

A FRAMEWORK OF SCIENCE AND TECHNOLOGY IN HIGHER
EDUCATION FOR SUSTAINABLE DEVELOPMENT FOR SOMALILAND

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A FRAMEWORK OF SCIENCE AND TECHNOLOGY IN HIGHER
EDUCATION FOR SUSTAINABLE DEVELOPMENT FOR SOMALILAND

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DEDICATION

I would like to dedicate this thesis to my parents Mum and Dad for their long-lasting prayers and moral support throughout my entire life. This thesis is also dedicated to my beloved wife, Fosia, who has been extremely supportive throughout the duration of my studies, not forgetting my sisters and brothers too. Similar dedication goes to my 5-year-old son Abdirahman and 3-year-old daughter, Rayaana, who has been an amazing, patient and understanding daughter throughout the years I had been working on my PhD. Last but not the least, my hearty dedication goes to my close friends who have been supportive and always been at my service at times of difficulty and ease.

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ABSTRACT

The integration of science and technology (S&T) in higher education institutions (HEIs) is significant for economic growth and sustainable development goals (SDGs). HEIs in Somaliland have not yet stressed the need to integrate S&T in education in their planning to achieve their national SDGs. Also, the government did not put a concrete plan in place towards building S&T capacities in education which play an important factor in the economic growth. Therefore, the aim of this research is to develop an indigenous and comprehensive framework to ensure sustainable development goals in Somaliland. It is an integrated framework for SD of Somaliland that incorporates S&T, HEIs and human capital. This study used a mixed method (survey and interview) to collect the data from six HEIs in Somaliland and document reviews. Questionnaires were distributed to 350 respondents ranging from faculty deans/head of department of S&T related programs and senior lecturers, and 215 responded. Also, interviews were conducted with six top managements of the HEIs. The findings indicated that insufficient of S&T, research and development (R&D) and community engagement (CE) at institutional and program levels. It can be concluded that the S&T capacity in HEIs in Somaliland is not capable of advancing the progress for SDGs. In addition, the findings also show an ineffective and a lack of collaboration among HEIs, industries and public sectors within the national framework. The findings were used to develop the proposed (i) guidelines to incorporate capacities (S&T, R&D and CE) in HEIs into SDGs and (ii) the framework. The framework incorporates S&T in HEIs into Somaliland SDGs and other stakeholders including the business sector. The framework was validated by experts in education and development sectors. The framework is aligned to the SDG of Somaliland Vision 2030 as well as Higher Education Sector Plan. Future research, particularly in under-developed countries, should focus on specific industrial clusters as well as thematic measures of sustainability, policy implementation and HEIs leadership towards SDGs.

ABSTRAK

Integrasi sains dan teknologi (S&T) di institusi pengajian tinggi (IPT) adalah amat penting bagi pertumbuhan ekonomi dan matlamat pembangunan mapan (SDG). IPT di Somaliland belum lagi menekankan kepentingan untuk mengintegrasikan S&T dalam pendidikan dan perancangan mereka untuk mencapai SDG nasional. Kerajaan juga tidak meletakkan perancangan yang konkrit untuk membina kapasiti S&T dalam sistem pendidikan negara bagi memainkan peranan penting dalam pertumbuhan ekonomi. Oleh itu, tujuan kajian ini adalah untuk membangunkan satu rangka kerja asli dan komprehensif bagi memastikan matlamat pembangunan mampan di Somaliland. Ia merupakan rangka kerja bersepadu untuk SD Somaliland yang menggabungkan S&T, IPT dan modal insan. Kajian ini menggunakan kaedah campuran (tinjauan dan wawancara) untuk mengumpul data daripada 6 IPT di Somaliland dan analisa dokumen. Soal selidik diedarkan kepada 350 orang responden yang terdiri daripada dekan/ketua jabatan program berkaitan S&T dan pensyarah kanan, dan 215 responden telah memberikan maklum balas mereka. Wawancara juga telah dijalankan dengan enam pengurusan tertinggi IPT. Dapatan kajian ini menunjukkan bahawa S&T, penyelidikan dan pembangunan (R&D) dan penglibatan masyarakat (CE) adalah tidak mencukupi, di peringkat institusi dan program. Dapat disimpulkan bahawa kapasiti S&T di IPT di Somaliland tidak mampu untuk menyumbang ke arah pencapaian SDG. Di samping itu, dapatan kajian juga menunjukkan kurangnya kerjasama antara IPT, industri dan sektor awam dalam kerangka kebangsaan. Dapatan ini digunakan untuk membangunkan garis panduan (i) yang dicadangkan untuk menggabungkan kapasiti (S&T, R&D dan CE) di IPT ke arah pencapaian SDGs dan (ii) rangka kerja. Rangka kerja ini menggabungkan S&T di IPT dengan pelan SDG Somaliland dan pihak berkepentingan lain termasuk sektor perniagaan. Rangka kerja ini telah disahkan oleh pakar dalam sektor pendidikan dan pembangunan. Rangka kerja ini sejajar dengan SDG Somaliland Vision 2030 serta Pelan Sektor Pendidikan Tinggi. Kajian untuk masa depan, terutamanya di negara-negara kurang maju, harus memberi tumpuan kepada kelompok-kelompok perindustrian tertentu juga langkah-langkah tematik berkaitan kemampanan, pelaksanaan dasar dan kepimpinan IPT ke arah pencapaian SDG.

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LIST OF ABBREVIATIONS

AET	-	African Education Trust
CE	-	Community Engagement
CS	-	Community Service
CVI	-	Content Validity Index
CVR	-	Content Validity Ratio
DGs	-	Development Goals
DESD	-	Decade for Education for Sustainable Development
EESD	-	Engineering Education for Sustainable Development
ES	-	Education for Sustainability
ESD	-	Education for Sustainable Development
ESI	-	Education Sustainability Initiatives
GDP	-	Growth Domestic Product
GII	-	Global Innovation Index
HC	-	Human Capital
HE	-	Higher Education
HEIs	-	Higher Education Institutions
HESD	-	Higher Education for Sustainable Development
HESF	-	Higher Education Sustainability Framework
HESP	-	Higher Education Sector Plan
HII	-	Human Development Index
IDGs	-	International Development Goals
IMF	-	International Monetary Fund
NDGs	-	National Development Goals
NFSD	-	National Framework for Sustainable Development
R&D	-	Research & Development
RI	-	Research Institutions
SD	-	Sustainable Development
SDF	-	Somaliland Development Fund
SDGs	-	Sustainable Development Goals

SESP	-	Somaliland Education Sector Plan
SHEP	-	Somaliland Higher Education Plan
SHE	-	Sustainability in Higher Education
SNDGs	-	Somaliland National Development Goals
SNSDGs	-	Somaliland National Sustainable Development Goals
SSDGs	-	Somaliland Sustainable Development Goals
S&T	-	Science & Technology
SWOT	-	Strengths Weaknesses, Opportunities and Limitation
UNDESD	-	United Nation Decade for Education for Sustainable Development

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CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter provides a synopsis of the present study and describes the overall organization of this thesis. The chapter encompasses of 10 sections ranging from background to the organization of the study. However, this research topic is about Education for Sustainable Development (ESD) in general and specifically targets Science and Technology (S&T) in Higher Education for Sustainable Development (HESD) in Somaliland/Somalia. HEIs comprise all post-secondary education, training and research guidance at education institutions such as universities that are authorized as institutions of higher education by state authorities. In otherworld, Higher Education Institutions are education institutions that provide higher learning educational programs (Institute, 2014). The main reason for considering HEIs within SDGs lays in the S&T provisions as the key enablers to economic growth, development and social wellbeing.

SDG can be defined set of universal goals that comprise 17 goals and 169 targets and they build on the proceeded Millennium Development goals (Hák, 2016). The study reviewed the prior work about the impact of HEIs on SDGs and indicators that have been used to measure their competencies and capabilities towards contributing to SDGs.

Technology education is crucial knowledge and its application in SD has been tremendously contributing towards national development goals (NDGs) for the developed nations. SD is defined as a development that meets the needs of the present generation without compromising the future generation's ability to meet their needs. Sustainable Development is said to be achieved through consideration of and balance between the social, environmental and economic 'pillars' of development

(Cuthill, 2010). Technology is an effective capacity finding solutions for SD challenges. However, the usefulness of S&T education to the sustainability debate as a whole and to education for SD in particular has largely been overlooked in the past. Indeed, there is a paucity of academic studies which examine the contribution that technology education may provide to ESD (Leal Filho, Manolas, & Pace, 2009).

Similarly and most importantly, science is the driving force for the technological advancement and they are the two sides of the same coin. The countries that achieved SD have given a high priority to S&T education in formulating education policy (Alam, 2009).

S&T is the engine of innovation, entrepreneurship is the jet engine to SDGs, and they are also the major influencers of socio-economic progresses, growths and crises. S&T are connected rings in synergy chain of science and wealth. Looking back at the growth and development histories, most major revolutions were closely linked with transformative breakthrough in S&T which had a far-reaching impact on the rise and fall of a nation and the destiny of a country as well (Mahdia, 2015).

Sustainability is a major issue for all the organizations in the twenty-first century. Increasingly, corporations are being encouraged or required to address sustainability by boards, stockholders, and other stakeholders – and are exploring and implementing sustainable practices to improve both the environment and their own competitiveness. At the same time, institutions of higher education are exploring means to integrate sustainability into curricula. Over the past several years, there have been a growing number of studies on how to integrate sustainability in higher education (SHE). Within this, the United Nations Decade of Education for Sustainable Development (2005-2014), seems to pose a relative shortage of broader, more general frameworks (Cathy A Rusinko, 2010).

HEIs are crucial sector in social development and their roles in SDGs have been acknowledged. However, their contributions to SDGs through the different provisions are not effective unless collective and collaborative efforts within the national framework are established. This research explores S&T capacities of HEIs

in relation to SSDGs. The analysis focuses on specific or traditional role of HEIs including S&T, R&D, CE and IC. The presented research explores in the field of sustainability-oriented HE networks, analyses their key areas of interest, inter-network relationships, links with the policy field, and cooperation in joint programs and strategy development (Leal Filho, Manolas, & Pace, 2015).

Considering the need for skilled human capital to remedy the NDGs and the prevailed challenges, the pivotal role of HEIs need to be assessed (Sivapalan, 2015). The current Somaliland Development Goals and the Higher Education Sector Plan and Policy are also based on and emphasises the need to improve the quality of education that contributes to the 2030 vision of Somaliland. Based on the current SSDGs, there are gaps within coordinating and implementing these strategies as they are not properly integrated within a framework in HEIs.

With respect to information obtained through desk-top research to plan the potential institutions of study, 6 HEIs were selected. Structured interviews and survey were designed to administer to the academic staff of the selected HEIs and document reviews were also used to supplement the data obtained through the survey and the interviews. The quantitative data was designed to measure S&T, R&D, EC and AQ of the surveyed HEIs while the qualitative data was used both as triangulation and to complement the gaps within the existing themes.

As such, given that HESD has been an important approach, it will contribute to the national and global initiatives in achieving SDGs. It is thus important for Somaliland's National Education Policy to be aligned with the country's developmental agenda. Additionally, Somaliland's education sector must also consider the vital role of S&T in HEIs within its national education system, given the fact that the majority of the country's human capital is products of the country's education system particularly the HE system. Likewise, within the context of HE, specifically S&T in education, the need to instil S&T in ESD awareness and competences is also crucial, as 'the need to educate the S&T of the 21st century differently – or more precisely, more strategically – is essential to the endurance of the profession' (Sivapalan, 2015).

There is hence an urgent need for Somaliland HEIs to advance HESD and S&TESD amongst their S&T related programs and academic staff, so they will be in a position to meet and embrace the SDGs challenges that the country is facing at the present. Given the above scenario, this study however, unravels the ways HE in Somaliland, namely S&T education can play its role in developing context based S&T in HESD framework to support the nation's vision of 2030 and beyond. Chapter 1 thus sets the focus of the study, by establishing the need to re-look at Somaliland's HEIs programs through an integrating approach which incorporates institutional and national levels through policy, strategies and inter-institutional collaboration. The findings of this research contribute towards the enhancement of S&T capacities of HEIs and institutional practices within the field of S&TESD.

As a result of this, perspectives of studies related to ESD that are multidimensional and diversified encompass innovation transfer, R&D, STEM, leadership, policies, strategic innovations, engineering for SD and environmental issues. ESD nowadays is considered to be a cross-sectorial area and cross-cutting issues such as the absence of standardized ESD framework is availed for all the countries having different context and priorities in their education systems.

Nonetheless, the present study attempts to review the prior research works on ESD. Similarly, existing efforts in Somaliland context were also reviewed to translate that Somaliland needs indigenous and context based framework for its development goals in relation to S&T, R&D and EC in HEIs.

1.2 Background of the Study

At the present and of course over the past decades, many HEIs incorporated SD into their educational programs, R&D and community engagement (Müller-Christ et al., 2014). The incorporation of HEIs' capacities into SD is an important approach for achieving sustainability. HE comprises all post-secondary education, training and research guidance at education institutions such as universities that are authorized as institutions of higher education by state authorities. In otherworld,

Higher Education Institutions are education institutions that provide higher learning educational programs (Institute, 2014). Though these competencies vary from one context to another, but the general consensus is that education is the heart for SDGs (Lozano, Lukman, Lozano, Huisingh, & Lambrechts, 2013).

The role of education towards contributing to the SDGs is both important and more challenging for HEIs in the underdeveloped countries (Somaliland) and the developing world. This section further explains the indispensable need to incorporating SD capacities and competencies into HEIs in Somaliland (North-Western Regions of Somalia). The researcher starts the discussions of this section with the importance of HEIs' provisions and capacities toward contributing to the national development goals through producing human capital with scientific and technological knowledge required. This section also indulges into S&T, R&D and community engagement as the key contributors to SDGs. Therefore, it is vital for all the HEIs to upgrade their capacities in S&T so that they could play a substantial role in achieving the SDGs of Somaliland.

Initiatives of SD undertaken by HEIs around the developed and developing countries provide striking evidence for the growing demand for context based sustainability framework. This section further discusses the need to integrate HEIs' provisions and capacities into SDGs.

The main rationale of this study is to develop and propose an integrated framework for Somaliland that combines provisions in HEIs and Somaliland National Development Goals (SNDGs) within the Somaliland Education Sector Plan (SESP). The study aims to analyse and evaluate HEIs' capacities and provisions in terms of S&T, R&D and Community Engagement and ways to integrating them into Somaliland national development goals.

The spirit of this study was encapsulated in the review of the past and current efforts made in Somaliland to achieve economic growth by addressing five economic pillars stated in its millennium development goals. These development goals could be achieved through capacities of S&T within HEIs. Opinion makers believed that

STEM in education has not been considered as enabling factor to the growth and development of Somaliland despite the decades of its existence. These opinions often shape the society's acknowledgement and understanding about the role that S&T would play in achieving SD. It will bestow far-reaching implications and influences on national development amongst areas of HEIs, agriculture, health, environmental issues and infrastructure development (Harris, 2000).

This study therefore, attempts to relate S&T provision of HEIs into SD and proposes a comprehensive framework for Somaliland HEIs that foster national development. It is expected that this study would reveal the various limitations about the evolution of S&T in Somaliland. As such, the study makes suitable suggestions on what could be done to improve the existing approach so as to make S&T truly global and competitive in the country. The results of the study provide with enormous benefits to all the stakeholders in the S&T sector and more notably, to the economic sectors, public, private business institutions and HEIs. Given that, government is the major stakeholder and industries major investors for development programs (Biermann, Man-san Chan, & Pattberg, 2007). The study proposes a framework for government to embark on its restructuring process in developing national development strategies.

Also, this study stands as a guide towards formulating measures to promote S&T, R&D and ESD of the country at both, institutional and national levels. The results from the empirical analysis shall provide with the background information to evaluate or assess the effectiveness and efficiency of S&T structures and the overall performance of its institutional framework. Part of the overall expectation from this study is to propose national indicators for evaluating the impact of HEIs on the Somaliland National Development Goals (SNDGs). This study emphasizes on the need to enhance and upgrade HEIs' capacities in terms of S&T facilities, R&D provisions and community engagement activities. With improved S&T in HEIs, their contributions to holistic development would be of great significance. Also, the organized private sector will find the result of the study pretty helpful in shaping opinion on the need for government to foster effective and unbroken linkage with other institutions including the business sectors. These institutions will benefit from

the S&T outputs and R&D provisions that HEIs leverage if they are properly arranged within the Somaliland National Development Priorities (SNDPs).

It is therefore anticipated that the ideas emerging from the study could be used by voluntary and non-governmental agencies when implementing policies pertaining to S&T, HEIs and R&D. It could also be used by educational institutions, training centres and research institutions as the basis for planning new programs tailed with the marketplace requirements.

Somaliland set development goals comprising of five strategic pillars as the main priorities toward achieving Somaliland Development Goals. Education Sector Plan of Somaliland is another national priority aimed at improving the country's education system. These two plans lack elements of HEIs' capacities that could foster the economic growth through STI transfer, R&D and CE (Ssebuwufu, Ludwick, & Béland, 2012). Therefore, this section concludes with the need to fill up the gaps within ESD and propose context based framework for Somaliland and other similar countries that want their HEIs foster the national economic growth.

Finally, it is hoped that the research findings from this study generate diverse interests in the field of S&T provisions at HEIs at all levels to influence Somaliland economic growth, in terms of strategies, policies and plans intended to foster the national development. As a result, linking universities with other sectors of the development would effectively contribute to the development of the country through coordinated and collaborative functional structures as indicated in the framework. In addition, the links between the larger policy context, HEIs and national development priorities are vital towards achieving Somaliland development goals.

In short, there are no specific sectorial policies and frameworks formulated to direct the development initiatives in the prioritized areas of development. These policies and frameworks include the following:

- i. There have been insufficient frameworks that integrate higher education capacities into national development goals;

- ii. Somaliland lacks a context based ESD framework that guides the process of development;
- iii. There is scarcity of other complementary policies designated to improve capacities of the national institutions such as industrial policy, agricultural policy, environmental policy among the others;

1.2.1 Context of the Study

The modern republic of Somaliland, which declared its independence from Somalia on 18th May 1991, is the third incarnation of territory established by the British in the Horn of Africa. The holistic establishment of constitutional Somaliland government came into birth in the Borama conference in 1993. It extends to a land area of 137,000 KM² or approximately 22 per cent of the previous Somali Republic (637,540 square kilometres), most of which receives less than 300 millimetres of rainfall annually. The population is currently estimated at between three and four million (the lower figure is probably more accurate) out of some 13 million inhabitants of the whole Somali Republic. The average growth rate of Somaliland population is 3.1%, 55% of the population is nomadic or semi-nomadic, with 45% living in urban areas or rural towns. The average life expectancy for males is 50 years old and 55 years old for females. Most of Somaliland population is dispersed in Hargeisa which is the capital city, Borama , Burao, Erigabo, Saylac, Gabiley, Boon, Baki, Las Anod, Lughaya, Berbera and others (Omar, 2008).

Republic of Somaliland is one of the poorest countries in the world. The region's potential revenues come from export of livestock (camels, cattle, goats, and sheep) to Saudi Arabia and the Gulf States through the port of Berbera. Products from agriculture are mainly sorghum and maize, with the Hargeysa region and Awdal region highlands being best suited for dry-farming, whilst the Haud region is more suitable for animal grazing. The region's main source of income comes from the export of livestock (camels, cattle, goats and sheep) to countries like Saudi Arabia and the Gulf States through the Port of Berbera and other natural ports in

Awdal region (Lugyaha and Saylac). The region has good agricultural areas and mainly sorghum and maize are cultivated for consumption purposes (Ahmed, 2014).

Somaliland has both offshore and onshore oil and natural gas reserves that are not yet extracted or exploited. Several wells have been excavated during recent years but because of the unrecognized status, foreign energy companies could not benefit from it. Additionally, Somaliland has a long coastal line which extends to the Gulf of Aden and it is one of the richest seas on earth. It has as well mineral ores in the mountainous regions particularly Seemoodi Mountains. Vast majority of the Somaliland community heavily depends on money remittance from the Diaspora families who fled the country during the civil war in the 1988. The estimated value of their contribution is estimated at 300 million US\$ a year. Somaliland remains unrecognized for decades yet functions as a legitimate state. Nonetheless Somaliland cannot appeal to the World Bank (WB), International Monetary Fund (IMF) or other international support, which gravely increases its susceptibility to poverty and unemployment amongst its population (David Bassiouni, 2008).

As a result of the long war against the military regime of Said Barre which reached its peak during 1988-91, virtually all educational institutions and teaching, learning materials in Somaliland were destroyed and looted. Given that, Somaliland claimed the restoration of its independence in 1991. In the year of 1993 local and regional authorities of Somaliland have sought to re-establish the basic education system. In 1993, the new Ministry of education was established. Its aim was to get the education system back on track, starting with the lower primary grades. Schools were started under the shade of trees and the compounds of the destroyed schools. Empty milk cans and stones were used as chairs for the pupils. Teachers who were a part of the largely displaced community started teaching again voluntarily without any teaching materials, let alone incentives and wages.

Once this initiative had begun, the need for textbooks became increasingly urgent. Subsequently, UNICEF, EU, and UNESCO funded by EC and the Royal Government of Netherland took the responsibility of the development printing and distribution of upper primary textbooks. These newly developed textbooks took a

special role in improving the education of our children. Similarly, we hope that our teachers will take their role in upgrading the educational level of our children (Ministry of Education, 1995).

According to a report of ministry of education, 1997, the need for secondary education came into existence as the number of enrolments increased year after year with limited educational infrastructure at school and educational centres. UNICEF and UNESCO sponsored number of projects towards extending and rehabilitating existing schools, and by African Education Trust (AET) supported the schools with teaching materials, particularly the secondary education schools. In addition to infrastructure support, AET and other international organizations started to provide teacher training programs for the schools' teachers to upgrade their teaching capacity. With the help of Somaliland ministry of education and other donors, bold steps were taken towards improving education quality across almost all regions in Somaliland by promoting both formal and non-formal education as well as through the establishment of vocational training centres (Bekalo, Brophy, & Welford, 2003).

The year of 1997-98 is marked the birth of the Somaliland Higher Education and it starts with Amoud University to be the first HEI ever established in Somaliland followed later by University of Hargeisa and others (Mauch, 2002). In general, the Higher Education system of Somaliland has been arbitrarily growing in an environment without having notable policies and procedures in place. At the present, there are over 17 universities in Somaliland; most of them are private, only three universities are considered to be public. Most of these universities offer undergraduate programs except a very few of them, which offer both undergraduate and postgraduate degrees. The majority of universities of Somaliland have fewer programs in S&T offered and the few of them that offer these fields do not have the capacity of S&T provisions in terms of infrastructure and the human resource.

Additionally, since there is no collaborative framework between the government and the HEIs to foster national development, it questions the role of these institutions in Somaliland Development Plans and Vision 2030. Government ministries and almost all HEIs operate independent and their contributions to national

development are arbitrary as there is no synergy and collaborative efforts to develop and address the SDGs of Somaliland. Yet, Somaliland lacks sophisticated mechanisms to improve its national economic development. There is a pressing need for a framework that puts key participants together and links their respective potential contributions to the development. Other prevailing challenges are lack of well-integrated strategies, policies and plans towards ensuring and addressing national development goals.

1.3 Problem Statement

The significance of S&T integration into HEIs for achieving economic growth and development cannot be overstated. As such, approaches and strategies for achieving SDGs require the consideration of S&T integration into the National Development Goals (Yigitcanlar & Teriman, 2015). Wide varieties of plans and strategies have been pledged in an effort to foster Somaliland National Development Goals (SNDGs) with consideration of five pillars as the current priorities (Planning, 2014). These national priorities could be difficult to achieve without leveraging S&T capacities that are tailed with Somaliland development priorities and potentialities. Nonetheless, any efforts without incorporating scientific and technological knowledge into the national priorities are not practically contributing towards the realization of the development objectives planned (Nour, 2010).

Furthermore, HEIs are also very important in the creation and transfer of scientific and technological knowledge to improve potential economic development pillars. However, Somaliland National Development Goals and its Vision are not linked to S&T provisions or capacities of HEIs. Despite the facts that STEM in education are believed to be crucial for any kind of development, endeavors towards it is absent or very limited in Somaliland. Moreover, Somaliland set numerous national development plans in the last decade in regards to improving five economic pillars as discussed, and indicatively, the plans are facing many challenges to be realized (Sacad, 2013).

There are over 17 universities in Somaliland that would play an important role in achieving the development objectives through producing the required STEM. Most of these HEIs have been focusing on business or social sciences related courses while S&T programs are rarely offered by HEIs. In addition to this, there is a lack of collaboration amongst HEIs, industries and public institutions. Enhancing collaborations on the development initiatives, in terms of planning, consulting and any other efforts towards realizing the SDGs is very important. HEIs would contribute to SD if they are incorporated and collaborated with other government entities that involve in the development sector planning and implementation (Zilahy & Huisingh, 2009).

Likewise, with respect to development plan, Somaliland is lacking policies, and clear strategies or comprehensive integrated framework that is targeted towards national planning on the development of S&T. As such, S&T has been seldom considered as a crucial element as far as national policy is concerned. While the country has been focusing on other aspects of economic development for over 20 years, thus so far, there are only limited sectors that have been developed with the help of project interventions.

Furthermore, the government of Somaliland has shortage of well-established national research institutions which would participate in development sectors including, building the human capital and developing strategies based on empirical research analysis. Lack of collaboration between HEIs and private sectors might have resulted mismatch between programs offered at HEIs and marketplace requirements.

S&T and R&D are the key factors that contribute to the development sectors of the economy, however, they are generally considered very weak in Somaliland. Likewise, the government did not frame a concrete plan yet towards building S&T infrastructures which would help with the economic growth and enable all types of institutions address the overall development of the country.

Subsequently, Somaliland requires appropriate scientific and technological society at all levels that would play a leading role in the various aspects of economic development through knowledge/skills transfer. Currently Somaliland lacks technical vocational training (TVET); certainly the absence of any TVET options circumstanced Somaliland to be dependent on foreign experts (Jones, 2016).

Minimum numbers of scientists and experts as we know are the first layer and the backbone for the development. One of the most crucial prerequisites for advancing S&T in HEIs depends on the possession of the human capital and experts who are capable to improve S&T sectors. However, if these experts are not existent, then the development of S&T for institutional sustainability will not go well. The acquisition of S&T and having the required experts who would conduct research do not only depend on the development of the human capital but both the factors also heavily depend on national policies and strategies crafted towards creating knowledge societies or professional organizations with the required capacities and standards.

However, strategies towards SD or economic growth must adopt a national strategic framework that addresses key institutions, policies and plans needed to achieve the objectives of the development goals. The existing frameworks for ESD are not suitable or compatible to the Somaliland context. Therefore, there are limited universal frameworks for ESD that are applicable to all countries regardless their economic or development status. While there has been consensus upon the notion, there are dissimilarities according to local context, priorities and approaches. Each country has to study and define its own national development priorities and strategic ways to integrating them into their education system. As a result of this, the present study aims to develop and introduce an indigenous comprehensive framework to ensure/assist Somaliland Sustainable Development Goals (Zadorsky, 2006).

1.4 Research Objectives

Objectives of the study are:

1. To evaluate capacities of HEIs in terms of S&T, R&D and CE in relation to Somaliland National Development Goals (SNDGs);
2. To analyze the extent to which HEIs' provisions and national polices/plans are incorporated into Somaliland Sustainable Development Goals (SSDGs);
3. To propose and validate a framework for S&T in HEIs for Somaliland Sustainable Development Goals;
4. To integrate the proposed framework into the existing policies, strategies and other institutions including HEIs;

1.5 Research Questions

This study intends to answer the following research questions:

1. What are the pertinent gaps in capacities that hinder HEIs' contribution to SNDGs?
2. To what extent HEIs' provisions and SNDGs are integrated within the national priorities?
3. How to develop and validate a framework of S&T in HEIs for SNDGs?
4. What approaches should be taken to integrate the proposed framework into existing policies, plans and structures to support HEIs contribute to the SSDGs?

1.6 Significance of the Study

The present study intends to develop an integrated framework for evaluating competencies and capacities of HEIs in terms of S&T, R&D and community engagements. The commitment of Somaliland to foster economic growth is certain; given the numerous strategic initiatives put in place by the government to ensure the SDGs targets. It is very important and significant to note that nation's development depends on its human capital with S&T skills. Therefore, Somaliland HEIs have a crucial role to play in ensuring that Somaliland achieves its national development goals.

This study is significant at both national and international level. First, at the national level, the S&T in HEIs framework for SD is intended to confer upon the country's emphasis for DGs through developing competent human resource.

The results of the study will therefore be instrumental to the Ministry of Education and Ministry of S&T, particularly in setting SD related higher educational philosophies and guidelines for both public and private institutions of higher learning in Somaliland. The findings will also be advantageous to HEIs in Somaliland that offer S&T programs, as it would give an edge to project level of S&T within the institutional goals to significantly contribute to the national development.

At the international, there are a few frameworks for SD, the most common and the familiar one is HEISD proposed by the UN. This framework is neither specifically addressing the present needs nor does it indicate the timeframe for the future generations. Additionally, this framework introduces a comprehensive approach for getting the bigger picture of crucial dimensions of SD particularly for the third world countries in Africa. The findings of this study would be beneficial to S&T offering institutions as it could enable HEIs to develop holistic ESD guidelines and policies that are regionally and internationally accepted.

Finally, the notable contribution of the present study thus is two folds; theoretical and practical views. Evaluating contributions of HEIs in Somaliland will

increase the scholarship works on integrating S&T into development goals in order to foster the national economic growth. The previous scholarships on ESD have been focusing on developed countries but this study contributes towards the pool of knowledge by providing empirical based framework for underdeveloped countries like Somaliland. This study also contributes to the body of knowledge in ESD within which limited numbers of frameworks are published and too little frameworks are based on empirical evidence.

1.7 Scope of the Study

This study investigated and evaluated capacities of HEIs in Somaliland towards contributing to the SSDGs as its vision of 2030. The research looked at S&T including R&D and CE of HEIs along with SNDGs, Somaliland Education Sector Plan and S&T Policy if any. Six universities were selected on the basis that they are either the largest or public universities that offer S&T related programs. Given the purpose of this research, S&T, R&D and CE in HEIs need to be enhanced and upgraded in way that contributes to the SSDGs. The research adapted cross-sectional and used pragmatism mixed method (Quantitative and Qualitative). The respondents of the study were academic staff of HEIs including deans, lecturers and the top management. Perspectives of ESD experts and practitioners were also sought to better understand the present ESD landscape. These experts were used in the Delphi process to validate items of the research instruments. The final research framework proposed was validated through self-structured iteration matrix (SSIM) with experts.

1.8 Conceptual Framework

The conceptual framework is very important in the whole research process and it guides to achieve the research questions and its objectives. Researchers and methodologists suggest that there is no single standard to establish or provide conceptual frameworks in the fields of ESD. However, this study adapts two major theories that would help in proposing an appropriate conceptual framework for the

present study. The conceptual framework of this study guided the review and analysis of the data collected. The researcher used a critical research and social constructivist approach through an applied research perspective. By incorporating an applied research perspective to this study, the results were presented in a manner that can “be used by administrators and policy makers to improve the way things are done” (Merriam & Tisdell, 2016).

However, the proposed conceptual framework of this study is based on two concepts. The first concept is ESD particularly higher education sustainability initiative (HESI) (Huckle, 2015). The main conclusion that can be drawn is that HEIs are obligated to align their functions and roles within SDGs. HESI suggested that HEIs should transform perspective programs by reorienting their education, research, community engagement/outreach in a way that is contributing towards SDGs (A. E. Wals, 2014). This framework of HESI does not outline areas within HEIs and priorities that are supposed to develop. Though it has not been explicitly mentioned in the framework, seemingly, it lacks the clear linkages between HEIs and economic growth. The details of this framework were discussed in chapter two.

Secondly, in the same way, Higher Education for Economic Growth for Sub-Saharan African countries was used as another foundation framework for the conceptual framework (Eberhardt & Teal, 2011). This framework advised that HEIs can lead to economic growth through collaborating both with private and public channels. As its name or description indicates, this framework links HEIs with economic growth in collaboration with multi-stakeholder involvement. The following figure 1.1 shows higher education framework for economic development links HEIs to economic development. The following generic framework is the basis for developing the proposed framework for this study.

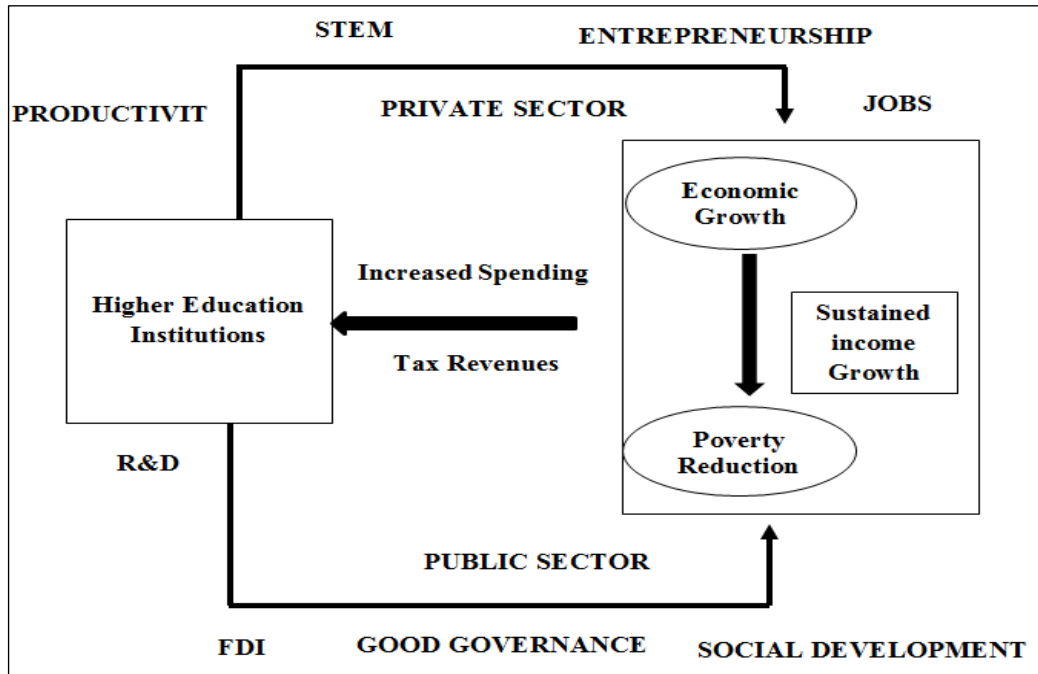


Figure 1.1 Tertiary Educations for SD (Eberhardt & Teal, 2011)

According to the above framework in figure 1.1, it demonstrates that HEIs are very crucial in this case, since they provide human capacity with the knowledge of S&T. S&T knowledge is the know-how towards improving and leading SDGs by collaborating with relevant ministries including ministries of S&T and Research, and HEIs. Additionally, HEIs are also responsible for engaging with community services that are believed to be the direct contributions to the national development both at regional and national levels. Community services ranging from training, teaching and consultancy would contribute to both private and public sectors, and are the main roles that HEIs are supposed to undertake to ensure an improved quality of services and the wellbeing of the wider public (Shiel, 2015).

Similarly, all other existing frameworks are also based on these two concepts and are contextualized according to their issues within. For instance, developed countries and other developing nations focus on STI for sustainable development and engineering education for sustainable development, just to mention a few. Almost all European countries focus on curricula matters and SD.

Furthermore, the conceptual framework of this study specifically adapts HEIs for SD which necessitated many universities to become engaged with SDGs. Theory of SD is conceptualized in three generic folds; social, economic and environmental sustainability. In early 1960s and late 1990s economic development model was based on the concept of frontier model, which is based on exploitation and discovery of natural resources. In the last two decades this model has lost its dominance (Kukeyeva, 2014).

Over the past decades, HEIs incorporated SDGs into their programs, R&D, outreach and roles. Within HEIs, capacities of HEIs regarding SDGs have been identified, programs on SDGs have been developed, and guidelines and approaches for teaching SD have been developed and integrated into the curricula. The integration of competences for SD in HE programs can be seen as an important step in achieving sustainability in HEIs (Lambrechts, 2013).

Similarly this research attempts to find out how and to what extent SDGs related to capacities of HEIs are integrated into Somaliland National Development Priorities. Some of the universities, for instance analysed programs like Business Management, ICT and Office Management. Conversely, the present study provides with a solid preparatory idea to further incorporate capabilities for SD into study programs, reorient existing competences toward sustainability, and to a wider extent, rebuild the curriculum toward SD. The two approaches that were used to develop the conceptual framework are tailed with the problem statement and the current objectives of this study. One approach is based on a country's national principles towards its development goals. And the other approach uses empirical data analysis through research findings aligned with existing gaps and capacities at institutional level to address the development goals set. Therefore, this study combines the two approaches to create a comprehensive and integrated framework for HESD in Somaliland. The first approach is imperial evidence obtained through the surveys and the second approach is to reviewing the existing documents including policies, strategies and other available frameworks.

The conceptual framework of this research describes a method that explains the approach of S&T integration within HESD through generic policy and strategy. These methods were obtained from the literature reviews of the other researchers on this field that is complementary to the proposing research framework. It was designed as a formative evaluation looking at S&T integration as part of the enhancement strategies for the sustainability and development of the institutions. Before this conceptual framework is proposed, it is very important to evaluate and analyse the current status of S&T in HEIs at national levels. The main theory that the framework uses is ESD as a universal or global principle that suggests the role of education in achieving SDGs. This theory also prescribes both the structure and the function of SD frameworks that is based on the level of development at national, regional and even global levels (Horváth & Harazin, 2016).

In the SD context, education should respond to the global socio-economic dynamics, ecological factors and envisage future solutions. The education systems in different countries and regions tackle SD issues in relation to the nature and extent of their knowledge, cultural values, languages and ideological perspective in different ways. Therefore, this conceptual framework consists of two perspectives; one is the role of HEIs towards contributing to SSDGs and the other perspective is the role of relevant government institutions towards promoting the SDGs by collaborating with HEIs. The following framework in figure 1.2 combines the collaborative efforts of HEIs and government ministries towards achieving SSDGs. This sustainable development scheme can be conceptualized more simply as a triangle with a clear list of “ingredients” in each of the three sections: economic, social, and environmental (Kukeyeva, 2014).

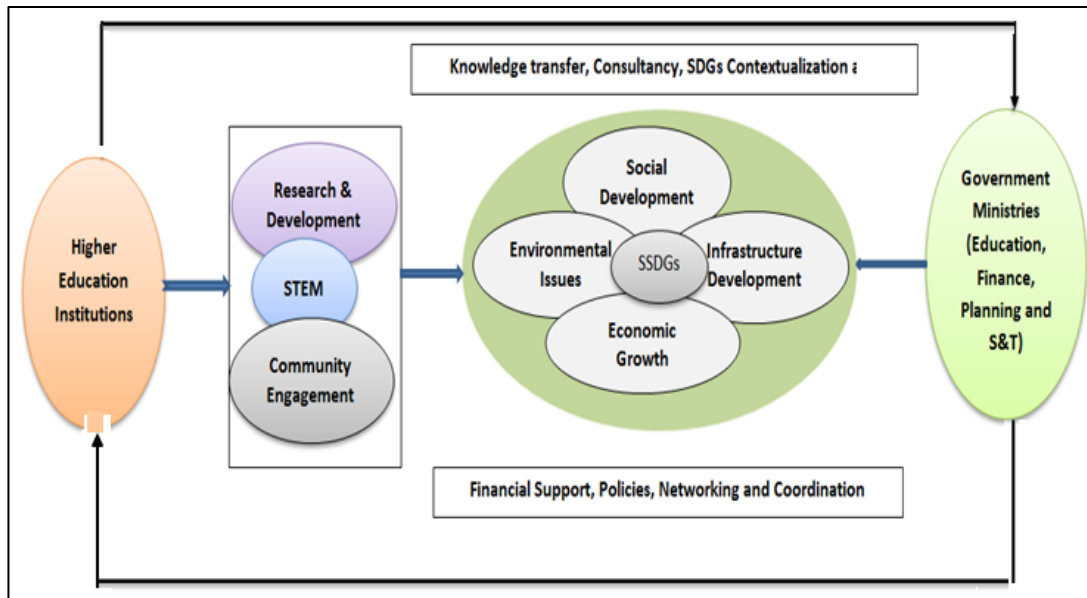


Figure 1.2 Conceptual Frameworks (Author)

This conceptual framework is based, as mentioned before on two views; the five guiding principles of SD incorporated with government roles- in this case the S&T, R&D, and CE for SD. The combination of these two views established the framework shown in figure 1.2. The five guiding principles can summarize as:

- i. Social Development;
- ii. Achieving Sustainable Economy;
- iii. Using Sound S&T Responsibly;
- iv. Promoting Good Governance; and
- v. Environmental Protection.

On the other hand, the principle of ESD related specific capacities or competencies within the educational portfolios at HEIs. In this case, depending on the context of Somaliland and the need to enhance capacities of HEIs, it is important to address the following provisions within the HEIs rose:

- i. Science & Technology;
- ii. Research & Development;
- iii. Community Engagement; and
- iv. Sustainability in Education in General.

These principles are based on HEIS sponsored by the UN in 2005-2014. It is at the same time the moving point for other countries to develop their own SD framework linked to their respective priorities. While the government institutions are responsible for enforcing and implementing SD strategies without collaborating HEIs, which are the enablers in this case, SDGs would not be achieved.

Limited frameworks for HESD are based on empirical analysis and there is a need to propose an evidence-based framework that combines both quantitative and qualitative methods. Although there are specific SDGs frameworks within HEIs which focuses on specific matters; for instance, health, engineering, technology and innovation transfer; none of them are suitable to Somaliland context. At present, there is no ESD framework designated to the least developed countries like Somaliland and almost all the available frameworks are not suitably fitting with the context. Some of the existing frameworks have been used as the theoretical basis of this study and are thoroughly discussed in chapter 2- the review of literature.

The most common strategies and frameworks for SD discussed are very general. For instance, Education Sustainability Initiatives (ESIs) is a framework within ESD that discusses four important pillars in SDGs ranging from educational and environmental perspectives of sustainability. This framework is comprehensive and provides a big picture of the different dimensions of the SD and again addresses the key sectors that play substantial role in development endeavours (Haertle, 2014).

The existing frameworks are very broad but they could be contextualized, since there is no standardized framework or model for SD. This is to say, that SD of a nation depends on capacities in terms of the knowledge of understanding on an exploitation of its potential natural resources on earth's crust. This means that SD

and education are independently guided by scientific and technical knowledge, which particularly influences the country's developmental endeavours. This is the reason for which UNESCO proposed that SD and education should be integrated to foster national development (Amina, 2015).

Furthermore and in particular the focus of SD is to achieve education for inclusive development, economic growth, environmental protection, poverty reduction, good governance among the others (Ahunanya Stella, 2010). This definition sounds suitable to the undeveloped countries and might be reflecting relevant frameworks and strategies to be adapted so as to improve the current status of these countries and particularly in the situation of Somaliland.

With respect to this matter, many developing countries in Africa like Rwanda, Kenya and Uganda acknowledged this endeavour and strive to adopt integration of S&T into education at all levels (Rwanda, 2014). Nonetheless, the successful implementations of S&T in HEIs are challenging, particularly in the underdeveloped world due to lack of policy, resources and long-term strategies. This needs collaborative efforts of the concerned ministries including ministries of S&T, HE, planning and finance as well as the private sectors. Another example is Tanzania, like any other undeveloped country in the region which has been swept out the wave of adopting modern S&T in education moves to adopting S&T more significantly in HEIs by the ministry of ICT and passed Tanzanian ICT policy of 2003 (Tanzania National ICT policy). Other countries in the region including Kenya, Ethiopia have set S&T policy plan particularly in the sector of HEIs to foster their national economic growth and development.

The developed countries started breakthrough when they established universities funded by the state. These universities have been the main source for producing Scientists, Technologists, Engineers and Mathematicians (STEM), who have been contributing toward the advancement of economic sectors and the current knowledge/innovation-based economy. Countries like Rwanda and other countries in Africa recognize that relevant high quality of HEIs that delivers internationally accepted education has critical role to play and would enable the country to realize

an indigenous SD and economic growth. Some of these countries in East Africa including Kenya, Uganda and Ethiopia are the fastest growing economy countries in the world. Thus, introducing or setting S&T policy framework for HE of Somaliland would create framework for knowledge production and sharing as well as linking knowledge work systems to strengthen SD in HEIs (Mr. Jason Mochache, 2012).

As result of this, there is an urgent need for Somaliland HEIs to advance ESD and S&T provisions within its programs. The academic staff needs strategies that guide their efforts and they would be better prepared to meet and embrace the SD challenges in the country. And this would move the country from least developed to a developing nation by the year 2030. Considering with the above challenges, this research however unravel strategies in which HEIs in Somaliland, particularly the three public universities and other universities that offer S&T related programs could play a significant role in contributing to the national development goals for 2030 and beyond.

In SD context, government institutions are responsible for the enforcement and the implementation of the Somaliland Development Goals. Usually, government ministries are responsible for capacitating HEIs by providing financial support; human resource planning, policies and other procedures towards strengthening S&T capacities for these institutions.

1.9 Definitions of Terms

This section defines the terms used in the chapters of this thesis as presented below:

Sustainable Development -is defined as a development that meets the needs of the present generation without compromising the future generation's ability to meet their needs. Sustainable Development is said to be achieved through consideration of and balance between the social, environmental and economic 'pillars' of development (Cuthill, 2010).

Higher Education Institutions – comprises all post-secondary education, training and research guidance at education institutions such as universities that are authorized as institutions of higher education by state authorities. In other words, Higher Education Institutions are education institutions that provide higher learning educational programs (Institute, 2014).

Education for Sustainable Development - is an educational philosophy and process of achieving human development in an inclusive, equitable and secure manner which includes education for inclusive development, economic growth, environmental protection, poverty alleviation, human rights, gender equality, cultural diversity, international understanding among the other factors (Huckle, 2015).

Human capital development - is the stock of knowledge, habits, social and personality attributes, including creativity, embodied in the ability to perform labour so as to produce economic value (Debrah, Oseghale, & Adams, 2018).

Sustainable Development Goals - is defined set of universal goals that comprise 17 goals and 169 targets and they build on the proceeded Millennium Development goals (Hák, 2016).

Millennium Development Goals - are the eight international development goals that were established following the Millennium Summit of the United Nations in 2000, also following the adoption of the United Nations Millennium Declaration (Hajer et al., 2015).

Economic growth - is an increase in the amount of goods and services produced per head of the population over a period of time (Van den Berg, 2016).

Economic Development - is a policy intervention endeavour which aims at the economic and social well-being of people; economic growth is a phenomenon of market productivity and rise in GDP (Van den Berg, 2016).

1.10 Operational Definitions

The following Operational definitions are based on the authors understanding based on tuition, experience and the review of literatures made during the course of the study.

Sustainable Development -is defined as a progressive and sustained economic growth that meets the basic needs for all and covers social, environmental and economic dimensions as the key pillars for achieving sustainable development.

Higher Education Institutions –Higher Education Institutions are education institutions that provide higher learning educational programs particularly post-secondary education level.

Education for Sustainable Development - is an educational approach of integrating program outcomes into sustainable development across the different sectors within the national priorities.

Human capital development - is the knowledge base and skilled human resources that are capable of contributing to the development of the country by creating economic value.

Sustainable Development Goals - is the extension of the expired Millennium Development Goals with more specific and detailed goals that covers the 169 targets.

Millennium Development Goals - are the eight inclusive and cross-cutting targets designated to eradicate poverty and hunger as UN's Summit in 2000 declared to adopt these goals.

Economic growth - is an increase in the capacity in terms of productivity goods and services per head of the population compared from one period to another.

Economic Development - is the progression of the standard of living of a countries people from a low-income (poor) economy to a high-income (rich) economy. It can also be defined as all efforts aimed at improving quality of social well-being.

1.11 Organization of the Thesis

The study is organized into five chapters. The first chapter describes the study. It covers the introduction, background, context of the study, the problem statement of the study, the research objectives and the significance of the study. It also indicates the scope, the conceptual framework, the definition of terms and the operational definitions.

Chapter 2 provides the literature review of readings that are relevant to the study. The review of literature discusses relevant researches on ESD particularly S&T in HE for SD. The first part highlights the importance of HESD and how S&T, R&D and CE are the key capacities of HEIs that foster or lead towards achieving SDGs. Within the review of literature, HESD frameworks were discussed and gap analysis was done to highlight the deficiencies of the existing frameworks.

Chapter 3 covers the research methodology by describing the design of the study, including the data collection and statistical testing of the constructs. This study employed three approaches for data collection; survey, interviews and document reviews. Chapter 4 covers the findings and the analysis of the collected data. In Chapter 5, discussions of the findings are given. Also, in chapter 5 are the conclusions followed by the recommendations for Somaliland and future studies. After those five chapters, references and attachments are provided.

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LIST OF PUBLICATIONS

- 1** Strengthening Higher Institutions Towards Sustainable Development in Somaliland
- 2** Inter-institutional Framework towards Ensuring SDGs in Somaliland, Transformative Paradigm
- 3** A Look at Somaliland's Science & Technology Capacity in Higher Education
- 4** Incorporating Science and Technology in Higher Education into Strategic Planning for Sustainable Development in Somaliland
- 5** Integration of Higher Education into Sustainable Development: Analysis of Competences and Challenges
- 6** Science, Technology & Innovation (STI) Policy Reform in the Developing Countries at the Grass-Root Level