysis to measure the technical efficiency of public health centers in Kenya. *Journal of Medical Systems*, 155-166.

Kirigia, J. M. (2011). Technical efficiency of primary health units in Kailahun and Kenema districts of Sierra Leone. *International archives of medicine, 4*, 1-4.

Lilongwe. (2008). Technical efficiency of district hospitals in Malawi:An exploratory assessment using data envelopment analysis. 5-15.

Marschall, P. a. (2009). Assessing the efficiency of rural health centres in Burkina Faso: an application of Data Envelopment Analysis. *Journal of Public Health, 17*, 87--95.

Mercer, H. a. (2003). Human resources for health: developing policy options for change. *Towards a global health workforce strategy*.

Ministry of Finance. (2012). *National budget statement.* Kabul-Afghanistan: Ministry of Finance.

MoH. (2003). *A Basic Package of Health Services for Afghanistan (BPHS).* Kabul: Ministry of Health, Afghanistan.

MoPH. (2010). *A Basic Package of Health Services for Afghanistan.* Kabul: Ministry of Public Health, Afghanistan.

MoPH. (2011). *Afghanistan National Health Workforce Plan 2012-16,Draft version-2.* Kabul-Afhanistan: Ministry of Public Health.

MoPH. (2011). *STRATEGIC PLAN FOR THE MINISTRY OF PUBLIC HEALTH.* Kabul: Ministry of Public Health, Afghanistan.

Palmer, S. a. (1999). Economics notes: Definitions of efficiency. *BMJ: British Medical Journal, 318*, 1136.

Sabri, B. S. (2007). Towards sustainable delivery of health services in Afghanistan: options for the future. *Bulletin of the World Health Organization*, 712-718.

Singh, L. P. (2012). Public health care in Afghanistan: An investigation in suboptimal utilization of facilities. *Health (1949-4998), 4*, 794.

Strong, L. a. (2005). *Health policy in Afghanistan: two years of rapid change. A review of the process from 2001 to 2003.* London: London School of Hygiene and Tropical Medicine.

The world Bank. (2012). *The World Bank*. Retrieved 1 23, 2014, from The World Bank Data bank: http://www.worldbank.org/en/country/afghanistan

WHO. (2012, 1 27). *World Health Organization*. Retrieved 1 15, 2014, from World Health Organization Statistics: http://www.who.int/countries/afg/en/

World Bank Group. (2012, 04 14). *World Development Indicators 2012.* World Bank Publications.

World Health Organization. (2000). *World Health Organization*. Retrieved 05 04, 2014, from World health report: http://www.who.int/whr/2000/en/

World Health Organization. (2014). *Humanitarian Health Action*. Retrieved 05 04, 2014, from World Health Organization: http://www.who.int/hac/donorinfo/afg/en/index1.html

Yearbook, A. T. (2013-2014). Yearbook 2004-2005,(2006). *Central statistic organization*, *Ministry of economy*, *Islamic republic of Afghanistan*.

APPENDIX

Appendix A: Summary Data for All the Comprehensive Health Centers

Province	HF ID	Output Mix							Input Mix			
Badakhshan	401	1287	612	333	597	23779	1806	9	3	4	2	5
	402	1093	519	142	430	26646	1488	24	3	5	2	3
	406	1502	806	540	1027	31854	1573	6	3	4	2	4
	410	2746	1390	696	2095	51777	2419	37	2	7	2	5
	412	998	464	218	927	29092	1408	3	3	6	2	4
	425	1453	642	306	698	29941	1616	11	3	5	2	5
	1713	485	175	74	278	22633	947	7	3	5	2	5
	1838	544	312	161	641	23553	1468	16	3	5	2	5
	2049	4221	1097	290	1320	30633	1588	12	2	3	2	3
	2050	1461	844	302	1224	27382	1803	17	1	6	2	6
Badghis	615	1135	1978	501	1764	43102	3557	98	3	6	2	4
	616	529	381	10	1311	51622	1256	36	3	5	2	3
Baghlan	460	1759	842	616	1168	39886	3843	22	2	6	2	4
	478	1706	750	396	2189	40532	3103	12	4	5	2	4
	480	842	442	370	621	29963	1438	22	1	6	2	6
	481	919	771	696	1089	28670	1593	9	3	6	2	6
	483	1221	544	437	907	20074	2122	14	3	3	2	4
	486	810	525	414	688	31111	2001	29	3	4	2	4
	488	1445	651	427	1054	35663	3175	7	3	5	2	4
	492	1057	561	503	791	35901	2666	25	3	4	2	4
	1190	1326	560	425	1153	31084	2110	13	3	3	2	4
	1195	1335	695	503	1138	29227	2628	10	3	5	2	4
	1803	1548	711	616	1864	26266	3043	20	4	5	3	4
	1804	749	552	415	705	31472	1101	11	3	5	2	4
Balkh	548	2873	405	194	1689	48797	4416	52	3	6	2	4

Province	HF ID	Output Mix							Input M ix			
	552	1229	528	260	310	22420	1300	11	3	5	2	4
	566	742	285	97	481	20130	952	18	3	6	2	4
	567	2819	1387	566	1634	30245	2154	160	3	6	2	4
	576	1217	303	155	526	21914	1133	15	3	6	2	5
	1081	2332	651	249	1201	37055	3536	41	3	6	2	4
	1082	2194	725	192	1496	33975	2209	21	3	2	2	3
	1180	3255	1490	249	2449	35680	2209	34	3	7	1	4
	1753	2499	1052	330	1660	36940	2081	17	3	6	2	4
	1762	912	125	96	438	21358	1488	0	3	4	2	4
	1829	1080	375	257	615	28099	932	11	3	5	2	3
Bamyan	494	1392	427	166	296	20763	781	8	3	5	2	4
	495	1172	403	266	268	35538	979	9	3	3	2	4
	1063	574	198	88	821	19598	1089	1	1	4	2	4
	1076	636	172	94	1166	17611	592	2	3	4	2	4
	1163	1327	336	202	440	21375	826	3	3	4	2	4
	1571	1541	325	179	383	17383	517	0	3	5	2	5
	1572	1017	407	215	411	20814	626	0	3	5	1	4
	1574	1036	210	122	491	17258	552	0	3	5	2	4
	1742	482	204	186	445	14903	674	10	3	4	2	4
	1774	347	86	48	203	8313	396	0	3	4	2	4
Dykundi	1822	564	125	188	271	24353	1544	0	3	6	2	4
	2200	635	221	168	1164	22580	2015	8	3	4	2	4
	2203	800	369	286	1514	31177	3651	2	3	4	2	4
Farah	674	462	206	102	755	31657	2092	7	3	5	2	4
	676	134	87	0	287	30468	1773	29	3	2	2	4
	677	498	304	277	1265	26653	864	8	3	4	2	4
	678	827	551	626	2443	77489	2675	51	3	4	2	3
	679	1132	557	116	820	36867	1065	14	2	4	0	4

Province	HF ID	Output Mix							Input M ix			
	680	453	386	324	1127	30778	2211	12	3	4	2	4
	683	579	240	285	1202	26491	2209	4	1	5	2	5
	684	914	790	148	670	23867	1729	7	3	6	2	4
	1175	630	426	403	1741	42131	2090	18	3	4	2	6
Faryab	595	1154	230	130	720	23560	2269	9	3	5	2	4
	597	2629	1218	394	583	33083	3313	7	3	5	2	4
	598	2307	1629	1079	1056	52715	6448	24	3	8	1	8
	600	1049	379	335	347	22366	3910	21	3	8	1	4
	603	3571	1060	748	1096	44098	5144	25	3	6	2	4
	604	2944	877	930	613	47594	4714	26	3	6	2	4
	609	1005	725	209	189	32366	1537	19	3	6	2	4
	1093	1263	841	398	628	37966	3784	20	3	6	2	4
	1551	1602	714	513	988	36193	3532	14	2	6	2	4
	1554	4159	1208	548	1469	33375	2906	15	3	5	2	4
	1909	756	358	282	704	44841	2635	20	3	6	2	4
	1913	950	312	303	243	25664	2450	14	3	3	2	1
	1918	1499	1142	273	1729	39871	2571	21	3	5	2	4
Ghazni	95	2789	2599	1309	2568	51295	3273	76	3	6	2	5
	96	1402	538	387	369	22912	2414	3	3	4	2	5
	99	342	212	0	380	21969	1528	23	3	2	2	5
	100	467	391	239	271	18027	2363	28	3	4	2	5
	107	1839	615	183	823	27821	2001	4	3	4	2	5
	253	540	349	280	658	16988	1448	2	3	5	2	4
	255	535	395	312	634	18422	1335	5	3	5	2	4
	260	774	331	69	344	18842	2737	8	3	4	2	4
	266	1834	1335	687	1181	26857	2603	0	3	5	2	5
	274	1341	627	162	906	32464	2627	6	3	5	2	5
	275	394	225	180	177	26643	1584	3	3	4	2	4

Province	HF ID	Output Mix							Input M ix			
	1078	661	259	235	497	23036	2453	18	3	4	2	4
	1229	153	115	0	291	15429	1532	1	3	2	1	2
	1615	703	404	523	425	21253	2334	4	2	7	2	5
	1616	935	391	329	376	23018	2032	14	3	5	2	5
	1625	259	96	68	136	10736	776	0	3	3	2	4
	1771	233	177	171	225	10879	733	3	3	5	2	4
	1988	354	223	310	352	13874	1101	11	2	5	2	5
	1989	332	256	162	527	11401	504	2	3	4	2	4
	1990	535	308	194	311	31781	1717	4	3	4	2	5
	2040	543	444	513	218	18632	1864	2	0	5	1	5
	2042	908	532	208	285	25790	2993	2	2	4	2	5
	2044	1593	1261	159	437	39638	2294	5	3	3	2	4
Ghor	793	801	499	373	4034	26963	2808	17	3	9	2	9
	794	951	237	161	1655	35322	1481	47	3	6	2	5
	795	804	270	84	664	35315	2123	35	3	6	2	5
	797	1583	1334	139	3385	36801	3064	25	2	3	1	5
	1581	978	442	377	3049	33107	2605	15	3	4	2	4
	1583	645	525	58	546	27814	2795	17	3	6	1	5
	1800	640	260	107	935	19247	1801	3	3	5	2	5
	1801	484	335	78	935	17999	1935	11	3	4	0	5
Helmand	693	1123	380	294	1614	31234	2213	8	2	4	1	4
	695	224	95	0	97	19994	2355	2	3	2	2	4
	697	1020	291	179	1717	24929	2281	12	3	5	2	3
	699	603	476	423	1908	39821	3596	19	1	6	2	3
	702	1278	332	251	464	32992	4522	15	3	6	1	6
	707	763	729	208	917	63805	3124	4	3	6	2	4
	708	491	332	142	225	19756	1507	2	3	5	2	3
	1626	1740	413	390	1046	54259	4315	29	3	8	1	4

Province	HF ID	Output Mix							Input M ix			
	1632	599	165	0	228	45556	1709	0	3	3	1	4
	1790	1037	1044	1010	1383	34603	4006	11	3	6	2	4
	1845	531	92	30	549	32909	5658	10	3	4	2	4
	1850	377	183	108	725	31231	2898	5	3	4	2	4
	1851	470	302	108	535	24614	1208	4	1	5	2	4
	1883	117	73	0	116	17235	4190	3	0	2	2	3
	3021	244	96	0	139	10427	409	1	2	3	2	4
Hirat	626	6503	620	413	6665	54696	6258	38	3	6	2	5
	627	5156	588	381	3923	69096	7643	12	4	4	2	0
	628	3285	610	152	3433	50483	2756	24	2	8	2	5
	632	2552	367	312	4018	45342	4820	41	4	7	2	5
	639	3193	472	312	3765	72206	5672	9	3	8	2	0
	660	1749	639	549	1673	58757	4521	42	4	5	2	5
	661	784	370	343	1423	28418	1596	26	3	3	1	5
	663	650	471	437	2255	48836	1869	22	3	2	2	4
	665	1528	560	304	770	39369	2412	29	3	4	2	4
	667	350	160	109	390	20007	1863	35	3	2	2	4
	670	522	303	244	751	21132	1664	18	3	3	2	4
	671	1643	609	262	892	51349	2154	33	3	4	1	5
	1592	2479	392	233	2070	34202	1894	4	3	6	2	5
	1678	592	177	83	472	39969	4839	7	3	4	2	4
	1735	2728	593	436	1660	40576	3223	23	3	3	2	4
	1737	1286	619	541	2484	52599	2772	6	3	6	2	5
	1974	895	257	107	854	37529	1790	11	3	6	2	6
Jawzjan	585	1671	632	375	340	38014	1512	7	3	1	2	4
	587	1365	788	501	128	20791	2170	20	3	4	2	4
	592	1282	918	457	230	33617	2250	34	2	6	2	4
	593	2416	1628	737	667	46304	2398	13	3	5	2	4

Province	HF ID	Output Mix							Input M ix			
	1035	2567	1522	608	294	30813	3193	10	3	4	2	4
	2033	1216	330	141	184	22926	2454	23	3	3	2	4
Kabul	3	2898	1068	701	2455	36746	3096	9	3	6	2	4
	4	1586	451	294	1154	44960	1890	6	2	5	2	0
	10	1591	1231	424	1111	54597	1760	9	3	6	2	4
	14	696	421	47	870	30154	1119	3	3	6	2	4
	15	1107	1064	1005	826	56816	2031	15	3	6	1	5
	1671	838	589	39	556	23522	1268	6	0	5	2	0
	1672	746	441	79	367	19556	1328	2	1	1	2	0
	2150	0	0	0	0	21590	1455	1	3	3	2	0
Kandahar	711	880	266	69	591	33681	1551	8	3	3	2	4
	723	1540	593	156	472	35647	2399	25	3	6	2	4
	726	427	250	202	143	34289	1575	6	3	2	2	4
	733	793	319	111	327	25591	2531	6	3	5	2	4
	735	585	376	92	244	23002	981	2	3	4	2	4
	737	452	194	123	339	24070	1128	3	2	4	2	4
	743	514	206	91	387	47430	3072	17	3	5	2	4
	747	767	152	54	485	24592	969	19	3	4	2	4
	748	238	97	27	81	11226	1175	1	3	4	2	4
	754	164	88	71	381	26183	1867	5	3	0	2	4
	2017	12	4	0	131	13721	1419	7	3	2	1	4
	2025	677	249	43	497	31017	4640	15	2	3	2	4
	2157	2124	819	249	974	28363	2173	16	2	5	2	4
	2185	908	188	126	463	24460	2094	10	3	5	2	4
	2186	1651	272	92	1244	33187	3014	13	2	6	2	4
	2544	37	30	0	157	5876	524	0	3	3	1	4
	2926	1165	344	85	662	24599	1903	6	3	4	1	4
	2960	268	61	33	513	18591	1264	0	3	4	2	4

Province	HF ID	Output Mix							Input M ix			
	2963	916	342	41	208	25936	2397	19	3	4	2	4
	2964	933	139	48	440	32413	1803	27	3	3	2	1
Kapisa	48	1391	690	101	1459	32268	2040	14	3	4	2	0
	49	1309	475	58	1442	15308	1716	7	3	4	2	0
	55	1234	732	47	1022	22535	1338	1	2	6	1	1
	58	1161	863	65	821	26184	2193	4	3	3	0	1
	1545	901	784	91	1929	22171	1642	3	3	3	2	0
	1546	823	169	89	3063	24251	1620	22	1	4	2	4
Khost	864	619	413	307	874	19019	2729	16	3	3	2	6
	866	1303	1087	129	881	14810	2309	17	3	5	2	6
	867	508	102	0	488	15292	966	12	3	2	2	5
	868	214	16	0	131	13850	2860	9	3	2	2	5
	869	2228	1770	243	928	28738	3515	21	3	6	1	5
	870	652	486	77	368	31105	3883	10	2	2	2	5
	871	1610	633	266	1916	22230	2130	67	3	5	2	0
	872	1251	1222	122	508	18219	4027	20	3	3	2	6
	1029	999	1109	89	1701	19367	6898	18	3	5	2	5
	1618	54	15	0	126	11119	2422	8	3	1	2	5
	1621	1734	1278	406	655	22075	3575	12	3	2	2	5
	1622	1017	916	164	1507	16180	2809	14	3	4	1	6
Kunar	384	734	258	258	779	40764	1920	17	3	7	2	4
	394	699	559	536	1191	65367	2127	27	3	6	2	5
	395	850	714	709	1656	64955	1717	15	3	6	2	6
	396	356	119	118	490	40438	1379	16	3	6	2	4
	398	1142	809	794	998	61004	1809	40	3	7	2	6
	400	523	327	340	1373	52635	1941	12	2	6	2	4
	1591	330	216	257	620	23372	1265	21	5	5	2	0
	1944	666	370	307	864	63988	1475	51	2	6	2	5

Province	HF ID	Output Mix							Input M ix			
Kunduz	510	2189	1319	862	704	35193	3416	25	3	6	2	4
	516	2407	1108	854	874	33923	3573	48	3	3	2	4
	518	3094	1482	1285	666	51493	3887	78	3	5	2	6
	523	2175	891	659	560	22778	2619	17	3	6	2	4
	528	1860	988	612	719	26772	2756	33	3	5	2	4
	1155	3139	1128	526	607	29189	5767	35	3	6	2	5
	1934	1744	888	553	540	33572	2913	13	3	6	2	4
	1935	2300	620	548	319	24309	1153	23	3	5	2	6
	1937	1473	569	300	940	27035	1965	12	3	4	2	4
	1939	1421	690	364	486	22426	2516	15	2	4	2	2
	1955	2365	560	383	438	35251	1110	20	3	6	2	5
	2432	1673	563	179	635	43403	2382	17	2	3	2	1
Laghman	362	1493	636	637	1484	58965	4069	20	3	7	2	5
	365	621	419	417	821	50466	2427	1	3	7	2	6
	367	648	919	919	1177	42820	2347	11	3	7	2	6
	372	640	636	616	1016	39571	2417	23	3	7	2	6
	375	320	287	259	803	27480	1675	10	3	7	2	6
	376	316	209	211	396	24374	2272	5	3	7	1	6
	378	441	389	353	975	40582	2249	24	3	7	2	6
	1575	263	87	15	250	34086	1152	5	3	6	2	5
Logar	224	1290	342	106	699	30909	1824	10	3	6	2	4
	227	753	299	1	496	17457	1547	0	3	2	1	2
	230	1518	1184	351	671	36684	1259	21	3	6	2	4
	235	792	768	533	748	36411	1348	9	3	5	2	4
	241	707	263	1	487	33169	1232	5	3	6	2	4
	1522	1413	465	27	864	32415	1706	3	3	6	2	1
Nangarhar	307	897	756	510	1178	32071	3290	20	3	6	2	4
	315	1041	770	243	667	25030	2845	8	3	6	2	4

Province	HF ID	Output Mix							Input M ix			
	317	735	495	292	549	28815	2451	6	3	4	1	5
	323	745	387	280	857	58533	2559	30	3	6	2	4
	327	590	373	395	637	35881	1460	5	3	4	2	5
	330	1784	801	811	2591	28525	1870	17	3	5	2	6
	333	843	597	380	1044	43837	2769	22	3	6	2	5
	335	627	192	93	484	42768	3213	19	3	5	2	4
	342	1142	657	367	622	46694	5324	12	3	6	2	4
	345	648	609	538	1310	58154	1963	9	3	7	1	6
	346	767	910	881	555	35972	2556	15	3	5	2	5
	347	1290	565	276	834	66804	5218	19	3	7	2	6
	350	887	1642	1583	706	31794	4440	8	3	6	2	5
	352	661	290	229	815	37217	2915	43	3	5	2	4
	354	778	1030	966	1174	44226	1906	24	3	6	2	4
	1181	1190	986	990	1613	47250	3803	20	3	6	2	4
	1214	660	373	221	436	31477	2686	5	2	6	2	5
	2088	124	9	9	45	37179	2070	6	3	4	2	1
Nimroz	1031	621	364	237	790	23211	1718	8	3	5	2	5
	1858	380	125	0	64	31678	311	0	1	7	7	1
Nooristan	851	329	206	205	209	13921	468	5	3	5	2	5
	1578	124	50	33	66	10726	1208	17	3	4	1	4
Paktika	823	189	148	0	444	14723	1033	9	3	0	2	3
	825	369	294	24	776	21655	1114	0	3	2	2	4
	841	564	405	257	855	22742	3038	5	3	5	2	2
Paktya	282	2712	1338	1173	735	30099	3353	42	3	5	2	4
	287	1595	1341	969	1729	38412	1312	4	3	6	2	5
	1518	764	425	384	471	28478	2436	28	3	5	2	4
	1520	567	522	413	992	36588	1283	3	3	4	2	5
	1549	2131	867	1010	399	41200	2041	18	3	5	2	5

Province	HF ID	Output Mix							Input M ix			
	1718	1003	263	164	826	22020	1948	8	3	5	2	4
	1728	701	465	226	412	11770	1112	5	3	7	2	4
	1730	304	79	246	236	21302	1829	17	3	4	2	4
Panjsher	78	1370	559	163	1053	20568	473	3	3	2	1	6
	80	1008	283	115	344	19729	745	10	3	4	1	5
Parwan	16	647	175	40	213	9302	722	3	3	4	2	3
	18	1952	414	98	1120	48189	2614	17	3	7	3	4
	62	1123	263	52	780	20274	1170	7	3	4	2	3
	65	1847	512	333	603	19931	1324	10	3	5	2	3
	67	1315	252	227	779	23634	1191	7	3	5	2	3
	70	1249	318	168	271	17697	1492	30	3	4	2	3
	72	2185	424	414	581	35723	1095	32	3	7	2	4
	1043	1110	390	232	532	11253	1463	0	3	3	1	3
Samangan	534	849	449	285	431	27580	2438	20	0	3	0	1
	536	984	393	303	453	24070	1818	5	3	5	2	2
	538	567	190	103	305	17446	1381	3	3	4	1	2
	1116	1440	550	407	330	18002	2628	6	3	3	1	0
	1117	665	350	316	706	21158	1329	3	3	5	3	0
Sar-e-Pul	855	3104	1049	620	791	39570	2638	9	3	6	2	5
	857	894	441	198	169	28886	1408	3	3	4	2	5
	860	927	458	266	315	20639	2258	16	3	4	2	4
	1055	1587	773	759	1014	33651	2037	23	3	5	2	5
	1057	2328	1113	370	1279	33837	1809	14	3	5	2	3
	1537	2504	1586	650	1186	28645	2073	54	3	5	2	5
	1732	839	355	156	286	27402	2222	8	3	4	1	4
	1859	2096	1129	350	867	31549	1923	20	3	5	2	4
Takhar	427	2341	870	253	769	26864	3868	17	3	5	2	4
	434	1997	765	529	400	37062	3255	32	3	5	2	4

Province	HF ID	Output Mix							Input M ix			
	436	1317	635	370	270	22752	3024	14	3	6	2	4
	437	1865	822	235	244	19720	1275	14	3	3	2	4
	438	1374	557	431	440	29587	1256	40	3	5	2	4
	446	1399	757	419	731	31116	2173	18	3	5	2	4
	451	1902	1223	1067	531	52486	4469	43	3	5	2	4
	452	4244	1703	852	1228	40895	3509	28	3	6	2	4
	454	2595	1025	530	822	26989	1714	24	3	5	2	4
	455	1842	901	645	704	32242	2091	33	2	6	2	4
	1161	1613	693	293	303	18539	1326	9	3	4	2	4
	1709	3333	1236	625	800	29535	2197	43	3	6	2	0
Urozgan	767	686	190	73	364	64579	1960	0	3	2	2	4
	774	1426	455	364	255	56089	2177	15	3	3	2	4
	780	710	222	0	237	33845	2369	2	3	1	2	3
	2094	871	226	134	352	51612	3775	7	3	3	2	4
	2097	382	70	25	537	27419	1395	0	3	1	1	3
Wardak	88	421	275	125	437	21528	653	1	3	5	2	4
	197	458	231	189	483	22953	1601	13	3	5	2	4
	203	441	269	301	255	18323	1035	12	3	5	2	4
	207	506	353	135	395	26125	1224	11	3	5	2	4
	215	639	302	238	503	31383	1513	6	3	5	2	4
	223	419	80	30	287	47498	1245	14	3	4	1	4
Zabul	762	448	303	35	276	24136	1837	0	3	3	0	5
	1892	228	116	92	253	18300	854	4	3	3	2	0
	1893	177	147	132	214	7923	938	6	3	5	2	5
	1894	400	114	0	199	13778	1312	4	3	3	1	5
	2029	151	134	131	196	12295	918	0	3	2	1	5
	2106	249	118	56	274	13381	885	12	3	4	2	5

Appendix B: Results from DEAP Version 2.1

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
Badakhshan	401	0.451	0.456	0.99	drs	0.451	0.525	0.859	irs
	402	0.415	0.432	0.961	drs	0.415	0.478	0.867	irs
	406	0.617	0.618	0.999	irs	0.617	0.689	0.896	irs
	410	0.779	1	0.779	drs	0.779	1	0.779	drs
	412	0.351	0.428	0.82	drs	0.351	0.391	0.898	irs
	425	0.446	0.489	0.911	drs	0.446	0.468	0.951	irs
	1713	0.258	0.302	0.853	drs	0.258	0.375	0.687	irs
	1838	0.314	0.355	0.884	drs	0.314	0.39	0.805	irs
	2049	1	1	1	-	1	1	1	-
	2050	0.629	0.802	0.784	drs	0.629	0.681	0.923	drs
Badghis	615	1	1	1	-	1	1	1	-
	616	0.631	0.676	0.933	drs	0.631	0.656	0.961	irs
Baghlan	460	0.682	0.847	0.805	drs	0.682	0.729	0.935	drs
	478	0.589	0.632	0.932	drs	0.589	0.621	0.947	irs
	480	0.49	0.742	0.661	drs	0.49	0.503	0.974	irs
	481	0.526	0.545	0.964	drs	0.526	0.591	0.891	irs
	483	0.597	0.598	0.998	irs	0.597	0.723	0.825	irs
	486	0.543	0.544	0.998	drs	0.543	0.611	0.889	irs
	488	0.553	0.602	0.918	drs	0.553	0.556	0.995	irs
	492	0.635	0.635	1	-	0.635	0.655	0.969	irs
	1190	0.652	0.652	1	-	0.652	0.736	0.886	irs
	1195	0.53	0.541	0.98	drs	0.53	0.584	0.908	irs
	1803	0.621	0.651	0.954	drs	0.621	0.646	0.961	irs
	1804	0.448	0.467	0.96	drs	0.448	0.512	0.876	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
Balkh	548	0.737	0.886	0.833	drs	0.737	0.802	0.92	drs
	552	0.355	0.381	0.934	drs	0.355	0.44	0.808	irs
	566	0.26	0.306	0.849	drs	0.26	0.359	0.724	irs
	567	1	1	1	-	1	1	1	-
	576	0.295	0.341	0.864	drs	0.295	0.38	0.775	irs
	1081	0.579	0.697	0.83	drs	0.579	0.586	0.988	irs
	1082	1	1	1	-	1	1	1	-
	1180	0.893	1	0.893	drs	0.893	1	0.893	drs
	1753	0.576	0.655	0.879	drs	0.576	0.583	0.989	irs
	1762	0.306	0.321	0.952	drs	0.306	0.465	0.657	irs
	1829	0.378	0.418	0.904	drs	0.378	0.447	0.845	irs
Bamyan	494	0.324	0.359	0.9	drs	0.324	0.448	0.722	irs
	495	0.587	0.599	0.98	drs	0.587	0.62	0.948	irs
	1063	0.448	0.477	0.94	drs	0.448	0.568	0.789	irs
	1076	0.298	0.299	0.997	drs	0.298	0.509	0.586	irs
	1163	0.363	0.371	0.978	drs	0.363	0.508	0.714	irs
	1571	0.309	0.319	0.968	drs	0.309	0.459	0.673	irs
	1572	0.369	0.405	0.911	drs	0.369	0.48	0.769	irs
	1574	0.245	0.273	0.896	drs	0.245	0.415	0.589	irs
	1742	0.239	0.239	0.998	-	0.239	0.447	0.534	irs
	1774	0.121	0.127	0.953	drs	0.121	0.432	0.279	irs
Dykundi	1822	0.268	0.342	0.782	drs	0.268	0.343	0.779	irs
	2200	0.37	0.37	1	-	0.37	0.515	0.718	irs
	2203	0.572	0.578	0.989	drs	0.572	0.638	0.896	irs
Farah	674	0.38	0.451	0.843	drs	0.38	0.435	0.875	irs
	676	0.752	0.752	1	-	0.752	0.801	0.939	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	677	0.427	0.427	1	-	0.427	0.557	0.767	irs
	678	1	1	1	-	1	1	1	-
	679	1	1	1	-	1	1	1	-
	680	0.497	0.497	1	-	0.497	0.565	0.88	irs
	683	0.558	0.67	0.833	drs	0.558	0.609	0.917	irs
	684	0.383	0.42	0.911	drs	0.383	0.429	0.892	irs
	1175	0.637	0.637	1	-	0.637	0.646	0.986	irs
Faryab	595	0.323	0.386	0.836	drs	0.323	0.432	0.746	irs
	597	0.711	0.73	0.975	drs	0.711	0.715	0.994	irs
	598	0.974	1	0.974	drs	0.974	1	0.974	drs
	600	0.451	0.736	0.613	drs	0.451	0.502	0.898	drs
	603	0.82	0.925	0.886	drs	0.82	0.886	0.925	drs
	604	0.839	0.941	0.891	drs	0.839	0.906	0.925	drs
	609	0.437	0.497	0.879	drs	0.437	0.448	0.976	irs
	1093	0.548	0.667	0.821	drs	0.548	0.548	1	-
	1551	0.593	0.754	0.786	drs	0.593	0.593	1	-
	1554	0.888	0.897	0.989	drs	0.888	0.889	0.998	irs
	1909	0.474	0.617	0.768	drs	0.474	0.478	0.992	irs
	1913	0.681	0.686	0.994	irs	0.681	0.738	0.923	irs
	1918	0.665	0.68	0.978	drs	0.665	0.669	0.994	irs
Ghazni	95	1	1	1	-	1	1	1	-
	96	0.484	0.491	0.986	drs	0.484	0.554	0.874	irs
	99	0.589	0.589	1	-	0.589	0.69	0.854	irs
	100	0.491	0.491	1	-	0.491	0.537	0.913	irs
	107	0.497	0.518	0.959	drs	0.497	0.568	0.875	irs
	253	0.299	0.306	0.976	drs	0.299	0.442	0.676	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	255	0.314	0.321	0.979	drs	0.314	0.456	0.688	irs
	260	0.414	0.426	0.972	drs	0.414	0.492	0.842	irs
	266	0.663	0.666	0.996	drs	0.663	0.699	0.949	irs
	274	0.461	0.538	0.857	drs	0.461	0.472	0.976	irs
	275	0.37	0.382	0.968	drs	0.37	0.447	0.828	irs
	1078	0.445	0.445	1	-	0.445	0.502	0.886	irs
	1229	0.434	0.533	0.814	irs	0.434	0.85	0.511	irs
	1615	0.41	0.543	0.754	drs	0.41	0.455	0.9	irs
	1616	0.37	0.398	0.929	drs	0.37	0.437	0.847	irs
	1625	0.183	0.184	0.995	drs	0.183	0.5	0.366	irs
	1771	0.173	0.181	0.957	drs	0.173	0.382	0.454	irs
	1988	0.308	0.323	0.951	drs	0.308	0.459	0.67	irs
	1989	0.206	0.207	0.999	-	0.206	0.443	0.465	irs
	1990	0.43	0.454	0.947	drs	0.43	0.469	0.918	irs
	2040	1	1	1	-	1	1	1	-
	2042	0.548	0.598	0.917	drs	0.548	0.558	0.982	irs
	2044	0.926	0.926	1	-	0.926	0.926	1	-
Ghor	793	0.568	0.671	0.847	drs	0.568	0.587	0.968	drs
	794	0.526	0.584	0.9	drs	0.526	0.555	0.946	irs
	795	0.45	0.56	0.804	drs	0.45	0.466	0.966	irs
	797	1	1	1	-	1	1	1	-
	1581	0.76	0.764	0.996	irs	0.76	0.813	0.935	irs
	1583	0.435	0.556	0.783	drs	0.435	0.456	0.954	irs
	1800	0.271	0.316	0.857	drs	0.271	0.415	0.652	irs
	1801	0.982	1	0.982	drs	0.982	1	0.982	drs
Helmand	693	0.67	0.677	0.989	drs	0.67	0.711	0.942	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	695	0.504	0.504	1	-	0.504	0.649	0.776	irs
	697	0.392	0.412	0.953	drs	0.392	0.53	0.74	irs
	699	0.744	1	0.744	drs	0.744	1	0.744	drs
	702	0.639	0.777	0.823	drs	0.639	0.699	0.915	drs
	707	0.697	0.882	0.791	drs	0.697	0.795	0.877	drs
	708	0.28	0.316	0.885	drs	0.28	0.395	0.707	irs
	1626	0.582	1	0.582	drs	0.582	1	0.582	drs
	1632	0.898	0.909	0.988	drs	0.898	0.899	1	-
	1790	0.792	0.825	0.96	drs	0.792	0.797	0.993	irs
	1845	0.787	0.83	0.949	drs	0.787	0.803	0.981	irs
	1850	0.467	0.502	0.932	drs	0.467	0.505	0.926	irs
	1851	0.413	0.56	0.737	drs	0.413	0.448	0.921	irs
	1883	1	1	1	-	1	1	1	-
	3021	0.19	0.196	0.967	drs	0.19	0.545	0.348	irs
Hirat	626	1	1	1	-	1	1	1	-
	627	1	1	1	-	1	1	1	-
	628	0.687	0.985	0.698	drs	0.687	0.973	0.706	drs
	632	0.691	0.815	0.847	drs	0.691	0.693	0.997	drs
	639	1	1	1	-	1	1	1	-
	660	0.814	0.895	0.909	drs	0.814	0.814	1	-
	661	0.784	0.847	0.925	irs	0.784	0.91	0.861	irs
	663	1	1	1	-	1	1	1	-
	665	0.637	0.638	0.999	-	0.637	0.652	0.978	irs
	667	0.745	0.745	1	-	0.745	0.803	0.928	irs
	670	0.453	0.453	0.999	-	0.453	0.588	0.77	irs
	671	0.954	0.985	0.969	drs	0.954	0.981	0.973	drs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	1592	0.475	0.549	0.864	drs	0.475	0.529	0.898	irs
	1678	0.673	0.714	0.943	drs	0.673	0.714	0.943	irs
	1735	0.862	0.868	0.992	irs	0.862	0.888	0.971	irs
	1737	0.675	0.77	0.877	drs	0.675	0.678	0.996	irs
	1974	0.397	0.498	0.796	drs	0.397	0.417	0.951	irs
Jawzjan	585	1	1	1	-	1	1	1	-
	587	0.543	0.543	1	-	0.543	0.641	0.847	irs
	592	0.553	0.697	0.793	drs	0.553	0.554	0.998	irs
	593	0.852	0.859	0.992	drs	0.852	0.854	0.998	irs
	1035	0.895	0.895	1	-	0.895	0.904	0.991	irs
	2033	0.568	0.568	1	-	0.568	0.656	0.867	irs
Kabul	3	0.728	0.752	0.969	drs	0.728	0.74	0.984	irs
	4	1	1	1	-	1	1	1	-
	10	0.739	0.837	0.883	drs	0.739	0.746	0.992	drs
	14	0.348	0.425	0.818	drs	0.348	0.386	0.901	irs
	15	1	1	1	-	1	1	1	-
	1671	1	1	1	-	1	1	1	-
	1672	1	1	1	-	1	1	1	-
	2150	0.411	0.411	1	-	0.411	0.739	0.556	irs
Kandahar	711	0.516	0.524	0.986	drs	0.516	0.588	0.878	irs
	723	0.459	0.554	0.828	drs	0.459	0.465	0.988	irs
	726	0.645	0.645	1	-	0.645	0.713	0.905	irs
	733	0.358	0.423	0.845	drs	0.358	0.418	0.856	irs
	735	0.349	0.356	0.981	drs	0.349	0.444	0.787	irs
	737	0.364	0.401	0.906	drs	0.364	0.462	0.788	irs
	743	0.57	0.672	0.848	drs	0.57	0.572	0.997	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	747	0.377	0.378	0.999	-	0.377	0.475	0.795	irs
	748	0.177	0.188	0.94	drs	0.177	0.432	0.408	irs
	754	1	1	1	-	1	1	1	-
	2017	0.443	0.5	0.887	irs	0.443	0.771	0.575	irs
	2025	0.864	0.864	1	-	0.864	0.881	0.981	irs
	2157	0.562	0.643	0.874	drs	0.562	0.562	1	-
	2185	0.322	0.383	0.841	drs	0.322	0.407	0.792	irs
	2186	0.466	0.633	0.736	drs	0.466	0.474	0.983	irs
	2544	0.129	0.13	0.993	irs	0.129	0.6	0.214	irs
	2926	0.451	0.479	0.942	drs	0.451	0.584	0.773	irs
	2960	0.256	0.274	0.937	drs	0.256	0.44	0.583	irs
	2963	0.464	0.465	0.998	drs	0.464	0.5	0.928	irs
	2964	0.762	0.762	1	-	0.762	0.825	0.923	irs
Kapisa	48	0.838	0.838	1	-	0.838	0.89	0.942	irs
	49	0.627	0.627	1	-	0.627	0.818	0.766	irs
	55	0.729	0.785	0.929	drs	0.729	0.745	0.978	drs
	58	1	1	1	-	1	1	1	-
	1545	1	1	1	-	1	1	1	-
	1546	1	1	1	-	1	1	1	-
Khost	864	0.564	0.564	1	-	0.564	0.652	0.865	irs
	866	0.518	0.55	0.943	drs	0.518	0.549	0.945	irs
	867	0.373	0.375	0.995	irs	0.373	0.611	0.611	irs
	868	0.658	0.658	1	-	0.658	0.719	0.916	irs
	869	0.911	1	0.911	drs	0.911	1	0.911	drs
	870	0.979	0.994	0.985	drs	0.979	0.993	0.986	drs
	871	1	1	1	-	1	1	1	-

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	872	0.908	0.938	0.968	drs	0.908	0.924	0.983	drs
	1029	0.962	1	0.962	drs	0.962	1	0.962	drs
	1618	0.791	0.791	1	-	0.791	0.832	0.95	irs
	1621	1	1	1	-	1	1	1	-
	1622	0.672	0.707	0.95	drs	0.672	0.69	0.973	irs
Kunar	384	0.389	0.537	0.725	drs	0.389	0.402	0.968	irs
	394	0.679	0.858	0.791	drs	0.679	0.765	0.887	drs
	395	0.744	0.908	0.819	drs	0.744	0.852	0.874	drs
	396	0.417	0.522	0.799	drs	0.417	0.442	0.944	irs
	398	0.683	0.901	0.758	drs	0.683	0.841	0.812	drs
	400	0.642	0.857	0.749	drs	0.642	0.747	0.86	drs
	1591	0.568	0.568	1	-	0.568	0.691	0.823	irs
	1944	0.819	1	0.819	drs	0.819	1	0.819	drs
Kunduz	510	0.729	0.772	0.944	drs	0.729	0.736	0.991	irs
	516	1	1	1	-	1	1	1	-
	518	1	1	1	-	1	1	1	-
	523	0.599	0.64	0.937	drs	0.599	0.612	0.979	irs
	528	0.603	0.608	0.992	drs	0.603	0.642	0.94	irs
	1155	0.806	0.957	0.842	drs	0.806	0.925	0.872	drs
	1934	0.523	0.597	0.877	drs	0.523	0.539	0.971	irs
	1935	0.568	0.568	1	-	0.568	0.629	0.904	irs
	1937	0.476	0.486	0.978	drs	0.476	0.555	0.858	irs
	1939	0.617	0.619	0.997	drs	0.617	0.632	0.976	irs
	1955	0.496	0.58	0.854	drs	0.496	0.512	0.969	irs
	2432	0.898	0.941	0.954	drs	0.898	0.925	0.97	drs
Laghman	362	0.644	0.875	0.736	drs	0.644	0.781	0.824	drs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	365	0.478	0.68	0.702	drs	0.478	0.478	0.998	irs
	367	0.644	0.769	0.838	drs	0.644	0.646	0.998	irs
	372	0.492	0.633	0.777	drs	0.492	0.5	0.984	irs
	375	0.282	0.391	0.721	drs	0.282	0.335	0.841	irs
	376	0.303	0.452	0.67	drs	0.303	0.348	0.871	irs
	378	0.397	0.573	0.693	drs	0.397	0.405	0.98	irs
	1575	0.34	0.44	0.773	drs	0.34	0.379	0.897	irs
Logar	224	0.355	0.449	0.79	drs	0.355	0.394	0.902	irs
	227	0.526	0.578	0.911	irs	0.526	0.856	0.615	irs
	230	0.581	0.619	0.939	drs	0.581	0.587	0.989	irs
	235	0.553	0.56	0.988	drs	0.553	0.597	0.926	irs
	241	0.346	0.442	0.782	drs	0.346	0.387	0.893	irs
	1522	0.437	0.515	0.847	drs	0.437	0.464	0.941	irs
Nangarhar	307	0.515	0.593	0.869	drs	0.515	0.531	0.97	irs
	315	0.447	0.516	0.865	drs	0.447	0.456	0.98	irs
	317	0.586	0.602	0.974	drs	0.586	0.609	0.962	irs
	323	0.604	0.767	0.787	drs	0.604	0.62	0.973	drs
	327	0.523	0.523	1	-	0.523	0.561	0.931	irs
	330	0.842	0.842	1	-	0.842	0.869	0.97	irs
	333	0.503	0.64	0.786	drs	0.503	0.508	0.99	drs
	335	0.545	0.642	0.848	drs	0.545	0.551	0.99	irs
	342	0.633	0.816	0.776	drs	0.633	0.684	0.926	drs
	345	0.686	1	0.686	drs	0.686	1	0.686	drs
	346	0.721	0.721	1	-	0.721	0.751	0.96	irs
	347	0.67	0.968	0.692	drs	0.67	0.944	0.71	drs
	350	1	1	1	-	1	1	1	-

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	352	0.615	0.665	0.925	drs	0.615	0.62	0.992	irs
	354	0.796	0.842	0.944	drs	0.796	0.799	0.996	drs
	1181	0.83	0.896	0.926	drs	0.83	0.842	0.985	drs
	1214	0.406	0.582	0.699	drs	0.406	0.409	0.994	irs
	2088	0.566	0.577	0.981	drs	0.566	0.627	0.903	irs
Nimroz	1031	0.33	0.365	0.905	drs	0.33	0.419	0.788	irs
	1858	0.517	0.736	0.703	drs	0.517	0.537	0.963	drs
Nooristan	851	0.203	0.215	0.945	drs	0.203	0.383	0.53	irs
	1578	0.326	0.326	0.999	-	0.326	0.545	0.597	irs
Paktika	823	1	1	1	-	1	1	1	-
	825	0.452	0.459	0.985	drs	0.452	0.641	0.706	irs
	841	0.43	0.484	0.888	drs	0.43	0.494	0.87	irs
Paktya	282	1	1	1	-	1	1	1	-
	287	0.738	0.745	0.991	drs	0.738	0.773	0.954	irs
	1518	0.47	0.509	0.923	drs	0.47	0.509	0.925	irs
	1520	0.551	0.551	1	-	0.551	0.589	0.936	irs
	1549	0.834	0.834	1	-	0.834	0.847	0.984	irs
	1718	0.302	0.351	0.861	drs	0.302	0.426	0.71	irs
	1728	0.207	0.244	0.85	drs	0.207	0.324	0.64	irs
	1730	0.383	0.383	1	-	0.383	0.481	0.796	irs
Panjsher	78	0.761	1	0.761	irs	0.761	1	0.761	irs
	80	0.384	0.397	0.966	drs	0.384	0.56	0.686	irs
Parwan	16	0.163	0.169	0.966	drs	0.163	0.447	0.365	irs
	18	0.498	0.679	0.733	drs	0.498	0.523	0.952	drs
	62	0.322	0.334	0.966	drs	0.322	0.5	0.645	irs
	65	0.438	0.455	0.963	drs	0.438	0.518	0.845	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	67	0.344	0.376	0.913	drs	0.344	0.453	0.759	irs
	70	0.417	0.419	0.995	irs	0.417	0.587	0.709	irs
	72	0.474	0.595	0.796	drs	0.474	0.479	0.989	irs
	1043	0.496	0.538	0.921	irs	0.496	0.721	0.688	irs
Samangan	534	1	1	1	-	1	1	1	-
	536	0.399	0.42	0.949	drs	0.399	0.477	0.835	irs
	538	0.311	0.331	0.938	drs	0.311	0.567	0.549	irs
	1116	1	1	1	-	1	1	1	-
	1117	0.608	0.609	0.999	irs	0.608	0.654	0.93	irs
Sar-e-Pul	855	0.683	0.721	0.946	drs	0.683	0.687	0.994	irs
	857	0.424	0.449	0.945	drs	0.424	0.468	0.906	irs
	860	0.42	0.432	0.973	drs	0.42	0.499	0.843	irs
	1055	0.65	0.65	1	-	0.65	0.698	0.931	irs
	1057	0.649	0.652	0.995	drs	0.649	0.671	0.967	irs
	1537	0.805	0.805	1	-	0.805	0.827	0.973	irs
	1732	0.499	0.53	0.941	drs	0.499	0.544	0.917	irs
	1859	0.6	0.609	0.985	drs	0.6	0.627	0.956	irs
Takhar	427	0.629	0.683	0.922	drs	0.629	0.629	1	-
	434	0.612	0.661	0.926	drs	0.612	0.616	0.993	irs
	436	0.434	0.505	0.861	drs	0.434	0.452	0.961	irs
	437	0.617	0.617	1	-	0.617	0.72	0.857	irs
	438	0.511	0.525	0.974	drs	0.511	0.576	0.888	irs
	446	0.492	0.519	0.948	drs	0.492	0.528	0.931	irs
	451	0.998	1	0.998	drs	0.998	1	0.998	drs
	452	0.968	1	0.968	drs	0.968	1	0.968	drs
	454	0.644	0.644	1	-	0.644	0.673	0.958	irs

Province	HF ID	Output oriented				Input oriented			
		TECRS	TEVRS	SE	P.SE	TECRS	TEVRS	SE	P.SE
	455	0.64	0.731	0.875	drs	0.64	0.641	0.998	drs
	1161	0.448	0.448	1	-	0.448	0.563	0.795	irs
	1709	1	1	1	-	1	1	1	-
Urozgan	767	1	1	1	-	1	1	1	-
	774	0.878	0.881	0.997	drs	0.878	0.879	1	-
	780	0.907	0.907	1	-	0.907	0.936	0.969	irs
	2094	0.829	0.836	0.992	drs	0.829	0.836	0.992	irs
	2097	0.953	1	0.953	irs	0.953	1	0.953	irs
Wardak	88	0.269	0.298	0.903	drs	0.269	0.381	0.707	irs
	197	0.298	0.346	0.862	drs	0.298	0.391	0.762	irs
	203	0.296	0.302	0.982	drs	0.296	0.438	0.675	irs
	207	0.332	0.368	0.901	drs	0.332	0.387	0.857	irs
	215	0.372	0.428	0.868	drs	0.372	0.432	0.86	irs
	223	0.793	0.831	0.955	drs	0.793	0.804	0.987	drs
Zabul	762	0.875	0.875	0.999	-	0.875	1	0.875	irs
	1892	0.367	0.367	1	-	0.367	0.714	0.514	irs
	1893	0.154	0.164	0.936	drs	0.154	0.375	0.41	irs
	1894	0.307	0.31	0.99	irs	0.307	0.6	0.511	irs
	2029	0.384	0.416	0.923	irs	0.384	0.793	0.484	irs
	2106	0.224	0.224	1	-	0.224	0.429	0.522	irs

Appendix C: Summary of output slacks of CHCs

Province	CHC ID	Comprehensive Health Centers Output

		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
Badakhshan	401	0	0	0	936	0	0	18
	402	0	0	411	1786	0	403	0
	406	0	0	0	0	0	834	41
	410	0	0	0	0	0	0	0
	412	0	0	188	879	0	690	36
	425	0	0	173	1817	0	761	29
	1713	0	0	318	1977	0	350	19
	1838	1021	0	224	1384	0	0	0
	2049	0	0	0	0	0	0	0
	2050	0	0	23	19	0	0	5
Badghis	615	0	0	0	0	0	0	0
	616	110	7	607	496	0	829	0
Baghlan	460	0	129	0	0	0	0	3
	478	790	0	93	0	0	0	24
	480	0	188	0	284	0	665	4
	481	1009	1087	0	565	0	324	58
	483	330	30	0	0	5082	0	18
	486	720	0	61	422	0	0	0
	488	591	0	0	645	0	0	21
	492	1058	51	0	367	0	0	8
	1190	0	0	0	0	0	0	14
	1195	1008	58	0	0	0	0	33
	1803	1088	675	0	0	15259	0	21
	1804	0	93	0	867	0	586	37
Balkh	548	1491	278	238	2975	0	0	0
	552	0	0	119	2390	0	950	21
	566	0	0	366	1713	0	363	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	567	0	0	0	0	0	0	0
	576	0	0	155	2664	0	1206	0
	1081	1060	0	89	2894	0	0	0
	1082	0	0	0	0	0	0	0
	1180	0	0	0	0	0	0	0
	1753	0	0	350	1091	0	1293	25
	1762	0	167	177	1656	0	132	31
	1829	0	0	15	1489	0	1695	15
Bamyan	494	0	0	229	2872	0	2774	21
	495	0	0	0	1234	0	1141	10
	1063	536	67	156	0	0	967	22
	1076	739	0	155	0	0	1827	28
	1163	0	0	0	1419	0	2488	21
	1571	0	0	0	3054	0	3842	35
	1572	0	0	27	838	0	2289	22
	1574	0	0	120	2513	0	2659	43
	1742	0	0	0	0	0	627	9
	1774	0	0	143	1202	0	1589	32
Dykundi	1822	459	294	0	2008	0	0	29
	2200	1817	55	0	0	0	0	3
	2203	2248	37	0	0	0	0	14
Farah	674	1307	47	218	1287	0	0	12
	676	723	289	286	806	0	0	0
	677	653	137	0	0	0	984	26
	678	0	0	0	0	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	679	0	0	0	0	0	0	0
	680	1613	0	0	0	0	0	17
	683	240	200	0	0	0	45	18
	684	814	0	628	1254	0	0	38
	1175	769	121	0	0	0	0	16
Faryab	595	1197	0	80	2039	0	0	0
	597	0	0	307	2151	7140	0	38
	598	0	0	0	0	0	0	0
	600	1132	534	213	1079	17454	0	0
	603	0	0	0	2271	2806	0	2
	604	0	246	0	1066	0	0	13
	609	0	0	470	2295	0	252	18
	1093	1293	0	176	1547	0	0	0
	1551	0	40	0	86	0	0	7
	1554	0	0	37	2081	11224	969	23
	1909	1122	0	35	2204	0	0	0
	1913	1286	232	0	1211	0	507	0
	1918	385	0	522	149	0	0	25
Ghazni	95	0	0	0	0	0	0	0
	96	156	0	0	1088	0	0	31
	99	571	62	258	534	0	0	0
	100	2297	47	0	1573	7397	0	0
	107	0	0	216	785	0	23	22
	253	1539	177	0	0	0	0	45
	255	1210	168	0	0	0	0	42

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	260	1482	0	187	1909	5648	0	0
	266	0	0	0	488	6796	0	55
	274	694	0	372	1236	0	0	26
	275	1121	0	59	2236	0	0	29
	1078	2007	187	0	1144	0	0	0
	1229	843	115	217	303	3296	0	11
	1615	293	518	0	0	0	0	17
	1616	647	73	0	887	0	0	6
	1625	979	0	0	1394	0	0	19
	1771	573	84	0	0	0	0	31
	1988	1089	745	0	0	0	0	19
	1989	193	42	0	0	0	414	37
	1990	709	0	141	1996	0	0	32
	2040	0	0	0	0	0	0	0
	2042	849	0	143	1331	0	0	20
	2044	466	0	532	856	0	0	27
Ghor	793	4717	192	0	0	13972	1597	19
	794	612	396	301	0	0	518	0
	795	1568	213	396	2544	0	0	0
	797	0	0	0	0	0	0	0
	1581	2123	161	0	0	8358	668	12
	1583	903	194	661	339	0	0	0
	1800	1623	0	147	168	0	0	13
	1801	0	0	0	0	0	0	0
Helmand	693	485	71	0	0	0	84	22

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	695	1852	112	194	1669	3611	0	4
	697	1784	0	39	0	0	0	2
	699	0	0	0	0	0	0	0
	702	971	708	424	957	8290	0	1
	707	861	0	407	1766	0	0	39
	708	1443	0	190	2209	0	0	30
	1626	0	0	0	0	0	0	0
	1632	205	207	189	479	0	0	14
	1790	641	140	0	0	0	0	1
	1845	2291	565	184	1886	4213	0	0
	1850	2405	116	148	1478	0	0	9
	1851	156	0	184	0	0	123	25
	1883	0	0	0	0	0	0	0
	3021	0	0	323	404	0	176	17
Hirat	626	0	0	0	0	0	0	0
	627	0	0	0	0	0	0	0
	628	141	0	226	0	0	1721	0
	632	2229	282	51	0	0	0	0
	639	0	0	0	0	0	0	0
	660	1340	70	0	893	0	0	0
	661	641	527	0	0	0	1089	0
	663	0	0	0	0	0	0	0
	665	0	0	212	930	0	0	0
	667	827	263	81	486	3812	0	0
	670	876	30	0	0	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	671	0	0	101	844	0	530	0
	1592	0	0	72	1240	0	1801	30
	1678	3059	214	169	2309	0	0	0
	1735	0	82	0	0	0	0	0
	1737	619	160	0	0	0	0	43
	1974	0	3	283	1271	0	310	12
Jawzjan	585	0	0	0	0	0	0	0
	587	0	0	0	1304	1795	0	7
	592	379	0	97	1954	0	0	0
	593	0	0	103	1611	0	656	40
	1035	0	0	75	1576	6264	0	27
	2033	426	0	69	1541	1077	0	0
Kabul	3	0	369	0	114	1256	0	46
	4	0	0	0	0	0	0	0
	10	0	0	403	1277	0	1079	48
	14	0	0	616	636	0	654	43
	15	0	0	0	0	0	0	0
	1671	0	0	0	0	0	0	0
	1672	0	0	0	0	0	0	0
	2150	3686	539	280	2738	0	1994	6
Kandahar	711	0	0	171	546	0	0	4
	723	404	0	399	2909	0	0	0
	726	886	87	0	735	0	0	2
	733	1832	0	199	2269	0	0	4
	735	0	0	392	1262	0	52	36

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	737	0	29	178	1113	0	79	30
	743	1514	199	315	2375	0	0	3
	747	0	304	397	1088	0	540	0
	748	2530	0	200	2618	0	0	9
	754	0	0	0	0	0	0	0
	2017	1086	325	217	569	4540	0	0
	2025	1602	87	149	1230	4092	0	0
	2157	0	0	293	1569	0	467	20
	2185	1255	30	73	2625	0	0	0
	2186	708	73	184	1483	0	0	0
	2544	1963	194	265	420	0	0	13
	2926	41	0	135	776	0	0	5
	2960	1308	284	341	869	0	0	31
	2963	1158	0	455	1884	0	0	0
	2964	1094	460	246	1252	0	1040	0
Kapisa	48	1322	0	235	181	0	1170	2
	49	620	0	168	0	15163	1014	1
	55	495	0	380	0	8187	1201	26
	58	0	0	0	0	0	0	0
	1545	0	0	0	0	0	0	0
	1546	0	0	0	0	0	0	0
Khost	864	1791	15	0	206	9300	0	0
	866	0	0	642	523	14189	0	20
	867	0	179	292	0	0	0	0
	868	1820	303	199	1533	20340	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	869	0	0	0	0	0	0	0
	870	675	0	74	986	0	0	0
	871	0	0	0	0	0	0	0
	872	982	0	377	909	13974	0	0
	1029	0	0	0	0	0	0	0
	1618	1066	192	136	880	19470	0	0
	1621	0	0	0	0	0	0	0
	1622	519	0	94	669	18516	0	2
Kunar	384	171	47	51	1390	0	0	7
	394	109	0	35	1061	0	225	21
	395	336	229	0	647	0	919	40
	396	145	323	400	1504	0	33	20
	398	293	418	0	1382	0	891	16
	400	192	108	77	0	0	121	29
	1591	2937	488	0	1004	0	1783	0
	1944	0	0	0	0	0	0	0
Kunduz	510	0	80	0	1568	2563	0	11
	516	0	0	0	0	0	0	0
	518	0	0	0	0	0	0	0
	523	0	605	0	2131	16792	0	34
	528	81	0	0	928	8183	0	0
	1155	0	0	3	2407	16767	0	0
	1934	0	0	0	1247	0	0	22
	1935	0	116	0	1661	9170	2467	20
	1937	0	0	0	355	0	0	7

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	1939	209	0	5	1176	8250	0	9
	1955	0	0	0	3746	0	2697	15
	2432	234	0	169	1100	0	1009	3
Laghman	362	134	201	0	506	0	0	10
	365	477	23	0	1340	0	0	39
	367	1619	1062	0	1017	0	122	58
	372	971	191	0	0	0	0	20
	375	917	59	0	362	0	0	9
	376	1288	659	292	364	0	0	15
	378	1411	0	0	1156	0	0	0
	1575	229	353	592	1875	0	56	40
Logar	224	0	0	316	2103	0	375	14
	227	0	0	119	162	1421	0	6
	230	0	0	475	1617	0	1436	28
	235	348	156	0	1167	0	553	47
	241	0	0	552	1741	0	804	28
	1522	727	0	456	1587	0	2152	17
Nangarhar	307	1646	0	0	2	0	0	0
	315	816	0	270	1053	0	0	21
	317	1225	0	0	970	0	0	11
	323	378	29	192	1617	0	0	3
	327	273	53	0	665	0	67	44
	330	668	833	0	0	17303	1129	37
	333	1144	0	20	1425	0	0	2
	335	2167	225	291	2861	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	342	2030	0	73	1879	0	0	0
	345	0	0	0	0	0	0	0
	346	880	64	0	274	0	252	29
	347	1876	0	139	2824	0	0	0
	350	0	0	0	0	0	0	0
	352	2596	311	143	2455	0	0	0
	354	1104	509	0	800	0	1599	15
	1181	1130	495	0	0	0	0	25
	1214	1243	0	25	1589	0	0	8
	2088	2927	534	414	2834	0	1709	14
Nimroz	1031	1047	0	0	591	0	0	14
	1858	851	296	329	1308	0	2760	21
Nooristan	851	240	578	0	1529	0	783	40
	1578	2050	563	279	1413	5974	0	0
Paktika	823	0	0	0	0	0	0	0
	825	816	0	340	0	0	0	17
	841	2501	0	0	864	10077	0	8
Paktya	282	0	0	0	0	0	0	0
	287	625	775	0	245	0	1504	70
	1518	2355	122	0	1976	0	0	0
	1520	382	0	0	255	0	383	46
	1549	0	323	0	540	0	1702	33
	1718	372	0	40	516	0	0	0
	1728	0	0	3	868	1036	0	32
	1730	2128	602	0	1400	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
Panjsher	78	0	0	0	0	0	0	0
	80	0	0	81	1168	0	1921	0
Parwan	16	0	0	291	1411	0	222	9
	18	0	0	303	1978	0	1021	0
	62	0	0	348	498	0	1619	6
	65	0	100	0	627	0	1394	5
	67	0	59	0	1244	0	1701	21
	70	0	135	16	1329	0	0	0
	72	0	424	0	3095	0	2525	0
	1043	0	0	0	0	13051	366	24
Samangan	534	0	0	0	0	0	0	0
	536	367	0	0	1458	0	723	11
	538	1129	11	0	1279	0	0	6
	1116	0	0	0	0	0	0	0
	1117	2198	429	0	115	0	920	26
Sar-e-Pul	855	0	0	0	3068	0	947	45
	857	0	0	176	1857	0	0	34
	860	1158	0	0	1666	1708	0	0
	1055	0	482	0	0	0	361	30
	1057	0	0	268	700	0	1397	24
	1537	0	0	86	539	5877	120	0
	1732	1159	0	0	1686	0	0	0
	1859	0	0	342	1185	0	716	18
Takhar	427	0	0	341	1580	14775	0	8
	434	792	0	0	2360	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	436	494	0	0	1700	8522	0	0
	437	0	0	107	828	0	346	0
	438	0	168	0	1458	0	1081	0
	446	95	0	27	1335	0	0	14
	451	0	0	0	0	0	0	0
	452	0	0	0	0	0	0	0
	454	0	0	0	1681	7905	1366	11
	455	0	187	0	698	0	479	9
	1161	0	0	0	1277	0	0	13
	1709	0	0	0	0	0	0	0
Urozgan	767	0	0	0	0	0	0	0
	774	0	0	0	1434	0	390	9
	780	312	0	135	613	0	0	3
	2094	1308	99	86	1520	0	0	3
	2097	0	0	0	0	0	0	0
Wardak	88	0	0	304	1125	0	878	48
	197	1658	0	14	2105	0	0	0
	203	375	575	0	1056	0	0	17
	207	278	0	347	1606	0	0	19
	215	154	0	48	1587	0	0	28
	223	475	458	335	1286	0	371	16
Zabul	762	337	103	245	116	0	339	20
	1892	2849	223	20	1911	0	2883	0
	1893	2206	172	0	470	5581	0	0
	1894	1121	60	270	1150	0	0	0

Province	CHC ID	Comprehensive Health Centers Output						
		ANC	PNC	SBA	FP	OPD	Vaccination	TB+
	2029	668	156	0	0	994	0	17
	2106	1079	116	225	1171	0	0	0

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