THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Behind the Stagnant Journey of Science, Technology and Industry in Ethiopia: Challenges of Technological Innovation and Transfer

Muktar Ahmed
Lecturer, Department of Civics and Ethical Studies, ASSOSA University, Ethiopia

Abstract:
The aim of this article is to discuss and analyze the status of science, technology and industry in Ethiopia. Firstly conceptual clarification of the terms science, technology and industry was accomplished. The relation among these concepts and their journey from Ethiopian context was discussed in relation to the emergence of science, technology and industry from the global context. The second issue that discussed in this article the status of transfer of science, technology and industry in Ethiopia and the challenges examined the task. Among others, some reasons that were obstacle for the transference of science from given area of the world to other area especially from early industrialized world to Ethiopia was analyzed. The development experience of some newly industrialized countries next to western countries was raised briefly. Ideas that has root in epistemology like the meaning of knowledge, innovation and other related issues was elaborated .Some remedial action that might facilitate technology transfer in Ethiopia to boost knowledge based economy was suggested.

Keywords: *Knowledge, science, technology, industry, innovation, mapping function*

1. Introduction

The development of science, technology and industry is considered as some of distinguishing features of modern world. I will discuss about three of them because I understand that there is linear relationship between all of them and they influence each other. The development of one is the development of the other and vice versa. These developments vary according to country, and continent. Accordingly, countries that exhaustively used these developments improved the socio-economic conditions of their people while countries that could not effectively use this chance still struggle with poverty and backwardness of their nation.

The attempt of adopting science and technology in Ethiopia was started by Emperor Tewdros II who is considered as one of pioneer of change in Ethiopia by starting the process of modern unification of Ethiopia and industrialization simultaneously. The process was continued by emperor Tewdros' successors, Emperor Yohannis IV, Menilik II and even Emperor Hailseellasie I and his successors tried their best in order develop science, technology and industry in Ethiopia in order to change the life of people.

Despite the efforts of leaders and people to cultivate science and technology domestically and transfer it from early industrialized world, Ethiopia still did not benefited from science and technology as such. Because of lack of knowledge based economy within the country, Ethiopia is incompetent economically and considered as one of poor nations of the world. This article tried to raise some issues that were obstacle for the flourish of science and technology in Ethiopia and possible remedies since the blossom of science and technology has incalculable benefits for economic empowerment of a given country.

1.1. Objective of the Study

The rationale behind the work of this article was assessing the role and status of science, technology and industry in Ethiopia. Additionally the discussion was concerned with the obstacles for the transfer of science, technology and industry, factors that hindered the emergence of these concepts and other related ideas like innovation. Furthermore, the article aimed at suggesting some tips that might enable the country to benefit from the advancement of science technology and industry in order to enhance knowledge based economy that insure overall progress within the country.

1.2. Methods

In this study the researcher considered different contextual issues and used purely qualitative study approach as the best method in order to reach on meaningful conclusions.

In order to enhance the general objective of this article, various sources of evidence that are both primary and secondary were utilized. Accordingly, Review of literatures, analysis of documents that indicted the socio- economic conditions of Ethiopia and other world have been employed.

Primary Sources: Discussions with multidisciplinary scholars especially that of science, history, Philosophy and economics disciplines were examined as primary sources of evidences.

Secondary Sources: Various qualitative documents were critically and rationally analyzed. They include hand books, public reports, historical magazines, reputable news and academic literatures that are related to science, technology and industry.

1.3. What Is Science

The Etymological definition of science is derived from Latin language "Scientia" and its root verb is "scire" which means "to know" that was used primarily about knowledge of facts. Even though the etymological definition of science has general meaning "to know", the English term science consists the definition of science in narrower sense according to some writers.

> The English word "science" derives from the Latin "scientia", and originally, it had an equally wide meaning. It could refer to almost anything that you had to learn in order to master it: everything from scholarly learning to sewing and horse riding. But in the seventeenth and eighteenth centuries the meaning of "science" was restricted to systematic knowledge. The word could for instance refer to the knowledge you need to make a living in a particular practical trade. In the nineteenth century the meaning of "science" was further restricted, and it essentially meant what we would today call natural science (Layton 1976). Today, the term "science" is still primarily used about the natural sciences and other fields of research that are considered to be similar to them. Hence, political economy and sociology are counted as sciences, whereas literature and history are usually not. In several academic areas considerable efforts have been devoted to making one's own discipline accepted as a science. This applies for instance to social anthropology that is often counted as a science although it is in many respects closer to the humanities (Salmon, 2003).

Science was defined by different scholars from different perspectives. In order to capture the meaning of the term mentioning some of these perspectives is important.

According to Oxford Dictionary science is defined as "the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment". Science as it was defined by Science council in 2009:

"Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence".

1.4. The Progress of Science, and Enligtmentment of the world

Discussion of the world progress in science is precondition in order to discuss the path of scientific advancement in Ethiopia. The advancement of science is accomplished in world historical epoch known as modernity even though there are contributions of ancient and medieval civilization. Here is the definition of modernization:

> Modernization is the historical process whereby the social relations governing a human community have shifted from being based on kinship, tradition, collectivism, and magic/religion, to being based on rule of law, rationality, individualism, and scientific knowledge. The trick is to understand not only that modernization can be one of the unplanned effects of spontaneous industrialization, but also that political leaders keen to modernize their countries can deliberately use industrialization as a very potent means to that cherished end. D. Simandan,2009,421

Although the exact time at which modernization began was debatable, modernization especially that of western world was characterized by the following events and process.

> The Renaissance, Enlightenment Movement, and Science Revolution catalyzed European industrial revolution, political revolution and religious reform, and, accordingly, initiated the process of industrialization and modernization. In the history of modernization, two important science revolutions gave rise to the revolution in epistemology, led to the reforms in man's outlook on world, values and development, and provided knowledge backing for technology revolution.
>
> In the modernization process, the technology revolutions and industrial revolutions reinforced each other, resulting in a leap-frog advance in productivity and abundance of material wealth and causing extensive changes in economy, society and military force, thus becoming the engine to man's modernization drive(Lu,2010, PP:7-8).

The advance of science in modernity is the contribution of different peoples and cultures all over the world. For instance, ancient Greek and Roman civilization, Medieval Muslim Arab civilization and others. When Europeans start renaissance and tried to notice their ancient glorious civilization, the works of popular thinkers like Aristotle were preserved by Muslim Arab civilization. Arabs also contributed great to Metallurgy, alchemy, algebra and others. Chinese people discovered gun powder before Europeans. In general there are enormous examples that indicate the contact of civilization among peoples of the world in addition to that I have mentioned above.

But in addition to the concepts they inherited from other civilizations of the world, Europeans especially WesternEurope became the center of economic and scientific advancement more than any part of the world starting from 16th century. Even other parts of the world that were competing with Europe became lagged behind and Europe became the leader of world Civilization after this century.

1.5. Why Europe Became the WORLD'S Hub of Civilization in Modern World?

Scholars answered the above question from different perspectives. I will denote some of them in the following paragraphs.

The contribution of historical epoch known as Renaissance had incalculable benefit for the Europeans dominance across the 16, 17, 18, and 19thcenturies up to contemporary world. As far I understood from the different works of some scholars, Europe's great urge for secularism contributed for scientific development. More than anything Renaissance relieved Europeans from the bondages of any kind of dogmas.

Dogmas are any kind conservative attitudes whether it is religious or political institutions that hesitate change and want to preserve statuesque. The forerunners of European renaissance struggled against any kind of mysticism and especially they confronted with the church that dominated the world view of society in medieval age. They revived Greco-Roman civilization as the remarkable history of western world. In my view, the reason why Renaissance scholars appreciated and made Greco-Roman civilization as stepping stone for European advancement was that there were manifestations of freedom and secularism in ancient civilization. For example just to mention some, Ancient Greek was the home of famous philosophers like, Thales, Pythagoras, Empedocles, Sophists, Socrates, Plato, Aristotle, and historians like Herodotus and Thucydides as well as poets like Homer and Hesiod. Rome contribution for law discipline is also enormous. Rome contributed great scholars like Cicero, Seneca, and others.

The wisdom of ancient Greek and Rome penetrated even to modern world within different disciplines. One of the reasons why such wisdom flourished in Greek and Rome was that there was freedom of thought especially for Greek Pre-Socratic philosophers who raised a lot of metaphysical questions that contributed for modern science. For example, the idea of Atoms which developed by Democritus and Leucippus influenced modern chemistry. Plato's Republic influenced today's politics. Aristotle's ideas influenced both modern natural and social sciences. Archimedes, Euclid, and Pythagoras contributed for the advancement of modern physics, and mathematics just to mention few. Cicero from Rome influenced the development of law discipline.

Even though there were some circumstances that hindered the freedom of different narratives like the death of Athenian Socrates and some others, Greco-Roman world was better than medieval Europe in permitting different discourse. That is why European scholars of Renaissance took the Greco- Roman civilization as their base.

Thus, in order to build better Europe in the future they needed the freedom of ancient scholars. That is why they needed secularism. At that time medieval Europe was characterized by church domination and despotic rulers. But renaissance and enlightenment thinkers challenged these authorities and made Europe the center of science and progress. The following quotation will summarize why Europe became the center of progress:

> In the centuries ahead modern science would increasingly challenge not only the authority of the Christian church, but almost all religious beliefs and practices worldwide. Science began to formulate a new explanation and understanding of nature and reality. Eventually it overturned both mythological and religious stories of the origins of the universe, as well as traditional histories of nature and humankind. Further, it provided a new way of thinking and a new method for investigating nature – the scientific experiment. Finally, it laid the theoretical seeds for a new view of the future – the theory of secular progress.
>
> Although there were some notable connections between Western religion and science, as well as ancient Greek philosophy and science, a distinctively new belief system and approach to reality emerged in the Scientific Revolution during the sixteenth and seventeenth centuries.

Watson asks why the Scientific Revolution occurred in Europe as opposed to Asia or the Middle East. According to Watson, the rise of individualism (encouraging freedom of thought and inquiry), the increasing emphasis on quantification and precision, and the materialistic and competitive nature of Western capitalism all contributed to creating a favorable climate in Europe for the beginnings of science. Although there were as many scholars in Islam or China as in Europe during the period of the High Middle Ages, the former two societies had centrally controlled intellectual cultures, whereas European intellectual culture was more open, individualistic, and critical. All in all, it seems clear that the philosophy and practice of freedom of inquiry and individualistic competition were critical factors in stimulating the growth of science in Europe(http://www.centerforfutureconciousness.com).

The idea of renaissance and enlightenment thinkers finally culminated in scientific revolution which paved the way for the coming technology and industrial revolution. Scientific and industrial revolution empowered Europe economically and politically. These are events that made Europe the center of wisdom starting from 16th century.

1.6. What Is Scientific Revolution?

The idea of scientific revolution is controversial according to some thinkers. Some of scholars argued that scientific events that took place in 17th and 18th centuries are not considered as revolutionary. For them enquiries that took in Enlightenment are extended from the civilization of antiquity. Even according to them before enlightenment the word revolution itself was not understood as dramatic change but as periodically recurring cycle.

From antiquity through the early modern period, a _revolution_ invoked the idea of a periodically recurring cycle. In Copernicus' new astronomy of the mid _sixteenth century, for example, the planets completed their revolutions round the sun, while references to political revolutions gestured at the notion of ebbs and flows or cycles fortunes wheel_ in human affairs. The idea of revolution as a radical and irreversible reordering developed together with linear, unidirectional conceptions of time. In this newer conception revolution was not recurrence but its reverse, the bringing about of a new state of affairs that the world had never witnessed before and might never witness again. Not only this notion of revolution but also the beginnings of an idea of revolution in science date from the eighteenth_ century writings of French Enlightenment philosophes who liked to portray themselves and their disciplines, as radical subverters of ancient régime culture. (Some of the seventeenth_ century writers this book is concerned with saw themselves not as bringing about totally new states of affairs but as restoring or purifying old ones.)The notion of a revolution as epochal and irreversible

change, it is possible was_ first applied in a systematic way to events in science and only later to political events. In just this sense the first revolutions may have been scientific, and the _American, _ _French, _ and _Russian Revolutions_ are its progeny (Shapin, 1996,4).

Even though there are controversies on the meaning of the term "revolution" and scientific revolution, for the sake of this article I want to recognize my readers as the word revolution in my context is radical change in humans thought. In the above quotation Shap in together with other thinkers indicated that what took place in 16th, 17th and 18th centuries was not radical change or new state of affairs with regard to science but only purifying and restoring the old knowledge of antiquity. In this case even though, there are concepts that were taken from the ancient civilizations of Greek and Rome and others, there are enormous revolutionary ideas that occurred only in modern time. For example, heliocentric idea is revolutionary when we compare with geocentric view which was supported by Aristotle and medieval thinkers of Scholasticism. The discovery of Telescope by Galileo, Keplers' scientific ideas, and Newtonian physics, just to mention few examples indicated that science made radical/revolutionary/ change in modern time. Thus, in my view the existence of scientific revolution is vivid and not controversial.

One of the challenges that Renaissance scholars faced was Nicholas Copernicus' Heliocentric theory which challenged geocentric world view of Ptolemy's and church. This paradigm shift indicated that the previous world views toward cosmology and heaven was erroneous and Galileo supported Copernicus' ideas to be accepted by church. But the church labeled Galileo as Heretic and imprisoned him.

Despite churches condemnation, European renaissance thinkers did not hesitate to achieve paradigm shifts in scientific knowledge. They continued their inquiry of natural world and used experience and reason as the source of knowing natural world.

1.7. What Is Technology?

Technology is the systematic application of various branches of knowledge to practical problems". (Andrew O. Urevbu, 1997,8). According to S.O. Hansson, The word "technology" is of Greek origin, based on "techne" that means art or skill and "-logy" that means "knowledge of" or "discipline of". The word was introduced into Latin as a loanword by Cicero (Steele 1900, 389 quoted in S.O. Hansson, 2015,16).However, it does not seem to have been much used until Peter Ramus (1515–1572) started to use it in the sense of knowledge about the relations among all technai(arts). The word became used increasingly to denote knowledge about the arts. In 1829 the American physician and scientist Jacob Bigelow published Elements of Technology where he defined technology as "the principles, processes, and nomenclatures of the more conspicuous arts, particularly those which involve applications of science" (Tulley 2008 quoted in ibid).

With regard to the difference between science and technology, Science is broader knowledge about nature and technology is the method of solving practical human problems using science. The following are contributions of science to technology that indicate scientific knowledge is prior to technological knowledge.

> Science, technology and innovation each represent a successively larger category of activities which are highly interdependent but distinct. Science contributes to technology in at least six ways:
> (1)new knowledge which serves as a direct source of ideas for new technological possibilities; (2) source of tools and techniques for more efficient engineering design and a knowledge base for evaluation of feasibility of designs; (3) research instrumentation, laboratory techniques and analytical methods used in research that eventually find their way into design or industrial practices, often through intermediate disciplines; (4) practice of research as a source for development and assimilation of new human skills and capabilities eventually useful for technology; (5) creation of a knowledgebase that becomes increasingly important in the assessment of technology in terms of its wider social and environmental impacts; (6) knowledge basethat enables more efficient strategies of applied research, development, and refinement of new technologies.

The converse impact of technology on science is of at least equal importance: (1) through providing a fertile source of novel scientific questions and thereby also helping to justify the allocation of resources needed to address these questions in an efficient and timely manner, extending the agenda of science; (2) as a source of otherwise unavailable instrumentation and techniques needed to address novel and more difficult scientific questions more efficiently (Brooks, 1994,p,1)

The two scientific revolutions were followed by technology revolutions .The following quotation summarizes the two scientific revolutions and three technology revolutions as follows:

> In the modernization process, the technology revolutions and industrial revolutions reinforced each other, resulting in a leap-frog advance in productivity and abundance of material wealth and causing extensive changes in economy, society and military force, thus becoming the engine to man's modernization drive. The discovery of steam engine in Europe and its extensive application in the mid-18th century marked the first technology revolution, the machine-equipped industry gradually developed into five industrial systems from textile to excavating, metallurgical, machine manufacturing and transporting industries. The first industrial revolution completely smashed the old relations of production and changed the world structure. Hence began the era of industrial civilization of mankind. The advent of electric power technology marked the second technology revolution, in the 1830s, by advancing human society from steam to electric age. Internal combustion engine and motor engine gradually replaced the steam engine. Heavy industries such as electric power, oil and chemical industry rose very rapidly. The advent of electronic technology, space and aeronautic technology, nuclear technology, information and the internet technology, since the 1940s, has marked the third technology revolution, bringing mankind into the electronic age from the electric age. The

> rapidly developing electronic industry gave rise to many emerging industries, promoted the upgrading of conventional industry and the development of military and related industries. The rapid development of biotechnology has brought out the progress in medicine, health and agriculture industry (Lu,2010,pp: 8-9).

1.8. Industrialization and Industrial Revolution

The idea that there is linear model among Science, technology and industry is debatable. Linear model means the idea that Science pushed technology and technology pushed industry. One group of scholars argued that there is no linear model among them while other group of scholars insisted that there is no linear model among them. For example, Margaret C. Jacob supports a causal relationship between science, technology, and industrialization along the linear model:

The elements of the natural world encoded in science were not peripheral to industrialization and Western hegemony; rather they were central to it. The late eighteenth-century application of scientific knowledge and experimental forms of inquiry to the making of goods, the moving of heavy objects whether coal or water, and the creation of new power technologies dramatically transformed human productivity in the West. At the time there was a growing "audience for science" that not only the forms of scientific investigation but also the contents became instrumental and indispensable for technological development at the very beginning of the nineteenth century. The industrial entrepreneur girded with skill in applied science was already the key figure of early European industrialization (Jacob quoted in Wrengenroth, 2000 8) On the other hand A.R. Hall (quoted in ibid) insisted that there was no linear relationship among science, technology and industry in her article asking: "What did the Industrial Revolution in Britain owe to Science?"

Hall argued that" inventors during the Industrial Revolution in fact owed very little to contemporary developments in science. The mathematics that they often used forth first time in engineering was centuries if not millennia old". Moreover, references made to science could be shown to have been of no importance to the actual invention according to Hall. "On closer scrutiny they appeared as mere window-dressing to lend science's authority to engineering ingenuity".

In my view, there was linear model among science, technology and industry because science should pass one step which is technology in order to be changed to industry since it is broad knowledge to directly change to industry. Thus, scientific revolution pushed technology revolution while technology revolution again pushed industry revolution.

1.9. The Meaning of Industrialization

Once I have discussed the relationship between scientific, technology and industry revolution, industrialization should be defined. Because of linear model, industry is the result of science and technology. Here is the definition of industrialization:

> Industrialization' is a generic name for a set of economic and social processes related to the discovery of more efficient ways for the creation of value. These more efficient ways are lumped together under the label 'industry' or 'the secondary sector' (the primary sector of economic activity referring to agriculture, hunting, fishing, and resource extraction, and the tertiary sector referring to services). Beginning with the late-seventeenth century, industrial activity has dramatically enlarged its scope and scale, as machino-facture began to replace manufacture. Historically, industrialization studies have concerned themselves primarily with the period known as the Industrial Revolution, although in geography this area of enquiry has been the focus of many economic geographers interested in the contemporary logic of the global economic landscape.
>
> Using the criterion of the abruptness of change, one can distinguish two types of economic change: events (swift singular changes) and processes (protracted cumulative changes). Industrialization is a process, not an event. A process is an emergent property of a system (country or region) resulting from a collection of events that share a number of similarities and that unfold over a slower timescale than that of its component events (Simandan,2009,419).

1.10. The Transition from TRADITION TO Modernization in Ethiopia

The transition to modernization has contribution to understand the journey of science, technology and industrialization in Ethiopia. Because the epistemic bases for the development of Ethiopian science and technology was anchored on this transition.

As the case of Ethiopia, the transition to modernity had impact for western world that was industrialized early by using science and technology. In Western world science was the results of movements that took place in the heyday of modernization like renaissance, enlightenment and other attempts of modernization.

The difference between Ethiopian transition to modernity and European transition to modernity is that in case of European modernity, the elements like renaissance and enlightenment filtered the stock of their knowledge and paved the way for the development of scientific ideas and social progress. But in the case of Ethiopia, even though country had long history of literature and wisdom, this wisdom could not analyzed, criticized and filtered to extract scientific knowledge that might enhance material progress.

Western especially European enlightenment created elites from marvelous disciplines of sciences and these elites left remarkable literature for the generation that followed them. These literatures shaped the socio-economic and political life of western world.

In contrary to this, in the case of Ethiopia, the transition to modernity did not influenced as such by revolutionary ideas and movements that could relieve citizens from dogmatic ideas that might contribute for the flourish of scientific culture. The following quotation strengthens my idea:

Everyone can understand that we Ethiopians have enormous and incredible historical heritages. One of such historical heritages is our own historical alphabet. But despite our long history of developing our own alphabet, the absence of secular literature that aimed at research and study was astonishing. Even in the case of spiritual literature that has significant stock of literary works, the texts were written by Geez which had no access for many Ethiopians. In traditional Ethiopian educational system the culture of knowledge was not more than memorization of some texts that were spiritual in character. Few elite that has access only to spiritual literature passed many centuries by this culture of knowledge.

The same is true in Islam which is another great religion of Ethiopia. The Sheiks was taught Quran by Arabic language that was not mother tongue language for both Ustaz(teachers) and Darasas (students). Thus, as in the case of church, Madrasas also could not prepare elite for style of learning that contribute for scientific ideas.

Accordingly, a few elite that had relation with nobilities emphasized spiritual knowledge rather than secular knowledge. As are result these elites could not left literary works that emphasized worldly research and study for the coming generation. Such kind of elite culture was intended only to protect political and economic interests of nobilities and played great role to strengthen social conservatism. Such social conservatism of guilt system prohibited the spirits of questioning, analyzing and change that are genuine tools for development of science and technology. The characteristics of modern education in Ethiopia, is the same with that of traditional despite the language was changed to English. In addition to the lack of fluency in English, the education that was given could not able the elite to recognize the context of its society and could not initiated elite to research rather than simply rehearsing and preparing itself only to pass the exam (Andargachew,2005,81-83).

Andargachew classified modern Ethiopian elites in two categories. The first group of elite was that influenced by Ethiopian traditional guilt system and the second is the elite followed 1974 Ethiopian revolution. Andargachew states,

The first modern Ethiopian elites were swallowed by Ethiopian guilt system. Because of this they could not created any change by using their modern knowledge. The second modern elites of new generation (after 1974), that was many in number than the first group. But it was planted on the intellectual barren-land, and could not herald the bright future of Ethiopia. Even though, the second elite understood that the cause of Ethiopia's poverty, illiteracy and backwardness was the social and political system of guilt, it could not got intellectual tools that relieve it from this system from the first elite or could not prepare intellectual tools for itself that lead the country to prosperity. Following the expansion of modern education, it is not exaggeration if I argue that there is no knowledge about our country prepared by ourselves. Because of this we could not create matured intellectuals that was cultivated by disciplines like art and Philosophy, Natural and social science (ibid, 88).

2. Innovation and Technology Transfer in Ethiopia

Flawed transition from tradition to modernity by reasons mentioned above, caused the following core constrains, that contributed for the stagnant development of science, technology and industry in Ethiopia. These constraints are: lack of innovation and lack of technology transfer.

2.1. Lack of Innovative Activities and Culture

Sourced from both the business and library literature, here are several definitions of innovation(Vaughan, 2013, 11). "Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace." (AnahitaBaregheh, Jennifer Rowley, and Sally Sam-brook, 2009 quoted in Vaughan, 2013, 11).

"An innovation is a change, in a product, service, process or, more widely, an organization."(Rowley quoted in ibid). "A wise person once told me that innovation isn't just about doing things that are new or different; it's about doing things that in the eye of the beholder (the user, patron, or customer) meet a need that may not have been appreciated before. Innovations are the things that truly alter and improve how we do things; they may even shift our proverbial paradigms."(Dick Kaser, 2011 quoted in ibid).

2.2. What Are The Sources of Creativity and Innovation in Individuals?

Teresa Amabile PhD in Psychology and Head of the Entrepreneurial Management Unit at the Harvard Business School suggested the sources of creativity as follows:

Creativity arises through the confluence of the following three components: Knowledge: All the relevant understanding an individual brings to bear on a creative effort. Creative Thinking: Relates to how people approach problems and depends on personality and thinking/working style. Motivation: Motivation is generally accepted as key to creative production, and the most important motivators are intrinsic passion and interest in the work itself.(Amabile quoted in Adams, 2005, 4)

Sternberg (quoted in ibid, pp 6-7) promotes a "triarchic theory", asserting that there are three main aspects of intelligence that are key for creativity – synthetic, analytical and practical:

- Synthetic (creative): the ability to generate ideas that are novel, high quality and task appropriate.
- Analytical: Critical/analytical thinking is involved in creativity as the ability to judge the value of one's own ideas, to evaluate their strengths and weaknesses and suggest ways to improve them.

- Practical: Ability to apply intellectual skills in everyday contexts and to "sell" creative ideas.

In Ethiopia although there are abilities of generating ideas that are novel and high because of absence of analytical and critical investigation of different narratives and wisdom, there was no chance of extracting new ideas that contributed to creativity and innovation. The third aspect that is key to creativity according to Stenberg was also not developed since it depends on the second aspect (analytical) because sell of creative ideas necessitates analyzed and filtered ideas ready for practical application.

2.2.1. What is the Nature of Culture, Society and Economy That Makes a Given Country Creative and Innovative?

There is no consensus on the factors that initiate innovation in a given society. Some scholars indicate that cultural factors like individualist style of life of western culture are important while others disqualify this by giving recent developments like that of China that were industrialized without following individualism and capitalistic culture as such. The following scholar indicates that structural, institutional and economic factors play great role for creativity and entrepreneurship than culture:

Structural, institutional and economic factors may be more powerful variables in entrepreneurship than is culture. (Hayton quoted in Adams, 48,) provides a balanced view of the culture-innovation link with culture as "a moderator of the relationship between contextual factors and entrepreneurial outcomes," thus acting as a catalyst rather than a causal agent of entrepreneurship, (Hayton, et al; p. 45 quoted in Adams, 48). This suggests that simply teaching and encouraging creativity among students is one way to enhance creative outcomes and that socialenvironments should aim to protect individual autonomy. This idea may be related to why we see greater innovation in China today than in the past, despite the supposed cultural barriers. In other words, cultural barriers may be easily overcome when economics and institutions favor change(Adams,2005,PP: 48-49).

Moreover, considering only culture as the ultimate factor of innovation is difficult since there a lot of factors that might initiate innovation. I also feel that structural, institutional and economic factors may initiate innovation by taking culture as a catalyst.

2.3. Lack of Technology transfer

Technology transfer is one of the common terms redundantly heard by Medias, on different academic and other conferences but complex task in practice as far as I understood. Only few nations succeeded in catching up industrialized nations by means of technology transfer. In my view, like innovation, technology transfer itself seeks highly qualified skilled labor force.

Science, firstly flourished in Florence, and then flowed to England. But in England science was evolved to technology and industry that enabled England to enhance material progress. After England, Science transferred to other countries and continents together with its branches, technology and industry. Accordingly, France, Germany, other Europe and North America industrialized respectively. After that Science dramatically jumped to Asia (Japan, China, Korea, Hong-Kong, Singapore, Thailand, and Taiwan) and they were industrialized next to Western Europe and North America. This indicates that there are pre-conditions that should be fulfilled even to transfer technology from developed nations and change the standard of life of people .Despite scientific revolutions followed by technology revolutions and industry revolutions took place, Ethiopia couldn't either innovate or transfer the knowledge of innovated technologies except importing these technological goods from developed world.

3. Challenges of Innovation and Technology Transfer In Developing Countries: The Case Of Ethiopia

One of the reasons that make technology transfer difficult is that what we call useful knowledge is sophisticated and the task of transfer is also complicated.

3.1. The Meaning and Codification of Knowledge

3.1.1. What Is Knowledge?

`The meaning and source of knowledge is one of issues studied in Philosophy. The branch of philosophy that studies about knowledge is known as "epistemology". Accordingly, epistemology raises the following question that aimed at understanding the meaning and sources of knowledge.

Knowing is one of the most specific human processes and knowledge is its result. That means that knowing and knowledge have been subjects of human inquiry from the ancient times. Philosophers, starting with Plato and Aristotle developed Epistemology as a theory of knowledge, trying to answer to the fundamental question: What is knowledge? There were many answers and many arguments used in supporting them, but none of those theories has been accepted so far as being fully satisfactory. Defining knowledge and explaining its nature proved to be elusive and without a convincing and universally accepted result (Neta and Pritchard 2009; Russell 1972 (quoted inEttoreBolisani and ConstantinBratianu, 2018,2)

Theories that concern with knowledge are classified in to two. These are rationalism and empiricism. Both of them define knowledge as justified true belief even if the definitions of knowledge are enormous. But these two theories of knowledge have distinct assumption on the source of knowledge. According to rationalism the source of knowledge is theory while the source of knowledge is experience or practice according to empiricism. The definition of knowledge that as justified true belief is elaborated as follows:

A frequently adopted definition of knowledge is that of "justified true belief" (Nonaka and Takeuchi, 1995; p.87). That definition incorporates three basic conditions, fact for which some authors call it the tripartite account of knowledge. These conditions are the following (Neta and Pritchard, 2009).

- The Truth Condition: It requires that if one knows a proposition then that proposition must be true. If the proposition is not true, then that person does not know what he claims to know. The truth condition makes the difference between opinion and knowledge.
- The Belief Condition: That condition demands that if one knows a proposition then he believes that proposition.
- The Justification Condition: That condition requires a practical way of justifying that the belief one has is true.(ibid,5)

3.1.2. Knowledge Codification

In order to enhance knowledge based economy, knowledge codification and analysis is important. There a lot of codifications of knowledge. The following codifications are relevant to the intension of my article. Accordingly, there are four kinds of knowledge and understanding their distinction enables someone to understand its dissemination and usage of them efficiently. Here is their definition and their role in boosting economy;

- Know-what: refers to knowledge about "facts". Here, knowledge is close to what is normally called information – it can be broken down into bits. In some complex areas, experts must have a lot of this kind of knowledge in order to fulfill their jobs. Practitioners of law and medicine belong to this category
- Know-why: refers to scientific knowledge of the principles and laws of nature. This kind of knowledge underlies technological development and product and process advances in most industries. The production and reproduction of know-why is often organized in specialized organizations, such as research laboratories and universities. ◊ Know-how refers to skills or the capability to do something
- Know-how is typically a kind of knowledge developed and kept within the border of an Individual firm. One of the most important reasons for the formation of industrial networks is the need for firms to be able to share and combine elements of know-how.
- Know-who which involves information about who knows what and who knows how to do what. It involves the formation of special social relationships which make it possible to get access to experts and use their knowledge efficiently. It is significant in economies where skills are widely dispersed because of a highly developed division of labor among organizations and experts. For the modern manager and organization, it is important to use this kind of knowledge in response to the acceleration in the rate of change. The know-who kind of knowledge is internal to the organization to a higher degree than any other kind of knowledge (OECD,1996,12)

3.1.3. The Dissemination of Knowledge

Once it is identified that there are different kinds of knowledge, it is important to discuss about its dissemination. Because in order to diffuse knowledge, it is important to know the ways in which transfer is possible. There are a lot of channels that enable someone to disseminate knowledge. From this four kinds of knowledge, the fourth (know-who) is not easily accessed to be disseminated by most of common channels. The following idea strengthens my view:

Learning to master the four kinds of knowledge takes place through different channels. While know-what and know-why can be obtained through reading books, attending lectures and accessing databases, the other two kinds of knowledge are rooted primarily in practical experience. Know-how will typically be learned in situations where an apprentice follows a master and relies upon him as the authority. Know-who is learned in social practice and sometimes in specialized educational environments. It also develops in day-to-day dealings with customers, sub-contractors and independent institutes. One reason why firms engage in basic research is to acquire access to networks of academic experts crucial for their innovative capability. Know-who is socially embedded knowledge which cannot easily be transferred through formal channels of information (OECD,1996,).

Thus, one of the reasons that make the transfer of technology difficult is that some types of knowledge especially "tacit knowledge"(know how and know who) need personal and other informal contacts and discussions that should be accomplished by different technicians. As I have tried to mention in the previous discussions, for the development of science, technology and industry in a given country, it necessitates the ability to invent and innovate, and the ability to transfer invented technology from other country is also indispensable. Depending on these factors, the socio-economic condition of countries varies.

Technological knowledge is a kind of knowledge that enables us to manipulate nature for man's material purpose. Another scholar Mokyr divided knowledge in to two. These are: useful knowledge(S) and Techne(8).According to him in order to enhance socio-economic development mastering two kind of knowledge is necessary. Mokyr defines useful knowledge as "the union of all the pieces of useful knowledge contained in the living person's minds or storage device". He symbolized this kind of knowledge as "S". He explains the application of this knowledge as follows:

The role that useful knowledge (S) can play in society's technological development depends on the elements: how large is S(that is, what is known); how diffuse is this knowledge(who and how many know what is known); and marginal access cost(how much does it cost me to find out what I do not know? A lot will depend on the efficiency and cost access of the knowledge. In addition to useful knowledge about natural world, there is a second form of knowledge

which I call techniques. Techniques are essentially a set of instructions or recipes on how to manipulate nature. These instructions like all knowledge either resides in the people's brains or in storage devices. It consists of designs and instructions on how to adapt means to a well defined end, much like a piece of software or a cookbook recipe. They are usually the end product of some knowledge in S so they have epistemic base in S. I will refer to this set as 8. If S is episteme 8 is techne. Elements of 8 can be taught, imitated, and improved up on. A "how to" manual is a codified set of techniques. Not all techniques are explicit, codified, or even verbalized (Mokyr, 1999 pp, 4-6)

As indicated in the above quotation, access cost to the knowledge greatly determines the contribution of a given useful knowledge to boost technology and development. In my view, although the access cost of codified knowledge itself needs effort, the access cost of un-codified (tacit) Knowledge is great challenge for those societies who want to transfer technologies from developed nations. This is one of the great reasons why only some part of the world were industrialized zone, while most of the world nations are non- industrialized.

The same is true for Ethiopia. Although there was access to codified knowledge since the emergence of modern education in Ethiopia, especially Universities and colleges, still Ethiopia lacks tacit knowledge which is indispensable for innovation as well as coping innovative ideas from others. As a result, Ethiopia could not insure knowledge based economy the leads to industrialization.

England was the first industrialized nation of the world. One of the great achievements of England to become early industrialized is that it succeeded in the invention of machine. French was the first country that tried to catch up Britain. Because industry is impossible before someone can achieve to create its own machine .In order to adapt this technology from England, France expanded a lot of storage devices that transfer techniques of making machine. Accordingly, France fulfilled facilities like books, journals, encyclopedias and other inanimate storages of knowledge. In general France created conducive environment for transfer of knowledge. But these inanimate storages of knowledge did not enable France to catch up England for the time being because the techniques of making machine were tacitly embedded only in the mind English Mechanical engineers. Personal contact of English men and French technicians as well as visiting English industry was necessary. Not only France but all European countries faced such difficulties in order transfer the craft of making machine from Britain .The following idea indicates this:

> The same time, the French government became aware very soon of its backwardness and took various measures to reverse what Jean-Antoine Chaptal called this “inversion of natural order” (cited by Jacob, 1998, p. 78 quoted in Mokyr p,33). Chaptal, who was Minister of the Interior under Napoleon, was convinced that British industrial success was due to its superior “mechanical knowledge” and the close ties between the savans and the fabricans (Jacob, 1997, pp. 182-183 quoted in ibid). France’s innovation in this regard, in addition to engineering schools, was the organization of industrial expositions, in which technical knowledge was diffused in an efficient and concentrated manner(Mokyr,1999, ibid).
>
> Furthermore, France was characterized not only by expansion Universities, poly-techniques, books, and encyclopedia. Rather French scientists were known by originating great ideas that contributed a lot for various inventions of Englishmen. This indicates that only theoretical knowledge is not enough to achieve economic progress. It needs another knowledge that transforms these theoretical stocks of knowledge to practical application in order to solve concrete human problems. Britain was pioneer in this knowledge. That is why it was the first industrialized nation. Mokyr states,
>
> All codified knowledge surely needed to be complemented by tacit and implicit skills such as dexterity, a sense of “what worked” and so on. But often such skills are directed and focused by knowledge acquired from others or from reading. The exact mapping from useful knowledge to technique took complex forms, and it is striking that France seems to have led Britain in terms of technical education, engineering textbooks, encyclopedias, and other access-cost reducing developments. Yet this observation does not refute the argument I made here. Britain’s success in the Industrial Revolution was to a remarkable extent based on French inventions. From chlorine bleaching to gas lighting to Jacquard looms, Britain greedily looked to France for inspiration. To oversimplify to the point of absurdity, one could say that France’s strength was in S, Britain’s in 8, and that the mapping function (ibid, p, 32).

3.2. Lack of Mapping Function

Mapping function is the ability of a given expert to make channel or bridge between general useful knowledge and techniques to produce materials that benefit human being. As indicated above the great technological and industrial gap created between England and other European countries for specified time was because the mapping function of English men between theoretical and technical knowledge was greater than any European nations of the time. The first machine of Great Britain that fabricated in its industry was the result of mapping function of its scientists and engineers. In order to clarify what a mapping function let me add other example. For instance, Albert Einstein first understood the scientific idea of theory of relativity and mathematical equation of E= MC2. The application of this theory of relativity for Manhattan Project for the production of Atomic bomb and other nuclear technologies is mapping function. In this case theoretical knowledge and techniques collaborated and fabricated the bomb and other technologies that followed from nuclear power.

3.2.1. What are The Pre-Conditions for the Mapping Function?

Mapping function is the result of the existence of comfortable scientific environment. Accordingly, in England before industrialization, scientific ideas were popular across the country by formal and informal contacts among different experts. This facilitated the creation of scientific, culture, method and mentality that were one of the achievements of enlightenment.

The penetration of scientific method into technological research meant accurate measurement, controlled experiment, and an insistence on reproducibility. Even more important, perhaps, was scientific mentality, which imbued engineers and inventors with a faith in the orderliness, rationality, and predictability of natural phenomena. Finally, scientific culture, the culmination of Bacon an ideology, placed applied science at the service of commercial and manufacturing interests (Jacob, 1997 quoted in ibid). Science in the seventeenth century became increasingly permeated by the Baconian motive of material progress and constant improvement, attained by the accumulation of knowledge. Scientific culture led to the gradual emergence of engineering science and the continuous accumulation of orderly quantitative knowledge about potentially useful natural phenomena in "all matters mineral, animal, and vegetable." Although such relations are impossible to quantify, it stands to reason that in that regard science laid the intellectual foundations of the Industrial Revolution by providing the tacit and implicit assumptions on which technological creativity depended (Mokyr, 1999, pp:15-16).

From the above idea we understand that scientific method, scientific mentality and scientific culture had great significance in order to change scientific knowledge in to industry, and finally to enhance material progress because these three events minimize a cost of knowledge transfer from a given area toanother. One of fruitful results of globalization and computer age is that it minimized the cost of transmission of a given information and knowledge by different communication methods. The knowledge recipe prepared by scientific method, scientific mentality and scientific culture could easily disseminate from knowers to doers.

These above three events facilitated the task of minimizing access costs. If the access costs are to be affordable so that production can draw on accumulated useful knowledge, there has to be social contact between "knowers" and "doers." There is too much tacit and un-codefeable knowledge in technology for the written word and the graphical representation to do it all. Any society in which a social chasm exists between the workers, the artisans and the engineers on one side, and the natural philosophers and "scientists" (the word does not exist till the 1830s) will have difficulty mapping continuously from useful knowledge onto the set of recipes and techniques that increase economic welfare. If the savans do not deign to address practical problems where their knowledge could help resolve difficulties and do not make an effort to communicate with engineers and entrepreneurs, the fabricans will have difficulty accessing**. (**ibid p, 27)

3.3. Lack of Skills (Techniques) in Education

The goal of education is creating competent citizens in Knowledge, skill and attitude. Even if knowledge and attitude are crucial, economic progress needs development of skills, because skills are the methods that change knowledge to material benefits.

As historical society, Ethiopians had long history of wisdom and knowledge. Ethiopian Orthodox Church and Medaras as have long history of creating knowledgeable citizens. But they could not extract technical knowledge from general knowledge that fulfills material needs of societies. Even the modern education of Ethiopia lacks skills or techniques that foster innovation and industry. Among others, transference of these techniques was not achieved and this is one of obstacles for Ethiopian development of science, technology and industrialization.

The remedy of this limitation is strengthening the quality of research and development that leads to innovation within the country and creating environment in which Ethiopian researchers can adopt experiences from the researchers of developed nations. The contribution of Ethiopian Diasporas especially that of scientists, engineers, and other disciplines have to be considered.

3.4. Lack of Skills (Techniques) in Education

In addition to lack of skill there is also limitation of knowledge dissemination in Ethiopia. Firstly, since there is lack of skill to develop in science and technology this limits dissemination of them. That means there is shortage of knowledge and skill to be distributed. Secondly, even knowledge which is found within the country, and Diasporas could not efficiently disseminated by using both formal and informal means. Good political environment is also indispensable in order to attract skilled Ethiopian Diasporas to facilitate dissemination of knowledge.

3.5. Lack of Culture of Criticism and Freedom of Thought

The culture of Ethiopians especially that was guilt system was not flexible, and still there are shortcomings to host different narratives and world views. Especially criticism of ideas is not developed within the community as such. Without criticism it is impossible to originate new ideas that transform the society. One of fruitful results of European Renaissance and Enlightenment was that dogmatic ideas were criticized and analyzed especially within scientific community. Only reasonable ideas were tolerated and advanced ideas were isolated after different criticism was accomplished in different inquiries like science, politics and others. Scientific culture, mentality and method were the result of culture of criticism and freedom of thought. Less development of this culture severely deteriorated the journey of science, technology, industry and their transfer in Ethiopia. Even in addition to the stagnant development of science and technology, one of the reason that affected Ethiopian politics itself is that different political views could not reach agreement on the chair. This caused different political instabilities in different times that had contributed negative role for the development of science, industry and overall progress of the country. Ethiopian scholar Professor Mesfin Wolde Mariam indicated the importance of culture criticism and reactions of ideas for progress as follows:

> The collision of ideas is the key for thinking. If there is no collision of ideas there is no any kind of thought. Idea can be improved, developed and matured if there is reaction among ideas and the new advanced idea can be filtered from two colliding ideas. Debate and discussion with ideas is notconfined to only that take place

between different individuals. It could be accomplished as an individual because the quarrel of ideas can even take place within the mind of individual person. The last and new idea filtered from two antagonistic ideas of either individual or group by discussion and debate is improved one.

Moreover, the professor insisted that" the reason behind Ethiopian backwardness and poverty is not because Ethiopians were devoid of noble ideas. According to him even though many Ethiopians havenoble ideas and wisdom, they could not facilitated the chance of sharing these noble ideas with each other and expose it to the market. He argued that most Ethiopians locked their noble idea within their mind by strong fence. On Ethiopian Earth, without lack of thinkers, noble thoughts are failed within the mind of individuals and made failed society. As a result, we Ethiopians either could not innovate new ideas and tools and share to others or could not improve ourselves by transferring knowledge from other world, and we solitarily continued the down ward journey of civilization for centuries(Mesfin,2018,224 -226).

3.6. Lack of Balance among the Learned Disciplines

The development of Science and technology necessitates multidisciplinary style of education even if specialization is also important factor. Because of short history of institutes of excellence especially Universities, for example, the early graduates of Hailesellasie I University focused on foreign language in order to facilitate diplomatic missions.

During military regime in Ethiopia, Philosophy course was dominated by indoctrination of Marxist-Leninism ideology rather than focusing on school of thoughts like philosophy of science and others that might contribute for understanding of science. Despite its early establishment, science faculty was not developed as intended. It lacked world class scientists except few like AkliluLema, Professor Gebisa Ejata and some others.

3.7. Good Lessons from Some Industrialized Nations

Despite Significant attempts to industrialize the country, Ethiopia still couldn't diffuse technologies from industrialized nations or use its own domestic innovation. Still it is poor nation that needs great effort to industrialize itself and tackle socio-economic problems. Although there are a lot of nations that had good experiences in industrializing their country, I will mention just few of them as sample in this short article.

3.7.1. South Korea

South Koreans' development experience was known by slogans of exportization of all industries" and "scientification of all people," (Lim, 2010, pp, 6-7) that indicated their focus on human resource development and diversification of export and industries. Kwan S. Kim also summarized Korean development like this:" From the historical perspective of policy evolution, the post-Korean War era can be distinguished into three phases: import substitution (1954-1960); outward orientation (1961-1979); and balance and stabilization (post-1980)" that again can be good lesson for developing countries like Ethiopia.

3.7.2. Japan

Japan is also one of newly industrialized nations of the world and its experience is worth quoting. Especially their ability to adopt western technologies by relating it with their domestic innovations was a good job. Takada states;

The rapid economic growth in Japan from the beginning of the 1950s to the early 1970s did not only resulted from special government policies and revolutionary events, but were also achieved by the cumulative effort and hard work by the people. The unique characteristic and ability of the Japanese people to imitate and improve the skills learned, and then applying them to their own system was the most important factor for their successes. Technological improvements in Japan contributed greatly to its economic growth, because improvements of technologies in one industry influenced the growth of many other industries. For example, Japan's steel industry successfully improved the quality of the special steel used in automobiles and as a result of technological progress in the casing of parts, the automobile industry, too, grew into an industry to be able to compete in international markets for the first time. Similar progress occurred in the shipbuilding industry also, and numerous industries were growing almost at a proportionate rate (Takada 1999, pp, 12-13).

3.7.3. Israel

The industrialization of Israel teaches someone that more than the existence of abundant natural resource within a given country, the abundant knowledge within the mind of citizens of a given country can make a country prosperous. Because Israeli land is not as such comfortable for agriculture as some historians indicated. It is dominated by desert areas. But Israelis effectively used the scarce resource and achieved prosperity for their people because of their world class skilled labour force and their experience is worth for developing nations like Ethiopia.

3.7.4. China

Chinese industrialization is also considered as one miraculous development of newly industrialized nations within some decades. Chinese development is not only characterized as the fastest but sustainable growth that was focused on renewable resources using method. Lu States;

We can no longer boost our economy with the conventional mode of plundering non-renewable natural resources and centering the world resources only on a few big powers. Instead, we are in urgent need to develop new

resources, sort out new development mode and way-outs, and set up new mode of production and lifestyle. This need strongly calls for transformative breakthroughs in science and technology, and the benefits of science and technology for a majority of people. Human civilization requires a new round of Science& Technology revolution and industrial revolution as well.(Lu 2010, 9)

Each and every newly industrialized country I have mentioned had their own experiences for countries that are following them like Ethiopia. In all these industrialized nations after Western Europe and North America, science and technology played significant role for their development. One of the causes of backwardness and poverty in Ethiopia is that the country's economy is import oriented. It exports agricultural products and import capital goods that are expensive that lead to trade deficit. In order to change the economy to export oriented, the development of science, technology and industry is indispensable.

4. Conclusions and Recommendation

4.1. Conclusion

The significance of science, technology and industry is incalculable in order to enhance knowledge based economy. Despite it is historical and one of civilized nations in ancient world, Ethiopia could not compete with modern improvement of the world that is backed by flourish of Science, technology and industry.

One of the obstacles to Ethiopia in order to catch up modern developed nation was that the way country tried to transform to modernity was not conducive for science and technology as that of developed nations especially western world. The modernity of western world was examined by revolutionary movements like renaissance and enlightenment that paved the way for the blossom of science, technology and industry. By these movements westerners revived, analyzed and filtered their wisdom by using reason in order fight against dogmatic attitudes of any kind of discourses. This accomplishments fostered secularism that again cleared the way for the emergence of science, technology and industry respectively. Fortunately, this way enable westerners to be early industrialized and enhance knowledge based economy.

But in the case of Ethiopia, the ancient wisdom of the country could not examined by such movements like Renaissance and enlightenment. Even if the country achieved the creation of its own alphabet and had some literary works from its ancient history, the literary works could not prepare elite that left literary works that were secular and contribute to development science and technology. Most of the literary works were contributed for religious purposes rather than for material progress. The modern elite could not inherit literary works focused on the study of nature and science. Furthermore, the style of traditional Ethiopian education emphasized rehearsal rather than focusing on questions, analysis and curiosity that are genuine tools to enhance scientific knowledge. These and other related challenges retarded the journey of science, technology and industry in Ethiopia.

4.2. Recommendation

The emergence of Science, industry and technology in Ethiopia hosted different challenges and prospects. Accordingly, Modern Ethiopian Kings tried their best in order to unify and protect the integrity of the country, transfer technologies and industrialize the country. Their effort reached to the establishment of university and some industries. In my view there are enormous bases they founded for current generation. But still Ethiopia could not succeed to foster innovation and transfer of technology to solve its socio-economic problems. This article recommends the following in order develop science, technology and industry in Ethiopia:

- Protecting sustainable peace within the country since peace and stability have great role for the blossom of science, technology and industry.
- Cultivating the culture of criticism, dialogues and discussions in different schools of thought.
- Emphasis should be given for the third goal of education which skill in addition to knowledge and attitude in order to change theory to practice (mapping function) andto develop science and technology.
- Students' ability of creation and innovation should be cultivated and examined in addition to scoring grade.
- The quality of education at all levels especially in higher education should be given great emphasis
- Research and development in higher education should be given emphasis especially with regard to its quality.
- Private sector firms also should join research and development in order to develop investment.
- In addition to University-Industry linkage there should be exchange of result of research between these institutions.
- Foreign direct investment also should support research and development of both public and private academic institutions and industries.
- Currently emerging Industrial parks should have research and development center in Ethiopia in order to transfer technology.
- Ethiopian scientists, engineers and, researchers which are found in internationally recognized institutes of technologies, and should be invited to support Ethiopian research and development activities.
- International conferences that invite standardized scientists to Ethiopia and facilitate share of experience are needed.
- Facilitating scholarship for Ethiopian students to learn in World standard universities, and institutes of technology.
- There should be competition between private sector firms and government firms; that means monopoly of certain company hinders the development of different emerging firms whether that of private or public sector.

References

i. Adams, Karlyn (2006) "The Sources of Innovation and Creativity, National Center on Education and the Economy, America
ii. Andargachew,Tsige (2005) NetsenetyemayawkNetsaAweche(ነፀነት የማያውቅ ነፃ አውጪ: Civilization,Democracy and Prosperity, The Role of Political Elite in Modern Ethiopia: Addis Ababa
iii. Bolisani,E. ,and Bratianu, C.(2018) "The Elusive Definition of Knowledge "Cham: International Publishing .Springer
iv. Harrison. E Lawrence and Huntington. P Samuel(2000)" Culture Matters: How Values Shape Human Progress, A Member of the Perseus Books Group, New York
v. Hansson.S.O(ed) (2015**) "**The Role of Technology in Science: Philosophical Perspectives, Philosophy of Engineering and Technology, Springer Science Business Media Dordrecht
vi. Kim, s Kwam(1991) "the Korean miracle(1962-1980) revisited: myths and realities in strategy and development, working paper#166 :THE HELEN KELLOGG INSTITUTE FOR INTERNATIONAL STUDIES
vii. Lim. Wonhyuk (2010) "Joint Discovery and upgrading of comparative Advantage: Lesson from Korean Development experience, Korean Development Institute (KDI), Busan
viii. Lu. Yongtiang(2010) "Science and Technology in China: A Roadmap to 2050 ,Strategic General Report of the Chinese Academy of sciences, Sciences press Beijing and Springer-Verlag Berlin Hidelberg.
ix. Mesfin,WoldeMarium (2018)Enzech!- Emboch!(እንዘ ጭ-እንበ ጭየ ኢትዮ ያ ጉዞ (Ethiopian Journey): Addis Ababa.
x. Mokyr, Joel (1999) "Knowledge, Technology, and Economic Growth During the Industrial Revolution"
xi. OECD (organization for economic co-operation and Development)(1996)"The knowledge- based economy", Paris.
xii. Shapin, Steven (1996) " The Scientific Revolution" University of Chicago, The University of Chicago Press, Chicago
xiii. Simandan,D(2009) "Industrialization", Canada: Elsevier Ltd.
xiv. Takada, Masahiro(1999) "Japan's Economic Miracle: Underlying Factors and Strategies for the Growth"
xv. Vaughan, Jason(2013) **"**Technological Innovation: Perceptions and Definitions, alatechsource.org
xvi. Wengenroth, Ulrich (2000)"Science, Technology, and Industry in the 19th Century" Working Paper, Munich center for the history of science and technology
xvii. . sciencecouncel.org
xviii. http://www.centerforfutureconciousness.com