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Higher Education Skill Supply and Employers' Skill Demand: A Study on Ethiopian Engineering Graduates

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A Dissertation Presented to the Department of Educational Planning and Management, Addis Ababa University, in Partial Fulfillment of the Requirements for the Award of Degree of Doctor of Philosophy in Education Policy and Leadership

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Approved by board of examiners

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I the undersigned, hereby declare that this dissertation is my own original work and to the best of my knowledge and belief it contains no materials previously published by any other person except where proper citation and due acknowledgement has been made. I also confirm that this dissertation has not been presented to being submitted as part of the requirement of any other academic degree or publication, in English or any other language.

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Asmera Teshome Negeri

Certification

I the undersigned certify that the dissertation titled: Higher Education Skill Supply and Employers' Skill Demand: A Study on Ethiopian Engineering Graduates which is submitted to the Department of Educational Planning and Management of Addis Ababa University to award Degree of Doctor of Philosophy in Education Policy and Leadership is the original work of Asmera Teshome Negeri.

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Abstract

Demand for relevant skills and competences have increased with changing science and technology, globalization, and the intensity and complexity of the business environment across the world. This study investigated higher education skills supply and labor markets/employers skill demands in Ethiopia. Using the embedded design model of the mixed method approach (QUAN-qual), both primary and secondary sources of data were used to address the basic questions and hypotheses of the study. In addition to 260 respondents (90 employees, 40 employers, and 130 higher education instructors) who were recruited using simple random and purposive sampling techniques and filled out the study questionnaires, 15 individuals were purposefully selected and took part in key informant interviews. Data were analyzed using the mean, standard deviation, paired sample t-test, one-way ANOVA, Multiple comparison, and thematic analyses. The study found a wider mismatch between levels of higher education supply and labor market needs for indicators of discipline-specific, technical, interpersonal, and generic skills. Higher education moderately equips engineering graduates with the majority of indicators of these skill sets while labor market needs for the same skills remain high. The gap between the higher education skill supply and labor market need was widest for generic skills, followed by technical skills and interpersonal skills, but narrowest for discipline-specific skills. Employees, employers, and instructors have different views related to graduates' acquisition and employers' need for all types of skills under scrutiny. Employers and instructors believe that engineering graduates moderately acquire technical skills while employees believe that higher learning institutes well equip graduates with the same skills. For employers and instructors, technical skills are highly required in the engineering graduate labor market. Such mismatches between STEM skills supply and need hinder productive capacities, generate unemployment and underemployment, inflate average labor costs, affect firm-level profitability and the capacity of enterprises to innovate and adapt to changing market conditions. Strengthening collaboration with all stakeholders, including employers, in designing and implementing appropriate STEM curricula, conducting firm surveys to assess the skill needs, exposing students to lectures held by professionals outside universities, and implementing project-based and problem-oriented project-based learning to promote students' creativity and innovative, critical, and analytical thinking for future employment prospects should get prime priority in higher education. Future research should focus on the skills employees acquire at work through experience and the factors that contribute to the mismatch between the supply of higher education skills and employers' needs by including prospective graduates in sample selection.

Key words*:* *Skills supply, skill demand, Higher Education, Engineering graduate*

ACRONYMS and Abbreviations

CBE:	Competence Based Education
CGPA:	Cumulative Grade Point Average
CHEERS:	Careers after Higher Education: European Research Study Projects
ESC:	Education Strategy Center
ESDP:	Education Sector Development Program
ETP:	Education and Training Policy
FDRE:	Federal Democratic Republic of Ethiopia
HE:	Higher Education
HEIs:	Higher Education Institutions
HERQA:	Higher Education Relevance and Quality Agency
HESC:	Higher Education Strategy Center
HESO:	Higher Education System Overhaul
IMF:	International Monetary Fund
INCHER:	International Centre of Higher Education Research
IT:	Information Technology
MoE:	Ministry of Education
MoLSA:	Ministry of Labor and Social Affairs
MoSHE:	Ministry of Sciences and Higher Education
NEPSE:	National Employment Policy and Strategy of Ethiopia
PASDEP:	Plan for Accelerated and Sustained Development to End Poverty
PJBL:	Problem Oriented and Project Based Learning's
POPBL:	Problem Oriented Project Based Learning
WIL:	Work Integrated Learning

CHAPTER ONE

1. INTRODUCTION

This chapter provides detailed descriptions of the background of the study, statement of the problem, conceptual framework, basic questions and hypotheses, objectives, significance, delimitations and limitations of the study, definition of common terms, and organization of the study.

1.1 Background of the study

Preparing graduates for the world of work by equipping them with key skills and competencies has increasingly become one of the major goals and responsibilities of higher education institutions across the world (Humburg, Velden, & Verhagen, 2013). The need for a better understanding of graduates' competence requirements has also grown with the increasing demand for fresh STEM graduates from employers (Pang, Wong, Leung, & Coombes, 2019). Academic degrees alone are becoming inadequate because employers need potential STEM graduates with competencies and capabilities in generic skills to meet the demands of the globalization era and make their companies most competitive (Azmi, Kamin, & Noordin, 2018). Individuals' success in transitioning to the labor market and performance in their working lives are closely linked to the process of acquiring these skills and competencies.

With the changing business environment, the need for a workforce with a new set of skills that are flexible and adaptable to continual changes, keep abreast of new technology, and work effectively in the knowledge economy has become of prime importance. The new skills, knowledge, and competencies meeting the current labor market needs have particular importance for industry and are critical for sustaining and maintaining growth and succeeding in a globalized

society (Harvey, 2000; Jackson, 2013). The knowledge and skills graduates acquire during study at university determine both their transitions to the world of work and their productivity levels in the labor market (Mocanu, Zamfir, & Pirciog, 2014); increase prosperity and international competitiveness (Jackson, 2013); and enhance career success after graduation (Loo & Semeijn, 2004); increase graduates' performance and productivity in the current knowledge economy; enable graduates to have a competitive edge in getting jobs; successfully perform their job; and become lifelong learners (Shivorois et al., 2019). Such skills enable graduates to get employed outside their own field of study, adapt to new tasks and requirements, determine their productivity level on the labor market (Mocanu, Zamfir & Pirciog, 2014), and enable employees to function successfully in an organization (Azmi et al., 2018; Russell, Russell & Tastle, 2005).

Nevertheless, reaching consensus on the definition of skill remains a challenge, and the meaning of the term skill is different for different scholars and organizations. For instance, scholars (e.g., Strijbos, Engels, & Struyven, 2015; Suleman, 2018) define skill as the ability to perform a task to a predefined level of competence. For Green (2016), skill is any personal attribute having productive value that could be augmented through some form of investment. The skills of individuals primarily depend on the knowledge, attitudes, and competence they possess; the way they use those assets and present them to employers; and the context within which they seek work. Similarly, graduate attributes are the skills, knowledge, and abilities of university graduates beyond disciplinary content knowledge that are applicable to a range of contexts (Abdulwahed, Balid, Hasna, & Pokharel, 2013; Oluyomi &Adedeji, 2012).

The current rapid change from manufacturing to a service-oriented economy has led to a mismatch between the skills demanded by employers and those available in the labor market

(Branine & Avramenko, 2015). Skill mismatch is the discrepancy between skills acquired by graduates through studies at higher learning institutions and the actual skills required in the labor market (Asai, Breda, Rain, Romanello, Sangnier, 2020; Păcurariu, 2019). It denotes a gap between aggregate labor demand and aggregate labor supply (Beyene & Teklesilassie, 2018). The aggregate skill mismatch relates to skill gaps and skill shortages. Skill gaps are situations in which an employer believes that workers do not possess the adequate competencies to successfully discharge their current role (ILO, 2017). It results when the available workforce lacks the skills demanded by firms or when firms fail to use optimally the skills possessed by workers (Asai, Breda, Rain, Romanello, Sangnier, 2020).

The study by Andrews and Higson (2008) indicated increasing concern with the widening gap between the skills and capabilities of graduates and the requirements and demands of the work environment across the world. Such a mismatch is considered an important source of inefficiency in the labor market that can hinder productive capacities, which generate unemployment and underemployment (Asai, Breda, Rain, Romanello, & Sangnier, 2020). It harms productivity due to lower output per worker, inflates average labor costs, affects firm-level profitability, and affects the capacity of enterprises to innovate and adapt to changing market conditions (ILO, 2017; Teshome & Oumer, 2023); hampers economic growth, competitiveness, and innovative capacity at the macro-economic level (Oluyomi &Adedeji, 2012); and decreases the quality of human capital by discouraging investment in education and training by individuals. As a result, graduates of higher education face challenges in finding jobs suitable for their level and fields of study (Păcurariu, 2019).

Therefore, reviewing, understanding, and adapting graduate skills capable of meeting employers' needs is believed to be important in achieving sustainable economic growth and development in the context of the swelling number of higher education graduates and a knowledge-driven economy (Yibeltal, 2016). Educators should focus their efforts on the development of competencies that integrate knowledge, attitudes, and values for professional development, as well as the acquisition of interpersonal skills (Velasco-Martnez & Tójar-Hurtado, 2018).

Higher learning institutes have the mandate of preparing graduates to become highly productive and successful on the labor market by assisting in understanding how the lessons learned in the classroom are associated with future career opportunities (Jackson, 2013). They have the mandate to provide employers with a choice of talents for the current and future operations of their organizations and to integrate and build competences and skills standards into the curriculum of their study programs (Branine & Avramenko, 2015). Involving employers in course design and delivery; commenting on the relevance of the course contents; providing material and ideas for student projects and giving guest lectures; and employing innovative teaching techniques and implementing authentic assessment so as to make students able to apply skills in real-life situations are also mandates of higher learning institutes (Tran, 2017). Higher education is supposed to produce highly skilled graduates capable of responding to the ever-changing and complex needs of the present-day workplace (Andrews & Higson, 2008); ensure whether the skills and competences gained by graduates during their studies fit into the labor market needs or not (Wongnaa & Boachie, 2018).

In order to better prepare graduates and meet the demand for skills, STEM education programs must comprehend the nature of the skills required in the workplace (Jang, 2015). Scholars (e.g., Reda & Tsegai, 2018) argue that to meaningfully contribute to the socio-economic development of a country, higher education expansion must be aligned with market demand. It is believed that strong and close relationships between higher learning institutions and the labor market/employers help in eliminating the artificial division between vocational and academic education, creating an ecosystem that easily integrates work and learning, and contributing to understanding the way these components can evolve into partnerships and business models (Păcurariu, 2019). Workers are expected to have both cognitive and social skills, which are relevant to non-routine problem solving and complex communication (Jang, 2015).

University students are also supposed to prepare themselves for a changing world by actively improving their knowledge and skills to meet the demands of the modern workplace (Bridgstock, 2009). They are expected to possess high-level discipline-specific skills synthesized with more generic interpersonal and communication skills; be employment-ready; be equipped with the necessary skills and competencies; and be able to work with the minimum supervision (Andrews & Higson, 2008). However, the expansion of higher education in Europe following the Bologna Declaration (1999) led to questions about the quality of graduates labor market and their ability to meet the needs of employers (Andrews & Higson, 2008). Providing a standard curriculum to produce graduates with multi-skills and implicating the curriculum and factors supporting the career development of students are becoming challenges in higher education (Azmi et al., 2018). Higher education graduates, in turn, face challenges in finding jobs suitable for their level and field of study (Păcurariu, 2019).

The failure of universities to keep pace with the skill requests of rapidly growing industries has created a crisis in employability skills (Collet & Hine, 2015). Notably, in developing countries like Malaysia and Uganda, graduates have remained unemployed due to a lack of employability skills needed in the labor market. Similarly, education and training in developing countries, including Africa, also fail to supply graduates who meet the existing labor market needs in soft skills such as innovation and creativity, communication skills, and entrepreneurship skills (Azmi et al., 2018; Wongnaa & Boachie, 2018). Graduates of higher education on the continent often lack knowledge about the realities of the existing labor market. Higher education institutions are lagging behind in equipping graduates with the necessary skills that would meet the needs of industries (Getahun et al., 2020). The gap between educational institutions' output and labor market requirements has widened, resulting in a rising incidence and duration of graduate unemployment (Ibid.). Due to the mismatch between skills offered by schools and skills required on the labor market, employers claim they lack a qualified workforce to hire and are forced to invest in professional training when hiring new employees (Păcurariu, 2019). As a part of continental Africa, Ethiopia is not an exceptional country facing similar problems.

Ethiopia is the second-most populous country in Africa, next to Nigeria, with over 110 million people. The country is diverse in topography, climate, ethnic groups, language, and culture. More than 80 different languages, including 12 Semitic, 22 Cushitic, 18 Omotic, and 18 Nilo-Saharan, have been spoken in the country. These cultural, linguistic, and social diversities led to the establishment of 11 regional states and two city administrations within the federal state structure. While rural households in the more fertile highlands are dependent on agriculture, the lowlands are pastoralist communities primarily dependent on livestock production. Agriculture is

the dominant economic activity, supporting the livelihood of approximately 71% of the Ethiopian population. However, the country's efforts to reduce poverty have been heavily challenged by the declining quality of education and the mismatch between higher education skill supply and labor market skill demand (CSA, 2019).

The current higher education system in Ethiopia aims to supply knowledgeable, skilled, and attitudinally mature graduates in quantity and quality with a demand-based proportional balance of fields and disciplines that make the country competitive in global markets (Education Strategic Center, 2017). In response to the dire needs for higher education in the country, the government has begun expanding both public and private higher learning institutes with relevant programs and has formulated and implemented different policies and strategies emphasizing the importance of graduate skills that employers have needed since the 1990s (Yibeltal, 2016).

For instance, Higher Education Proclamation No. 650/2009 dictates that higher education institutions have the responsibility to prepare and supply qualified graduates with knowledge, skills, and attitudes based on the needs of the labor market (HEP, 2009). The Education Sector Development Program V (2015/16–2019/20) also underscores the importance of graduates with appropriate skills and competences capable of successfully meeting national and international standards. ESDP V recommends the need to implement high-quality degree programs capable of equipping graduates with relevant industry knowledge, up-to-date specialized skills and competencies, and work-ready attitudes to succeed in the world of work, industry, and research. The Federal Democratic Republic of Ethiopia Science, Technology, and Innovation Policy (2012), on its part, urges higher education and training systems to place emphasis on producing qualified engineers and natural scientists capable of understanding and utilizing appropriate

technologies in growing manufacturing and service-providing enterprises. More importantly, the labor market policy of 2009 states the need to match the skill levels of the graduate labor force with the requirements of the economy (Kibru, 2012; MoLSA, 2009; Yizengaw, 2004). Within these policy frameworks, Ethiopia has invested significantly in its HE sub-sector towards increasing access, quality, and relevance and making the universities and colleges more responsive to the needs of the country's economy over the past three decades (Yizengaw, 2004).

As a result, the country's higher education landscape has shown significant change in terms of enrollment, expansion, and graduate mix programs (Reda & Gebre-Eyesus, 2018). The number of public universities rose from two at the beginning of the 1990s to thirty-four, while the number of private higher education providers was about 100 in 2015 (Karorsa & Polka, 2015; MOE, 2015), and the number of public higher learning institutions rose to 46 in 2019. The total number of graduates in undergraduate programs from both private and government higher-learning institutions increased from 10,768 in 2005 to 102,890 in 2015 and reached more than 900,000 in 2018 (MoSHE, 2018).

To enhance the human resource base of the country with STEM education, the Ministry of Education launched the professional and program mix intake policy of Ethiopian public higher education in April 2008. The policy clearly articulates the 70:30 undergraduate professional mixes in favor of science and technology over the humanities and social sciences. As a result, 70 percent of the students leaving the schools had joined engineering and natural sciences faculties over the last decade. The policy was planned to increase the annual intake of engineering to 212,000 and of natural and computational sciences to 66,000 students at the end of 2013/14 (Abeje, 2014). In the 2nd Gross and Transformational Plan, the government planned to raise

regular enrollment to 600,000 while continuing to prioritize STEM education (Karorsa & Polka, 2015). The number of engineering graduates has also increased drastically since the introduction of the 70:30 professional and program mix policy.

Despite increasing numbers of higher education institutions, enrollment, and graduation, the labor market in Ethiopia continues to absorb a limited number of graduates while thousands remain unemployed each year (Fanta, Asnakew, Debele, Nigatu, & Muhaba, 2019; Semela, 2011; Reda & Gebre-Eyesus, 2018). The issue of the quality and relevance of higher education and the mismatch between the performance of higher education graduates and the need of the labor market remain critical challenges, and very few skilled human resources are available to generate and guide development in the country (Kibru, 2012; Olkaba & Tamene, 2017; Yibeltal, 2016). Similarly, complaints have been heard from different corners about the lack of skills needed by employers and poor technical and soft skills resulting in low labor productivity among higher education graduates in the country (Beyene & Teklesilassie, 2018). Thus, the purpose of this study was to assess the gap between the skill supply of higher education institutions and employers needing the same skills, with a special focus on engineering graduates of selected public higher education institutions in Ethiopia.

The findings of this study are believed to fill some of the existing knowledge gaps on labor market skill needs and higher education skill supply to reduce the current boom in graduates' unemployment in Ethiopia. It helps shed some light on the importance of frequent assessments of employers' skill needs and considering their needs in designing higher education curricula. It assists national and international universities, students, employers, policymakers, and employability stakeholders to critically assess and identify skills demanded in the current

dynamic technological era and the increasing internationalization of higher education and employment to design, implement, and evaluate policies that enhance their collaborative efforts. It encourages the development of national competence and skills policy frameworks based on stakeholders' needs for the current growing intake and graduation rates in engineering disciplines in Ethiopian public universities that would help guide higher education and employers in tackling the challenges of matching graduate skills with employers' skill needs.

1.2 Statement of the problem

With the swift expansion of higher education across the world, there has been surging concern about the weak relationship between higher education systems and the labor market for engineering graduates (Fatseas, 2010; Zaharim et al., 2009). Questions have been raised regarding existing wider gaps between the skills and capabilities of graduates and the requirements and demands of the world of work (Elias & Purcell, 2004; Pauw, Oosthuizen, Van Der Westhuizen, 2008; Tran, 2014). New and fresh engineering graduates face multiple challenges and competitions to get employment compared to previous graduates (Mohammad, Nor, Omar, and Mohamed, 2004). Employers have started to look for engineers with the required competencies and capabilities in generic skills that would meet the demands of the globalization era and make their companies the most competitive (Azmi et al., 2018). To remain competitive worldwide, engineering graduates should acquire certain competencies and skills (Zaharim et al., 2009). That would be why higher education institutions, employers, and graduates agree about the importance of other attributes in addition to subject-specific knowledge and discipline in enhancing graduate employability (Shivorois et al., 2019).

The knowledge and skills of graduates acquired during their studies at university determine both their transition to the world of work and their productivity level in the labor market. Graduates are expected to transfer and use skills developed at university in the work context during the transition phase into working life (Badcock, Pattison, & Harris, 2010; Jones, 2009; Young & Chapman, 2010). Among other things, engineering and technology graduates are required to have hard skills like fundamental knowledge of science, mathematics, engineering design, and problem-solving skills, as well as soft skills like communication skills, managerial skills, negotiation skills, and interpersonal skills, to be employable in today's global market (Mohammad et al., 2004). For authors (e.g., Zaharim et al., 2009), communication skills, problem solving skills, and interpersonal skills are the three most important employability skills of engineering graduates in Malaysia, Japan, Hong Kong, and Singapore. Employers from these four countries reported that good communication skills were very important, followed by soft skills like problem solving and interpersonal skills. Similarly, information technology, lifelong learning, and self-management skills are considered essential.

Skills such as critical thinking, problem-solving, oral and written communication, teamwork and interpersonal understanding, the capability to take responsibility for one's own learning, adapt to change and new situations, time-management skills, learning skills, and the ability to manage stress and heavy workloads are developed during studies at university (Badcock et al., 2010; Stiwne & Jungert, 2010). In contrast, the study by Keneley & Jackling (2011) argues that communication and collaboration skills are least developed during studies. In general, students develop more theoretical knowledge than academic skills during their studies at university (Monteiro, Almeida, & Aracil, 2016; Stiwne & Jungert, 2010).

Similarly, researchers (e.g., Azmi et al., 2018; Shivorois et al., 2019) from abroad also recommended the need to include graduate employability attributes like technical and non-technical skills in curricular and co-curricular activities. Yet evidence indicates that students have difficulties transferring these skills into different contexts (Smith, Clegg, Lawrance, & Todd, 2007; Tuononen, 2019). It is argued that the low quality of pre-university education and the focus on theoretical rather than practical aspects, the absence of employers' involvement in curriculum development and delivery, the lack of fiscal policies supporting their involvement, and the and the lack of career guidance and counseling services are among the factors negatively affecting graduates competences and skills (Mocanu et al., 2014).

With continued efforts by higher education institutions to build employability into their programs (Bowers-Brown & Harvey, 2004), graduate skills remained prominent and at the forefront of the agendas of higher education institutions, employers, policymakers, and graduates who had vested an interest in the concept (Jackson, 2013; Tuononen, 2019). Nevertheless, the current higher education institutions in developing countries like Africa are failing to supply graduates that meet the existing labor market needs (Mtebula, 2014). Graduates of higher education on the continent often lack knowledge about the realities of the existing labor market of the economy. The gaps between educational institution output and labor market requirements have been widening and have resulted in a rising incidence and duration of graduate unemployment (Boateng, 2002; Pauw et al., 2008). As part of continental Africa, Ethiopia is not the only country facing similar problems.

Despite quantitative changes in terms of the number of higher education institutions and student enrollment, the country's labor market continues to absorb a limited number of graduates

(Fanta, Asnakew, Debele, Nigatu, & Muhaba, 2019); the issue of quality and relevance of higher education and the mismatch between the performance of STEM graduates and the requirements of employers remain as critical challenges (Yibeltal, 2016); and very little attention has been paid to the issue of graduate skills and employers' needs in all higher education policies and strategies in Ethiopia. Previous studies in the country by Fanta et al. (2019), Jote (2017), Reda and Gebre-Eyesus (2018), and Yibeltal (2016) mainly focused on unemployment, graduate tracer studies, enhancing graduates' employability, higher education, and the labor market rather than directly focusing on graduate skills and competencies that are acquired at higher learning institutes and required by employers. They found that graduate skills and competencies have become a serious problem; wider gaps exist between employers' expectations and graduates' performance in terms of quality of work, productivity, and specific job-related skills and competencies. The studies were largely based on a case-study approach and could not be generalized to wider contexts due to a lack of quantitative evidence. These indicate a dearth of literature related to the relationship between skills and competencies acquired by STEM graduates in general and engineering graduates in particular and skills required by employers of the same graduates.

The trend in graduate unemployment has been mounting at the fastest rate, which was more than 20 percent at the end of the 2000s; not less than 40 percent in 2011; and will have the tendency to continue to rise unless effective intervention is made to mitigate the problem in the short, medium, and long term (Taye, 2013; Woldegiyorgis, 2015). Similarly, a recent study by Shimekit and Oumer (2021) also confirmed that the rate of higher education graduate unemployment increased from 2.6 percent in 2014 to 6.61 percent in 2018. Parents, employers,

and customers are also often questioned about the skills, knowledge, and personal attributes of Ethiopian higher education graduates (Shimekit & Oumer, 2021).

Higher education graduates in Ethiopia have low-quality skills due to low-quality training and a lack of entrepreneurial confidence and motivation due to the absence of career advice (Ibid.). Very little attention has been paid to the issue of graduate skills and employers' needs in all ESDP I-V, PASDEP, Higher Education System Overhaul/HESO, Higher Education Proclamation No. 650/2009, the Education and Training Policy (ETP) of 1994, the Education Sector Strategy of 1994, Proclamation No. 351/2003, and the higher education policies and strategies of Ethiopia (Yibeltal, 2016). The continuity of such a situation makes higher education providers lose their value, significance, and influence and become irrelevant; unemployment and poverty remain widespread, which could cause social and political instability in the country (Taye, 2013).

A few available empirical works (Jote, 2017; Taye, 2013; Yibeltal, 2016) show the existence of a significant mismatch between employers' expectations and the performance of graduates in terms of quality of work, productivity, and specific job-related knowledge and skills. There have been mounting complaints among employers about new graduates of Ethiopian higher education not properly meeting the required competencies (Taye, 2013). Most graduates of engineering and technology look for extra training immediately after labor market entry (Yibeltal, 2016). Considering the problems, studies (e.g., Asmare & Mulatie, 2014) strongly recommend the need for revising the existing education policy and curricula of higher education in line with the needs of society and the development plans of the country.

Understanding the skills and competencies that employers expect from graduates helps universities enhance graduates' employability and prepare graduates to increase their competition in the job market (Fitriani & Ajayi, 2022). Studying the state and trend of labor market mismatch enables policymakers to take corrective action in the event of a high mismatch between the skills available in the economy and the skills required by the economy (Beyene & Teklesilassie, 2018). Although collecting and consolidating data on the skill needs of the economy is important for proper analysis of skill mismatch, there is a critical shortage of data on the types and levels of skills the economy requires in Ethiopia (Ibid.). Therefore, this study aimed to investigate higher education skills and labor market skill demand by focusing on engineering graduates of selected public higher education institutions in Ethiopia using a mixed-methods research design. It mainly investigates levels of acquisition of these skills and employers' need, as well as the gap between the skill supply of higher education institutions and employers needs for the same skills.

1.3 Research Questions and Hypotheses of the Study

In order to shape and specify the focus of the purpose of the study, the researcher used research questions and hypotheses. The research questions inquired about the relationships among variables that the researcher sought to know (Creswell, 2014). Quantitative hypotheses, on the other hand, are predictions that a researcher makes about the expected outcomes of relationships among variables. They are numeric estimates of the population values based on data collected from samples. The testing of hypotheses employs statistical procedures in which the investigator draws inferences about the population from a study sample. Therefore, the current study sought answers to the following basic questions and tested the subsequent hypotheses.

1. To what extent do graduates of engineering from Ethiopian higher learning institutes acquire discipline-specific, technical, interpersonal, and generic skills?

The role of higher education institutions (HEIs) is to enable employability and graduate employment through the provision of certain courses, seminars, workshops, industrial training, and practical training. Graduate success in the labor market and workplace is determined by competencies and skills acquired at higher learning institutes. As the knowledge, competences, and skills that students acquire at higher learning institutes should be based on the needs of the needs of the labor market, labor market analysis is required and recommended on a regular basis to shape the higher education curriculum. Higher learning institutes are supposed to understand the knowledge, competences, and skills that meet the existing labor market needs and incorporate these knowledge, skills, and competences in both curricular and extracurricular activities.

However, the knowledge, competences, and employability skills produced at higher learning institutes in Ethiopia have a real marginalization of labor market realities, leading to mounting unemployment and underemployment of Engineering and Technology graduates in the context of massive higher education expansion. Therefore, it is important to identify the extent to which higher learning institutes are equipping learners with discipline-specific skills, technical skills, interpersonal skills, and generic skills. Testing whether or not there is a statistically significant difference between employees, employers, and instructors' perceptions of graduates' acquisition of discipline-specific skills, technical skills, interpersonal skills, and generic skills informs key decision-makers to design and implement higher education curricula in line with the skills needs of the labor market.

2. To what extent do employers of engineering graduates in Ethiopia need discipline-specific, technical, interpersonal, and generic skills?

Scholars argue that graduates of higher education are expected to possess skill sets that meet employers' needs. Employers often seek highly qualified and skilled employees who are capable of responding to changing, complex needs and trends in contemporary workplaces (Wongnaa & Boachie, 2018). Most graduates of Ethiopian higher education institutions are yet ill-equipped to meet the challenges of life and employment (Getahun et al., 2020). As a result, employers and industrial organizations complain that new graduates of Ethiopian higher education institutes are not properly meeting labor market needs and are in constant need of a consistent and reliable supply of educated and skilled graduates.

Graduates of engineering and technology require short-term on-the-job training that enables them to cope with the work context immediately after labor market entry. It has been argued that the knowledge, skills, and competences that students acquire at higher learning institutes should be based on what the labor market needs. That is the reason why labor market analysis is required and recommended on a regular basis to shape higher education curricula.

Higher education institutions are supposed to play a critical role in achieving both human resources and the overall social development of a nation by contributing to knowledge production through teaching, research, and the provision of community services. However, the failure of universities to keep pace with the skills requests of rapidly growing industries has created a crisis in employability skills. Thus, understanding how skills are described and applied in industry plays a key role in feeding curriculum development capable of addressing industry requirements. The quality of knowledge generated within higher education institutions and its

availability to the wider economy are becoming increasingly critical to national competitiveness, especially for developing countries like Ethiopia.

With mounting pressure from policymakers to meet the needs of employers, higher learning institutions also need to meet the needs of their students and graduates. Researchers confirmed that the majority of graduates felt skills were developed at both the university and the workplace. Modern engineering curricula should take the level of required knowledge and skills, professional and personal attributes, attitudes, and generic skills of the world of work into consideration (Nguyen, 1998; Pudlowski & Darvall, 1996). Parallel to developing technical and hard skills, giving attention to the development of soft skills is also important. Yet, there is also a scarcity of empirical evidence indicating whether skills needed by employers have been acquired by employees during studies at HEIs in Ethiopia. Thus, this study sought answers to levels of employers need to discipline specific skills, technical skills, and interpersonal skills and tested whether or not a statistically significant difference exists between employees, employers, and instructors in terms of perceptions of the employers' need for the same skill sets.

3. Do the skills needed by employers match those acquired at higher education institutions?

Linking education with the labor market requires designing and implementing an appropriate curriculum for employment. Efficiency and a competency-based curriculum can provide graduates with the necessary qualifications to gain successful employment in the global arena (Yazdi, 2013). The curriculum should place emphasis on learning outcomes related to graduate employability attributes (Shivorois et al., 2019), including both technical and non-technical skills in their curricular and co-curricular activities (Azmi et al., 2018).

The existence of a curriculum capable of instilling graduates with skills and attributes from diverse areas of social science, communication skills, social skills, presentation skills, interpersonal skills, and business/management makes prospective engineering graduates function effectively in a multidisciplinary environment. Such a curriculum is also important to equip students with leadership skills, business management skills, team-working skills, accounting skills, computer/technology, computer skills, programming skills, technical skills, design skills, mathematics/science, problem-solving skills, research and development skills, and analysis/synthesis skills (Yazdi, 2013; Yibeltal, 2016).

However, providing a standard curriculum to produce graduates with multi-skills and implicating the curriculum and factors supporting the career development of students are becoming challenges in higher education (Azmi et al., 2018). In addressing this problem, scholars have tried to connect the curriculum with the demands of society and the world of work (Yazdi, 2013). Modifying the curriculum and preparing students to match expectations is an important step to bridge the gap between the academic curriculum of higher education and industry needs (Kaushal, 2016). While matching skill demand and supply is a major factor shaping economic growth, productivity, and competitiveness (Beyene & Teklesilassie, 2018), a mismatch between the type of education provided at schools and the requirements of the labor market has resulted in an increasing unemployment rate for young people who have attained higher education (Kellow, Ayele, Yusuf, 2010).

Studying the state and trend of labor market mismatches enables policymakers to take corrective actions in the event of a high mismatch between the skills available in the economy and the skills required by the economy (Beyene & Teklesilassie, 2018). Labor market

imperfections and inadequate initial training are sources of mismatch between skills required by workers and those needed by employers. There is a dearth of up-to-date scholarly evidence indicating whether there is a matching between skills acquired by graduates and those required by the labor market as far as engineering graduates from Ethiopian public universities are concerned. Therefore, to understand the match between higher education skill supply and employers' skill needs, the following hypotheses were tested:

H0: There are no statistically significant mean differences between higher education supply and employers needs for discipline-specific academic skills, technical skills, interpersonal skills, and generic skills.

H0: The skills needs of employers do not match the skills acquired at higher education institutions as perceived by employees, employers, and instructors.

H0: There are no there statistically significant mean differences between higher education supply and employers needs for discipline-specific academic skills, technical skills, interpersonal skills, and generic skills as reported by employees, employers, and instructors.

1.4 Objectives of the study

The general objective of the study was to investigate higher education skill supply and employers' skill demand by focusing on Ethiopian engineering graduates.

More specifically, the study intended to achieve the following specific objectives:

- To identify levels at which academic, technical, interpersonal, and generic skills are acquired and required by engineering graduates during their studies at higher learning institutes.
- To identify the differences among employers, employees, and instructors in reporting levels of graduates' acquisition of and employers' need for academic, technical, interpersonal, and generic skills.

- To compare overall means of skills acquired by higher education graduates and skills required skills by employers.
- To compare means of discipline-specific, technical, interpersonal, and generic skills acquired by graduates at higher learning institutes and required on engineering labor markets.

1.5 Significance of the study

The findings of this study may be significant for the following purposes:

1.5.1 Practical significance

The findings of the study are believed to fill some sort of existing knowledge gap on labor market skill needs and higher education skill supply to reduce the current booming graduates' unemployment in Ethiopia. It also helps shed some light on the importance of frequent assessment of employers skill needs and considering their needs in designing higher education curricula. The government, employers, and higher education institutions can use the findings of this study to design, implement, and evaluate a policy that enhances their collaborative efforts.

1.5.2 Policy and administrative decision significance

The findings of the study will help generate data related to skills to be supplied by higher learning institutes based on employers needs for administrative decision-making and actions. In this regard, the study will help to provide data related to the types of skills acquired by graduates and required by employers and the gap between skills acquired during studies at higher learning institutes and the needs of employers for the same set of skills. The data related to the above issues will help universities, the Ministry Science and Higher Education, potential companies employing Science and Technology graduates, other sectors, and stakeholders take the necessary administrative decisions and actions that will enhance higher education graduate employment.

Based on administrative decisions and actions taken, the findings of the study will help to show areas that require critical attention in aligning higher education intake, training policies,

and planning in line with labor market needs and requirements. The findings of the study may help to strengthen collaborative relations among higher education, industries, the private sector, and other stakeholders in collegial planning and cooperation in equipping graduates with employers' need-based skills in the journey of poverty reduction. The findings of the study serve as input to improve both higher education and labor market policies and encourage universities to design curriculum capable of equipping learners with important skills. This could help higher learning institutions adjust their education programs in line with labor market requirements.

1.5.3 Theoretical and research significance

The human capital and job matching theories guided the study. Human capital theory is the most widely accepted theory for explaining the relationship between education and employment. Human capital argues that investment in human productive capacity through education and training provides knowledge and skills that can be used in practicing an occupation later and can thus productively be employed on the labor market (Boudarbat & Chernoff, 2009; Walters, 2002).

These theorists believe that higher education equips graduates with the skills necessary to perform complex jobs, fosters their productivity, and ensures sustained economic growth. With increasing human capital, people become more productive and secure the best jobs and the highest salaries (Sharma, 2016). That means investing in education will boost social and economic achievements (Taye, 2013). Thus, human capital denotes education, health, and other human capabilities that improve productivity when increased. The impact of investment in human capital is quite substantial for developing countries (Tadaro & Smith, 2012). While meeting the scarcity of human capital, a promotion to a higher position will follow to more

adequately match the level of human capital that an individual possesses (Boudarbat & Chernoff, 2009).

Both generic and specialist knowledge and skills acquired at school, together with those acquired from work experience, constitute human capital. Strengthening the link between the education system and the world of work helps to promote the formation of human capital through lifelong learning, which in turn could increase youth employment. Since the direct and indirect private costs of education are relatively low, individuals should escape limited job opportunities by acquiring more education and training (Tadaro & Smith, 2012). Similarly, employee wage and job search time depend on skill level and the level of human capital of the individual (Guarcello & Rosati, 2007).

Widespread recognition of education as human capital motivates societies to invest in education mainly to raise productivity and increase individual and social benefits (Boudarbat & Chernoff, 2009). Due to the lack informal and non-formal human capital that comes from work experience and specific professional and vocational training, young people face difficulty finding employment and wait a long period of time for a transition from school to the world of work (Refrigeri & Aleandri, 2013). It was argued that educational policies must integrate economic know-how and the pedagogy of the labor market in order to build a pathway capable of introducing young people to the world of work in the shortest possible time.

However, human capital theory has a number of weaknesses. Among other things, the theory claims that job-search success depends solely on quantity and quality and ignores the fact that education is usually used only as a base during the candidate selection process, with employers often using recommendations and other credentials to make their final selection. The

theory ignores the fact that investment in education also depends on the actual demand for the skills acquired by individual graduates. Another criticism is that education does not always provide knowledge and skills immediately applicable to work. Rather, there must be other attributes that employers look for. Therefore, looking for other theories seems important because the sole use of human capital theory makes this study incomplete (Boudarbat & Chernoff, 2009).

The job matching theory argues that the abilities of individuals do not give them any absolute advantages for employment in any possible job. But the specific demands that particular jobs entail determine their productivity (Heijke, 1996). The productivity of individuals depends on both their abilities and the characteristics of the specific position they hold. The individual can utilize comparative advantages by applying his or her knowledge and skills to the portion of the labor market where these are the most productive. One consequence is that, in contrast to the human capital theory, the knowledge and skills acquired in the education system are not rewarded with the same wages wherever in the labor market they are used (Heijke, 1996). The job matching theory also supposes that the information available in the labor market about both the skills required in various jobs and the skills that workers have is inadequate.

The heterogeneity and opacity on both sides of the labor market make it more difficult to achieve a perfect match between the characteristics of the employees and the jobs they perform. Workers will only get a true picture of their productive capabilities once they are actually at work. School-leavers' entry to the labor market may therefore involve a process of searching for the optimal job, leading to repeated job-switching, or 'job shopping' (Topel & Ward, 1992). According to job matching theory, school- teachers should know the type of knowledge and skills relevant to the available jobs. The theory insists that the that the provision of labor market

information differentiated by occupation and education is an important step in the direction of making the labor market transparent for those facing educational choices (Heijke, 1996).

With the above notions in mind, the researcher believes that human capital theory and job matching theory fit the criteria for guiding the study of the higher education STEM skill supply and employers' skill needs. This is because, firstly, scholars argue that both human capital theory and job match theories give special emphasis to the importance of the acquisition of skills that perfectly meet employers' needs. Secondly, in both theories, the acquisition of skills that meet employers' needs enhances the smooth transition of graduates from the world of schooling to the world of work and fosters graduates' productivity and effectiveness after employment, which could in turn increase organizational competitiveness. Therefore, higher education institutions are required to consider employers and labor market needs in designing and delivering curriculum related to skill acquisition.

The labor market will benefit from higher education graduates' knowledge and skills that could improve both labor market and employee performance, which in turn could accelerate the economic growth of the country and increase firm productivity and competitiveness. Among other things, the findings of this study will help the Ministry of Education and other stakeholders prepare qualifications, skills, and competence frameworks that meet employers' needs. The result of the study might be used as a sort of reference for researchers in the area and serve as a means of bridging the existing gaps in higher education expansion and engineering graduate employment in the Ethiopian labor market. It also sheds some light on future research areas deserving of scholars' attention.

1.6 Scope of the Study

This study was limited to assessing the supply of graduate skills in higher education and employers' skill needs by focusing on civil, electrical, and mechanical engineering graduates. The study was conducted on four selected public universities such as Adama Science and Technology University, Addis Ababa Science and Technology University, Jimma University, and Ambo University. Data was generated from both primary and secondary sources using questionnaires, key informant interviews and document reviews. The study involved employees, employers, instructors of higher education, experts, and policymakers to investigate higher education skill supply and labor market skill needs. Generalizations of the findings were also made to all graduates of civil, mechanical, and electrical engineering departments in the four selected higher education institutions in Ethiopia.

1.7 Limitations of the study

Despite unprecedented efforts made by the researcher, this study has some limitations. Firstly, scarcity of financial resources hindered the collection of large amounts of data from a large and representative sample size. Secondly, it didn't focus on the demand side of the labor market, especially job attractiveness; data was not secured from prospective graduates; and factors determining skills acquisition at higher education institutions and the skill demands of employers were not considered in the study.

1.8 Conceptual framework of the study

Conducting assessments of employers needs for various kinds of skills is one of the roles of higher education. The skill requirements of employers determine the type of skills students are supposed to acquire during their studies at higher learning institutes. Higher education institutions' understanding of the skills requirements of employers or labor markets helps to

match higher education skill supply and labor market needs to different kinds of skills. This in turn helps to enhance graduate employment and the productivity of higher education graduates in the labor market, which accelerates sustainable economic growth and development. Thus, higher education curricula should be designed based on the skills requirements of employers, with the active involvement of employers and industries in designing and implementing the same curricula. The researcher believes that engineering graduates' labor market success and sustainable economic development are the result of a balanced relationship between employers' needs for some skills and the attention given by HLIs to equip students with the skills indicated in the conceptual framework of this study (see figure 1.1).

After thoroughly reading different graduate skills and competences models developed elsewhere by different scholars, the researcher developed the following conceptual framework for the study of skills and competences acquired by graduates during studies at higher learning institutes and employers needs for the same skills. Skills acquired during studies at higher learning institutes and skills needed by employers are located at the center of the conceptual framework of the study.

Most international organizations classify skills into foundational skills, transferable skills, technical skills, and vocational skills (Palmer, 2018). For instance, the European Commission classifies skills as basic skills, transversal skills, and vocational skills; for the ILO, it encompasses foundational or basic skills, professional or personal skills, transferable skills or core work skills, and technical and vocational skills; for USAID, it includes soft skills, academic skills, and technical skills; and for the World Bank, it entails cognitive skills, behavioral skills, and technical skills (Palmer, 2018). Similarly, for scholars (e.g., Strijbos, Engels, & Struyven, 2015; Suleman, 2018), generic skills, transferable skills, employability skills, core competences,

and generic competences, as well as generic attributes, are used to refer to skills. This study mainly focuses on discipline-specific skills, technical skills, interpersonal skills, and generic skills.

Discipline-specific skills: Discipline-specific academic skills encompass professional expertise acquired from subject-area courses and seminars (Tuononen, 2019). Graduates with stronger discipline-specific skills have better chances of becoming employed in their own field of study and will receive higher wages as opposed to those who work in a mismatched job. Compared to social science fields, discipline-specific skills are more important in the fields of science, technology, engineering, and math (STEM) (Wongnaa & Boachie, 2018). Discipline-specific skills needed by employers of engineering graduates are competence in application and practice; engineering problem solving and decision-making include applying knowledge of science and engineering principles; competence in specific engineering disciplines; an engineering system approach; and designing and conducting experiments (Azmi et al., 2018; Shukla & Garg, 2016). In this study, the foundations of engineering, manufacturing, and construction, operation, measurement, and control technology, applying technical fields, planning, design, calculation, and construction, quality control and assurance, environmental safety, health, and security, applying knowledge of science and engineering principles, and skill in specific engineering disciplines and skill in application and practice were used to measure discipline-specific skills.

Technical skills: Technical skills are skills that are required to work within an occupation or occupational group (Palmer, 2018). Higher education institutions are expected to integrate technical skills into their curriculum and equip graduates with the same skills (Wongnaa & Boachie, 2018). With growing technologies, continuously updating and improving the technical skills of engineering graduates is crucial for their success on the labor market (Azmi, Kamin, &

Noordin, 2018). Job-specific technical skills are among the employability skills required by most employers because graduates acquisition of such skills indicates their proficiency to perform highly in a particular job and enables them to solve complex engineering problems at the workplace (Fitriani & Ajayi, 2022). Problem-solving skills, information technology skills, adapting to change, and risk-taking skills are the technical skills most demanded by employers (Siraye, Abebe, Melese, & Wale, 2018). For the purpose of this study, technical skills were measured in terms of computer skills, the skill of planning and organizing tasks, problem-solving skills, decision-making skills, professional skills, and the and the skill of seeking and developing opportunities.

Interpersonal skills: Interpersonal or social skills are skills necessary to produce desired effects on other people in social situations and enable graduates to work in a team and communicate and cooperate effectively with diverse colleagues and clients (Green, 2016). 21st century engineering graduates should be well equipped with a broader knowledge base and diverse personal and interpersonal key skills that help them succeed in the labor market (Collet & Hine, 2015). Therefore, educators should focus their efforts on the development of interpersonal skills (Velasco-Martínez & Tójar-Hurtado, 2018). Constructs such as teamwork, client/stakeholder focus, and working with people from different cultures, communication skills (both written and verbal), empathy, adaptability, and flexibility were employed to measure interpersonal skills. *Generic skills:* Generic skills are general skills that could apply to a whole range of industries and are increasingly becoming more important in modern economies (Asai, Breda, Rain, Romanello, & Sangnier, 2020; Green, 2016). Such skills denote certain personal abilities that can be taken from one job role to another, used within any profession, and at any stage (Shukla & Garg, 2016). Possession of many generic skills is proposed as part of the key to personal

employability, employment security (Green, 2016), and higher earnings in a competitive labor market (Asai et al., 2020). Thus, the employment and job qualities of graduates are primarily determined by generic skills acquired during university studies. Generic skills include creative thinking, willingness to learn, leadership skills, integrity, willingness to perform, a sense of responsibility, innovativeness, determination, loyalty to the institution and its objectives, the ability to assert oneself, self-confidence, and a sense of independence.

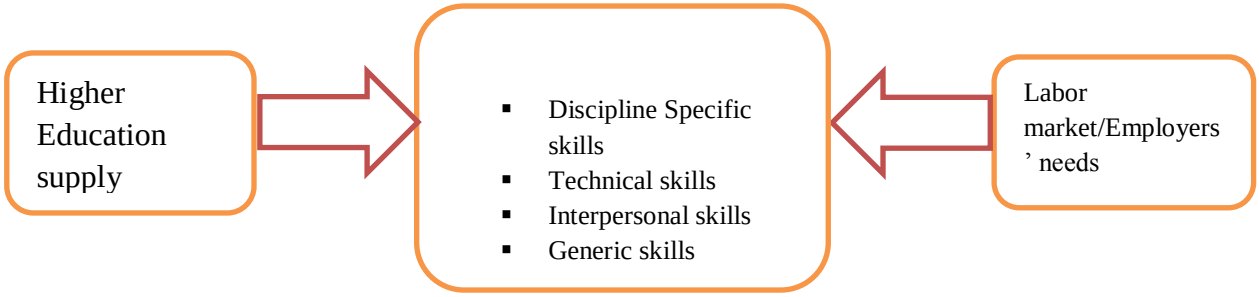

Figure 1.1: *Conceptual framework to study acquired and required skills*

1.9 Operational definitions of key terms

Higher education*:* the education sub-sector awards undergraduate degrees, MAs, and PhDs and is mainly financed and administered by the government of Ethiopia. In this study, the term is equivalent to public university.

Graduate: In this study, a graduate is refers to an individual who has completed an undergraduate degree from one of the Ethiopian public universities.

Engineering and technology graduates: In this dissertation, engineering and technology graduates replace graduates of civil engineering, electrical engineering, and mechanical engineering.

Graduate employability skills: Graduate employability skills denote generic qualities and skills that are suitable for contemporary work and allow graduates to identify relevant further learning opportunities for continuous professional and personal growth.

Competences: The capacity to use specific combinations of knowledge, skills, and attitudes in appropriate contexts.

Labor market*:* In this study, labor market denotes an economic sector or organization where a graduate labor force is employed after completing an undergraduate degree program.

Technical knowledge: refers to knowledge of science, math, and engineering principles and general problem-solving techniques.

1.10 Organization of the study

This dissertation has been organized into five chapters. The first chapter discusses the introduction, which primarily deals with the background of the study, statement of the problem, research questions and hypotheses of the study, objectives, significance, delimitations of the, limitations, and conceptual framework of the study, operational definitions of key terms, and organization of the study. Chapter two presents relevant literature reviewed by the researcher. It discusses the issues related to concept of skill, graduate skills, skills of engineering graduates, classification of skills, graduate employability in Ethiopia, employers skill needs, the concept of skill mismatch, impact of skill mismatches, the role of higher education in graduates' skill acquisition, curriculum development and graduate skills, learning approaches and graduate skills, graduate employability stakeholders, factors determining graduate Employability, historical overview of Ethiopian higher education, higher education policies and reforms in Ethiopia, and higher education enrollment and expansion in Ethiopia. Chapter three presents research design and methodology of the study, which comprises of research design, designs for a mixed

research approach, sources of data, population of the study, sample size and sampling techniques, data collection tools, questionnaire, interview, checklist for document reviews, procedures for data collection, methods and tools of data analysis, and ethical considerations. Chapter four provides detailed discussions on the data, presentation, analysis, and interpretation of the study. It mainly discusses the demographic background of the study participants. The demographic background of the respondents presented in this chapter includes sex of the respondents, study respondent by field of study, experience of the respondents, skills acquired during studies at higher learning institutes, levels of generic skill acquired, mean difference between acquired and required academic skills, and analysis of qualitative data. Chapter five provides an overall brief summary of the major findings, conclusion, and recommendations of the dissertation report.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

Chapter two presents relevant literature reviewed by the researcher. The reviewed literature was thoroughly organized under themes after consulting both local and global empirical works that have direct relation to the topic under investigation. The chapter presents relevant literature reviewed by the researcher. It discusses the issues related to concept of skill, graduate skills, skills of engineering graduates, classification of skills, graduate employability in Ethiopia, employers skill needs, the concept of skill mismatch, impact of skill mismatches, the role of higher education in graduates' skill acquisition, curriculum development and graduate skills, learning approaches and graduate skills, graduate employability stakeholders, factors determining graduate Employability, historical overview of Ethiopian higher education, higher education policies and reforms, and higher education enrollment and expansion in Ethiopia.

2.1 Concept of Skill

Reaching consensus on the definition of skill remains a challenge, and different scholars and organizations define the term differently. For scholars (e.g., Barrie, 2006; Strijbos, Engels, & Struyven, 2015; Suleman, 2018), generic skills, transferable skills, employability skills, core competences, and generic competences, as well as generic attributes are used to refer to skills. These scholars defined skill as the ability to perform a task to a predefined level of competence. Skill denotes any personal attribute having productive value that augmented through some form of investment (Green, 2016). As used in occupational psychology, skill has a closer meaning to competence (Green, 2016; Suleman, 2018). In broadest sense, competencies can be defined as context-specific dispositions that are acquired and needed to cope successfully with domain-specific situations and tasks (Bergsmann, Schultes, Winter, Schober, & Spiel, 2015). It is one of

the basic attributes of an employee that results in effective and superior performance in a job. These competencies and skills are often shaped during studies at higher education (Azmi et al., 2018). Therefore engineers need to be equipped with sufficient competence and skills before entering the labor market.

2.2 Graduate Skills

Graduates are expected to possess high-level discipline-specific skills synthesized with more generic interpersonal and communication competencies (Andrews & Higson, 2008). They are supposed to be employment-ready, equipped with the necessary skills and competencies, and able to work with the minimum of supervision (Ibid.). Despite recent decades having witnessed several education system reforms in many countries across the world, the assessment of clients' satisfaction, status, and performance of graduates in different countries shows that graduates lack the required knowledge, skills, and abilities to meet the requirements of the labor market (Yazdi, 2013).

The current education and training systems across the world do not necessarily produce graduates that meet the needs of the private sector, and the graduates lack knowledge about the realities of the labor market (Mtebula, 2014). For instance, engineering graduates in Malaysia lack creative and innovative skills, are dependent, and are poor in communication skills (Azmi et al., 2018). Graduate unemployment in the country is attributed to academic qualifications rather than non-technical skills that are very essential to employers. Graduates in non-professional fields encounter more difficulties in making the transition to the world of work, have poorer quality jobs, and have fewer labor market opportunities than graduates in professional fields (Okay-Somerville & Scholarios, 2017; Puhakka, Rautopuro, & Tuominen, 2010). In India, a lack

of employability skills has hindered graduates' success in the labor market (Kaushal, 2016). Employees lacked motivational skills, communication skills, interpersonal skills, critical thinking, problem solving, and entrepreneurship skills (Mustapha, 2002; Taylor, 2005). Graduates in the technical field are yet jobless because they lack employability skills rather than technical skills required by the industry. It has been found that these graduates are weak in communication, writing, and computer skills. There is a mismatch between the skills acquired at the university and the skills needed in the workplace (Rasul et al., 2012). Most graduates neither coherently nor comprehensively explain the skills they acquired at HEIs to employers nor relate these skills to a workplace context (Jackson, 2013). In addition, over the last two decades, the educational process and the new cohorts have been facing declining quality; teachers have lower credibility; students invest less in education and usually combine education and work by missing lessons and school (Mocanu et al., 2014).

Despite the fact that graduates lack the competencies requested by employers, employers themselves fail to make the right offers to attract qualified employees (Ho, 2015). Thus, university students are required to understand what competencies are most wanted by businesses, while business organizations also require an understanding of what kinds of knowledge and skills are wanted in job markets. However, the responsibility of developing graduate skills does not solely rest with higher education (Branine & Avramenko, 2015). The primary responsibility for employability rests on individual students and graduates. Yet graduate employability depends on the relationship between higher education and the employment market (Van Buren, 2003; McQuaid & Lindsay, 2005; Tan & French-Arnold, 2012; Leong & Kavanagh, 2013). University students should prepare themselves for a changing world by actively improving their knowledge and skills to meet the demands of the modern workplace (Bridgstock, 2009).

Due to technological advances and globalization, the intensity and complexity of the business environment have also increased, resulting in rising demand for relevant qualifications and skills (Branine & Avramenko, 2015). Nevertheless, the change from manufacturing to a service-oriented economy led to a mismatch between the skills demanded and available skills because graduates are not obtaining the qualifications that employer need (Branine & Avramenko, 2015). Still, there is a scarcity of empirical evidence on how the quality of students' learning is related to employability (Tuononen, 2019). More specifically, there is a scarcity of knowledge about graduate employment experiences and the effectiveness of university education in providing the necessary skills and knowledge required for working life (Jackson, 2013). As a result, special attention should be paid to the to the stakeholder perspective because their view has paramount importance in enhancing understandings of graduate employability.

There are different techniques to identify the skill requirements of the jobs. One of the approaches is to ask employed workers about whether they have the skills to do a more demanding job than the one they currently do or whether they need additional training to perform their job tasks (Pellizzari & Fichen, 2017). The education level required for a job is a measure of the general level of knowledge required. A long-term trend in the highest education qualification is helpful both to get the job and to do the job competently (Green, 2016). As a result of increasing technological change and innovation, increasing demand for highly skilled people is expected across all occupations (Strietska-Ilina, 2008). More importantly, the 21st century is characterized by the increasing importance of five types of skills: adaptability, complex communication skills, non-routine problem-solving skills, self-management and development, and systems thinking (Jang, 2015). 21st century engineering graduates should be well equipped with a broader knowledge base and diverse personal and interpersonal key skills such as

teamwork, communication, inter/multidisciplinary knowledge, analytical thinking, ingenuity, creativity, technological innovation, business and management skills, leadership, ethics, and professionalism (Abdulwahed, Balid, Hasna, & Pokharel, 2013).

The graduate transition from higher education to the world of work has been determined by generic skills such as interpersonal skills, communication skills, time management skills, teamwork ability, and internship engagement (Fenta, Asnakew, Debele, Nigatu, & Muhaba, 2019). Similarly, problem-solving skills, information technology skills, adapting to change, and risk-taking skills were the skills most demanded by employers (Siraye, Abebe, Melese, & Wale, 2018). Thus, to meaningfully contribute to the socio-economic development of a country, higher education expansion must be aligned with market demand (Reda & Tsegai, 2018). Graduates are expected to transfer and use skills developed at the university in the workplace during the transition phase. Subject skills are discipline-specific knowledge and skills that are more relevant to one's career (Shivorois et al., 2019). Graduates with stronger discipline-specific skills have better chances of becoming employed in their own field of study and will receive higher wages than those who work in a mismatched job.

In general, it has been argued that graduates are expected to possess high-level discipline-specific skills synthesized with more generic interpersonal and communication competencies. They are supposed to be employment-ready, equipped with the necessary skills and competencies, and able to work with the minimum of supervision. Nevertheless, the assessment of clients' satisfaction, status, and performance of graduates in different countries shows that graduates lack the required knowledge, skills, and abilities to meet the requirements of the labor market. The current education and training systems across the world do not necessarily produce

graduates that meet the needs of the private sector, and the graduates lack knowledge about the realities of the labor market.

There is a significant mismatch between the skills acquired at the university and the skills needed in the workplace. Most graduates neither coherently nor comprehensively explain the skills they acquired at HEIs to employers nor relate these skills to a workplace context. Despite the fact that graduates lack the competencies requested by employers, employers themselves fail to make the right offers to attract qualified employees. Therefore, university students are required to understand what competencies are most wanted by businesses, while business organizations also require an understanding of what kinds of knowledge and skills are wanted in job markets. They should prepare themselves for a changing world by actively improving their knowledge and skills to meet the demands of the modern workplace. Yet there is a scarcity of knowledge about graduate employment experiences and the effectiveness of university education in providing the necessary skills and knowledge required for working life.

More importantly, 21st century graduates should be well equipped with a broader knowledge base and diverse personal and interpersonal key skills such as teamwork, communication, inter/multidisciplinary knowledge, analytical thinking, ingenuity, creativity, technological innovation, business and management skills, leadership, ethics, and professionalism. The failure of universities to keep pace with the skills requests of rapidly growing industries has created a crisis in employability skills. Understanding how skills described and applied in industry play a key role in feeding curriculum development capable of addressing industry requirements.

2.3 Skills of Engineering Graduates

With increasing graduates across the world, globalization, and competition, labor market conditions are becoming tough for engineering graduates. To remain competitive worldwide, engineering graduates should acquire certain employability skills (Zaharim et al., 2009). Skills required in an engineering context are technical or hard skills and non-technical or soft skills (Abdulwahed, Balid, Hasna, & Pokharel, 2013). Contemporary engineering graduates are required to have hard skills like fundamental knowledge of science, mathematics, engineering design, and problem-solving skills, as well as soft skills like communication skills, managerial skills, negotiation skills, and interpersonal skills, to be employable in today's global market (Ibid.). They are also expected to be equipped with appropriate knowledge and skills required in the job market of the 21st century, including in-depth knowledge in the areas of expertise, problem-solving skills, making decisions, and the ability to maintain personal traits associated with a career (Kubler & Forbes, 2004; Mohammad, 2004). According to Zaharim et al. (2009), communication skills, problem solving skills, and interpersonal skills are the three most important employability skills of engineering graduates in Malaysia, Japan, Hong Kong, and Singapore.

Empirical studies (e.g., Kaushal, 2016) show that employers look forward to fresh engineers having sound knowledge of hard skills and adeptness in a few soft, or domain-general, skills. Skills often required by engineering graduates employers include communication skills, teamwork, problem-solving skills, initiative and enterprising, planning and organizing, managerial skills and leadership skills, interpersonal skills, adaptability or flexibility, creativity or innovation, negotiation skills, commercial awareness, and lifelong learning. Similarly, scholars (e.g., Garcia-Aracil & der Velden, 2008; Mocanu et al., 2014; Selvadurai, Choy &

Maros, 2012) identified planning skills, problem-solving skills, ICT skills, communication skills, teamwork, leadership skills, field-specific operational skills, and field-specific knowledge as employability skills required by employers and should be possessed by engineering graduates. Arguably, field-specific knowledge is relatively more important in the fields of medicine, law, science, technology, engineering, and math (STEM) than in the fields of humanities, arts, media/communication, and social sciences (Humburg et al., 2013). Graduates meet employers' expectations if and only if their engineering degree is accompanied by a combination of these skills (Ibid.).

The study conducted by Nguyen et al. (2005) grouped engineering employability skills required by employers in Japan as possession of scientific knowledge and employable personal qualities. Communication skills, responsibility, and initiative were the most requested personal qualities of potential employees by most engineering employers. To apply and practice their knowledge in the workplace, engineering graduates need to have certain generic or employability skills (Pool & Swell, 2007; Yorke, 2006). In the past decade, countries have started developing national frameworks on employability skills that serve as guides for employers, employees, and graduates. Nevertheless, rapid technological, economic, and labor market changes occurring across the globe require updating the frameworks based on workplace needs. Engineering practice is a basic understanding of elements shaping the early career of engineers' decisions to prepare new engineers for a successful transition to the workplace (Azmi et al., 2018). In order to better prepare graduates and meet the demand for skills, STEM education programs must comprehend the nature of the skills required in the workplace (Jang, 2015).

Competent, competitive, and multi-skilled human capital resources are needed to meet the needs of the contemporary globalization era (Azimi, Kamin, Noordin, 2018). Engineers need

to be equipped with sufficient competencies before entering the labor market. Among other things, the industries need graduates with language skills, communication skills, thinking skills, planning and administration skills, and ICT skills. In addition, graduates who think critically, have the ability to argue, are knowledgeable, and are eager to learn are also required in the labor market. Graduates are expected to have both cognitive and social skills, which are relevant to non-routine problem solving and complex communication (Jang, 2015). Thus, educators should focus their efforts on the development of competencies that integrate knowledge and attitudes and values for professional development, as well as the acquisition of interpersonal skills (Velasco-Martínez & Tójar-Hurtado, 2018).

With increasing graduates across the world, globalization, and competition, labor market conditions are becoming tough for engineering graduates. To remain competitive worldwide, engineering graduates are expected to be equipped with appropriate knowledge and skills required in the job market of the 21st century, including in-depth knowledge in the areas of expertise, problem-solving skills, making decisions, and the ability to maintain personal traits associated with a career. Especially, planning skills, problem-solving skills, ICT skills, communication skills, teamwork, leadership skills, field-specific operational skills, and field-specific knowledge are employability skills required by employers and should be possessed by engineering graduates. To apply and practice their knowledge in the workplace, engineering graduates need to have certain generic or employability skills. Engineering practice is a basic understanding of elements shaping the early career of engineers' decisions to prepare new engineers for a successful transition to the workplace. Engineers need to be equipped with sufficient competencies before entering the labor market. They are also expected to have both cognitive and social skills, which are relevant to non-routine problem solving and complex

communication. Thus, educators should focus their efforts on the development of competencies that integrate knowledge and attitudes and values for professional development, as well as the acquisition of interpersonal skills.

2.4 Classification of Skills

Most international organizations classify skills into foundational skills, transferable skills, technical skills, and vocational skills (Palmer, 2018). For instance, the European Commission classifies skills as basic skills, transversal skills, and vocational skills; for the ILO, it encompasses foundational or basic skills, professional or personal skills, transferable skills or core work skills, and technical and vocational skills; for USAID, it includes soft skills, academic skills, and technical skills; and for the World Bank, it entails cognitive skills, behavioral skills, and technical skills (Palmer, 2018). Similarly, for scholars (e.g., Strijbos, Engels, & Struyven, 2015; Suleman, 2018), generic skills, transferable skills, employability skills, core competences, and generic competences, as well as generic attributes, are used to refer to skills. This study mainly focuses on discipline-specific skills, technical skills, interpersonal skills, and generic skills, which are subsequently defined as follows:

2.4.1 Discipline-specific Skills

Discipline-specific skills encompass professional expertise acquired from subject-area courses and seminars (Tuononen, 2019). Graduates with stronger discipline-specific academic skills have better chances of becoming employed in their own field of study and will receive higher wages as opposed to those who work in a mismatched job. Compared to social science fields, discipline-specific skills are more important in the fields of science, technology, engineering, and math (STEM) **(**Wongnaa & Boachie, 2018)**.** Discipline-specific skills needed by employers of

engineering graduates are competence in application and practice; engineering problem solving and decision-making include applying knowledge of science and engineering principles; competence in specific engineering disciplines; an engineering system approach; and designing and conducting experiments (Azmi et al., 2018; Shukla & Garg, 2016).

2.4.2 Technical Skills

Technical skills are skills that are required to work within an occupation or occupational group (Palmer, 2018). Higher education institutions are expected to integrate technical skills into their curriculum and equip graduates with the same skills (Wongnaa & Boachie, 2018). With growing technologies, continuously updating and improving the technical skills of engineering graduates is crucial for their success on the labor market (Azmi, Kamin, & Noordin, 2018). Job-specific technical skills are among the employability skills required by most employers because graduates acquisition of such skills indicates their proficiency to perform highly in a particular job and enables them to solve complex engineering problems at the workplace (Fitriani & Ajayi, 2022). Problem-solving skills, information technology skills, adapting to change, and risk-taking skills are the technical skills most demanded by employers (Siraye, Abebe, Melese, & Wale, 2018).

2.4.3 Interpersonal Skills

Interpersonal or social skills are skills necessary to produce desired effects on other people in social situations and enable graduates to work in a team and communicate and cooperate effectively with diverse colleagues and clients (Green, 2016). 21st century engineering graduates should be well equipped with a broader knowledge base and diverse personal and interpersonal key skills that help them succeed in the labor market (Collet & Hine, 2015). Therefore, educators should focus their efforts on the development of interpersonal skills (Velasco-Martínez & Tójar-Hurtado, 2018).

2.4.4 Generic Skills

Generic skills are general skills that could apply to a whole range of industries and are increasingly becoming more important in modern economies (Asai, Breda, Rain, Romanello, & Sangnier, 2020; Green, 2016). Such skills denote certain personal abilities that can be taken from one job role to another, used within any profession, and at any stage (Shukla & Garg, 2016). Possession of many generic skills is proposed as part of the key to personal employability and employment security (Green, 2016) and higher earnings in a competitive labor market (Asai et al., 2020). Thus, the employment and job qualities of graduates are primarily determined by generic skills acquired during university studies. Local researchers (eg., Reda & Gebre-Eyesus, 2018) identified generic skills like group effectiveness (interpersonal skills, negotiation skills, team work), influencing skills (organizational effectiveness skills, and leadership skills), personal development (self-esteem skills, motivation and goal-setting skills, and personal and career development skills), adaptability (problem solving skills, creativity skills), academic basics (reading skills, writing skills, and computational skills), communication skills (speaking skills, listening skills), and learning to learn (foundation skills and learning how to learn).

2.4.5 Firm-specific and Transferable Skills

Skill can be classified as firm-specific (having value in the firm where a person works) or transferable (can be applied to other firms). While transferrable skills are used across large numbers of different occupations, vocational skills are specific occupational or technical skills needed to work within an occupation or occupational group (Oluyomi &Adedeji, 2012). Transferable skills are basic skills minimally required for being employable in any job across the economy, while generic skills are general skills that could be applied in a whole range of the

economy and increasingly become more important in modern economies (Asai, Breda, Rain, Romanello, Sangnier, 2020; Green, 2016).

In the contemporary economy, transferable skills encompass literacy, numeracy, and appropriate work behaviors. Occupation-specific skills refer to fields of knowledge and manual dexterity that help to operate in a particular occupation (Green, 2016). For example, attitudes, interactive skills, communication skills, and emotional labor are among the very productive occupational skill types, referred to as soft skills. Scholars (e.g., Oluyomi &Adedeji, 2012) also identified transferable or generic skills and vocational skills. Specific skills are valued in a single firm and directly linked to a job; they cannot be transferred to another one (Asai, Breda, Rain, Romanello, Sangnier, 2020). Such a skill requires extensive and long periods of educational training. General skills are not attached to a particular firm and are valued in several employment opportunities. The acquisition of general skills will translate into higher earnings in a competitive labor market (Ibid.).

2.4.6 Hard Skills and Soft Skills

A knowledge-driven economy requires individuals with the knowledge, skills, and creative potential to be capable of meeting the challenges of an emerging global economy with rapid change (Arthur & Rousseau, 1996). With the changing business environment, the needs of a workforce with a new set of skills that are flexible and adaptable to continual changes, keep abreast of new technology, and work effectively in the knowledge economy have become of prime importance (Jackson, 2013; Harvey, 2000). Reading, writing, science, mathematics, oral communication, listening, learning, reasoning, creative thinking, making decisions, problem solving, responsibility, self-confidence, self-control, social skills, kindness, honesty, flexibility,

accuracy, efficiency, self-directedness, proper working attitude, ability to participate, motivation, self-management, and spirit of teamwork are employment skills in the globalized era (Yazdi, 2013). These skills are classified as soft skills and hard skills.

Soft skills refer to people skills, life skills, interpersonal skills, employability skills, and emotional intelligence (Rao, 2014). Soft skills, or transferable or generic skills like listening, professionalism, interpersonal skills, time management, and teamwork skills, are among the factors affecting graduate employability (Siraye, Abebe, Melese, & Wale, 2018). Scholars (e.g., Billing, 2003; Bridgstock, 2009; Heckman & Kautz, 2012; Robinson, Garton & Vaughn, 2007) reported that soft skills are the employability skills most desired by employers in the workplace. As a result, recently, more attention has been given to the importance of soft skills by both educational researchers and employers (Andrews & Higson, 2008; Omar, Manaf, Mohd, Kassim, & Aziz, 2012). For scholars (e.g., Russell et al., 2005), the most important soft skills required in this era are the ability to demonstrate effective interpersonal relations, self-management strategies, teamwork, a creative way of problem solving, and decision-making.

For Sisson and Adams (2013), soft skills include career identification and planning; interview practice; understanding of a career and how it works; communication skills; decision-making skills; presentation skills; and teamwork skills. Soft skills are important for the development of large inter- and intra-personal skills. In general, soft skills refer to attributes that enable effective teamwork, communication, presentation, leadership, customer service, and innovative problem solving.

While discipline-specific knowledge is characterized by content-specific knowledge, soft skills are recognized to be non-academic skills that are supposed to be useful in a range of

working environments and transferable from one job to another (Chamorro, Premuzic, Arteche, Bremner, Greven, & Furnham, 2010). Hard skills, on the other hand, encompass job searching techniques, assisting graduates with job search, CV writing, contacts with employers, help with finding and securing work placements and internships, career events and fairs, computer skills, research skills, time management, literacy, and provision of temporary and vacation work (Woods & King, 2002). Scholars (e.g., Binet, 2006; Humburg et al., 2013) identified professional expertise, general academic skills, innovative/creative skills, leadership skills, strategic/organizational skills, interpersonal skills, and commercial/entrepreneurial skills as employability skills supposed to help graduates perform tasks in the 21st century. Other scholars (e.g., Rasul et al., 2012) identified basic skills, thinking skills, resource skills, informational skills, interpersonal skills, system and technology skills, and personal quality skills as important skills in manufacturing industries.

Higher education institutions aim to develop both hard and soft skills that could enhance graduates employability. Students develop such skills as critical thinking, problem-solving, oral and written communication, teamwork and interpersonal understanding, the capability to take responsibility for one's own learning and adapt to change and new situations (Badcock et al., 2010; Keneley & Jackling, 2011), time-management skills, learning skills, and the ability to manage stress and heavy workloads (Stiwne & Jungert, 2010) during studies at universities. Inversely, studies (e.g., Keneley & Jackling, 2011) show that communication and collaboration skills are least developed during studies at university. Researchers (e.g., Stiwne & Jungert, 2010; Monteiro et al., 2016) argue that students develop more theoretical knowledge than academic skills at higher learning institutes.

In summary, the term skill is conceptualized differently by different scholars. While some scholars define skill as the ability to perform a task to a predefined level of competence, for others, skill denotes any personal attribute having productive value that could be augmented through some forms of investment. These variations in the definition of the term skill also manifest in the classification of skills. The classification of skills ranges from simple technical skills to complex intellectual abilities and ethical values, which students could develop during their studies at higher education institutions. These skills include those that are discipline-specific and those created at different universities and in different countries. The current volatile business environment requires a workforce with a new set of skills that are flexible and adaptable to continual changes, keep abreast of new technology, and work effectively in the knowledge economy.

While both hard skills and soft skills were considered employment skills in the globalized era, nowadays more attention has been given to the importance of soft skills by both educational researchers and employers. The responsibility of equipping graduates with both hard and soft skills is bestowed on higher education institutions. Students develop such skills as critical thinking, problem-solving, oral and written communication, teamwork and interpersonal understanding, the capability to take responsibility for one's own learning and adapt to change and new situations, time-management skills, learning skills, and the ability to manage stress and heavy workloads during studies at universities. However, it has been argued that communication and collaboration skills are least developed during university studies. It was argued that students develop more theoretical knowledge than academic skills at higher learning institutes.

2.5 Graduate Employability in Ethiopia

Graduate employability is a less researched area in Ethiopia (Siraye et al., 2018). Few previous studies (e.g., Denu, Tekeste, & Van Der Deijl, 2005; Yibeltal, 2016) reported that with an increasing number of tertiary institutions, an increased enrolment rate, and increased graduate turnout, the issues of long-term job search and graduate unemployment are increasing in Ethiopia. Researchers (e.g., Broussard, Nzinga, & Tekleselassie, 2012; Fanta et al., 2019) found that the current higher education in Ethiopia is not in line with opening doors for graduates for future business and the foundation of their reasonable vocation. Thus, to produce employable graduates, the level of university-industry linkage is increasingly important (Fanta et al., 2019).

In a contemporary, growing economy, the relationship between labor market needs and the actual competencies of tertiary education graduates, together with increasing unemployment, has drawn scholars' attention (Molla, 2013; Yibeltal, 2016). There is an increasing mismatch between the skills of higher education graduates and the skills required in the current competitive global economy dominated by information technology (IT) (Yibeltal, 2016). With rapidly changing situations in higher education and the labor market, the economy is becoming increasingly knowledge-based and competitive. In response to meeting the knowledge-driven economy, following the Bologna agreement, the Ethiopian higher education system adopted the European Credit Transfer System and higher education curriculum modularization with the belief of aligning the existing curriculum or designing new academic programs with learners' capabilities so as to achieve competency-based education (CBE). This made a significant shift in curriculum thinking and design based on global and local economic needs (Gebremeskel, 2014; Olkaba & Tamene, 2017). Competence-based education involves aligning the existing curriculum or designing new academic programs (Gebremeskel, 2014).

The introduction of CBE has brought a shift from traditional way of looking into curriculum as subject matter designed by professors within a university (subject matter) to designing curriculum based on the need labor market (Gebremeskel, 2014). Many educators agreed that competence is the possession of certain attributes (knowledge, skills, and attitudes). These all indicate the importance of investigating graduate employability in Ethiopia (Yibeltal, 2016).

Furthermore, there is a lack of literature on how university education meets the requirements of the world of work by preparing students for working life in Ethiopia. The available evidence shows that there are gaps between the developed competencies and the competencies needed in working life. That means there is a scarcity of evidence showing the relationship between working, learning, and study success in Ethiopia (Yibeltal, 2016). A few previous empirical studies (e.g., Broussard & Teklesillasie., 2012; Fanta et al., 2019) identified problem-solving skills, information technology skills, adapting to change, and risk-taking as the skills most demanded by employers. Most graduates of engineering and technology require short-term on-the-job training that enables them to cope with the work context immediately after labor market entry (Yibeltal, 2016). Enhancing graduates' employability in Ethiopia requires designing and implementing higher education curricula in line with the skills the labor market's requirements (Fanta et al., 2019). Subject-specific knowledge, academic performance in general (cumulative grade point average), their soft, transferable, or generic skills, and involvement in internship programs prior to graduation are among the complex factors influencing successful transitions of graduates from education to work (Ibid.).

The above evidence indicates that graduate employability is a less researched area in Ethiopia. The issues of long-term job search and the increasing unemployment rate are becoming

a great concern with the increasing number of tertiary institutions and enrolment rate. There is an increasing mismatch between the skills of higher education graduates and the skills required in the current competitive labor market. With rapidly changing situations in higher education and the labor market, the economy is becoming increasingly knowledge-based and competitive. In response to meeting the knowledge-driven economy, following the Bologna agreement, the Ethiopian higher education system adopted the European Credit Transfer System and higher education curriculum modularization with the belief of aligning the existing curriculum or designing new academic programs with learners' capabilities so as to achieve competency-based education (CBE). This marked a significant shift in curriculum thinking and design based on global and local economic needs. However, there is a lack of literature on how university education meets the requirements of the world of work by preparing students for working life in Ethiopia. The available evidence shows that there are gaps between the developed skills and the skills needed in working life. That means there is a scarcity of evidence showing the relationship between working, learning, and study success in Ethiopia. Few previous empirical studies identified problem-solving skills, information technology skills, adapting to change, and risk-taking as the skills most demanded by employers. Most graduates of engineering and technology require short-term on-the-job training that enables them to cope with the work context immediately after labor market entry. Enhancing graduates' employability in Ethiopia requires designing and implementing higher education curricula in line with the skills the labor market requires.

2.6 Employers Skill Needs

The current labor market has characterized by intense competition and constant change whereby employers and employees have been facing increasing risk and uncertainty with regard to

financial stability of the organization (Shivorois et al., 2019). Employers and their skill demands are significant to the employability agenda driven by policy makers. Higher education graduates are expected to possess skill sets that meet employers' needs.

Employers often seek highly qualified and skilled employees who are capable of responding to changing, complex needs and trends in contemporary workplaces (Wongnaa & Boachie, 2018). Among the other things, communication and language skills are the most required skills by employers, followed by problem-solving and analytical skills, computer and software application skills, teamwork skills, and leadership skills. Leadership skills have become an emerging requirement for companies determined to maintain their competitive edge (Getahun et al., 2020). Pang et al. (2019) also argue that ability and willingness to learn, teamwork and cooperation, hard work and willingness to take on extra work, self-control, and analytical thinking are skills necessary for graduates' success on the labor market. However, most graduates of Ethiopian higher education institutions are yet ill-equipped to meet the challenges of life and employment (Getahun et al., 2020). Higher education graduates in the country do not acquire the required generic skills. They especially lack key employability skills such as communication skills, teamwork and interpersonal skills, leadership skills, problem-solving skills, and technological and entrepreneurial skills. Studies (Fanta et al., 2019) also identified problem-solving skills, information technology skills, adapting to change, and risk-taking as the skills most demanded by the Ethiopian labor market. Employers and industrial organizations are in constant need of a consistent and reliable supply of educated and skilled graduates (Getahun et al., 2020).

Similarly, Azmi et al. (2018) argue that due to the minimum industrial exposure period, graduates often face a lack of communication skills, business skills, teamwork skills, creativity,

lifelong learning skills, and problem-solving skills. Particularly, the study by Kaushal (2016) identified communication skills, teamwork, problem-solving skills, initiative and enterprising, planning and organizing, managerial skills and leadership skills, interpersonal skills, adaptability or flexibility, creativity or innovation, negotiation skills, commercial awareness, and lifelong learning as skills often required by engineering graduates and employers.

In a nutshell, employers and their skill demands are significant to the employability agenda driven by policymakers. The main focus employers are the skills, competencies, attributes, and experiences of graduates required for the future productivity and performance of their organization. In some countries, employers expected newly graduated students to have good transferable skills rather than excellent academic grades. They look for graduates who are motivated and willing to learn and to work in teams and have good communication skills (oral and written), leadership skills, and IT skills. In contrast, excellent academic qualifications are preferred over transferable skills among employers in other countries. In some other countries, employers often prefer focused and passionate candidates for the profession they aspire to enter. Most graduates, on their part, look for jobs that would provide career progression, training opportunities, a good salary and benefits, and employment security. Employers are a useful resource that HEIs can work in partnership with to enhance graduate employability because employers offer higher education graduates work placements, internships, and graduate positions. They can also contribute towards curriculum design and development by advising on the skills, knowledge, and characteristics necessary for the current and future workplace. In addition to academic skills, employers have recently needed generic skills like analytical, critical thinking, communication, entrepreneurial, decision-making, information technology, interpersonal, problem-solving, self-directed, and numeracy skills.

Engineering graduates often lack more generic or non-technical skills than other skills. Skill sets required from engineering graduates include communication skills, teamwork skills, problem solving skills, business and management skills, ethics and responsibility lifelong learning, creative thinking, leadership skills, practical skills, cultural and social awareness, system design skills, analytical thinking, critical thinking, inter/multi-disciplinary skills, innovation skills, systems thinking approach, professionalism, information and computing technology skills, entrepreneurship skills, foreign language skills, technical skills, managing change skills, decision-making skills, and numeracy skills. Employers give high emphasis to ICT skills, numeracy skills, technical knowledge, forging language, and decision-making skills, which are noted as the generic required skills as compared with engineering skills. Problem-solving skills, information technology skills, adapting to change, self-management and development, systems thinking, and risk-taking skills were the skills most demanded by employers.

2.7 The Concept of Skill Mismatch

The concept of skill mismatch is very broad and incorporates a variety of measures (ILO, 2017). Skill mismatch is the discrepancy between skills acquired by graduates through studies at high school and actual skills required in the labor market (Asai, Breda, Rain, Romanello, Sangnier, 2020; Păcurariu, 2019; Pellizzari & Fichen, 2017; Oluyomi &Adedeji , 2012). In a broader sense, skill mismatch reflects a gap between aggregate labor demand and aggregate labor supply (Beyene & Teklesilassie, 2018). Individual concepts of mismatch represent the degree to which workers in firms possess skill or education levels that are above, below, or poorly connected to those required within their current job and the degree to which the education and skills of job applicants meet the requirements of the hiring firm (ILO, 2017). The aggregate skill mismatch

relates to skill gaps and skill shortages. Skill gaps are situations in which an employer believes that workers do not possess the adequate competencies to successfully discharge their current role (ILO, 2017). It results when the available workforce lacks the skills demanded by firms or when firms fail to use optimally the skills possessed by workers (Asai, Breda, Rain, Romanello, Sangnier, 2020).

The situation is constructed by comparing the skills (or qualifications) of an employed worker with the skill (or qualification) needs of the job without taking the non-employed and the vacant jobs into consideration (Pellizzari & Fichen, 2017). There is increasing concern about the gap between the skills and capabilities of graduates and the requirements and demands of the work environment across the world (Andrews & Higson, 2008). As a result, there is an increasing need for a better understanding of graduates' competence requirements with the increasing demands of fresh graduates from employers (Pang, Wong, Leung, & Coombes, 2019).

Similarly, the supply side of the Ethiopian labor market is characterized by the existence of a low-quality labor force due to low educational levels and low-quality skills. These in turn result from low early human capital development, low quality of training, a lack of entrepreneurial confidence and motivation, and the absence of career advice (Kellow, Ayele, Yusuf, 2010). Studying the state and trend of labor market mismatches enables policymakers to take corrective actions in the event of a high mismatch between the skills available in the economy and the skills required by the economy (Beyene & Teklesilassie, 2018).

Most studies use qualification mismatches as a proxy for skill mismatches due to data limitations. Such a measure not only disregards specific skills required by jobs but also the type of education required, as it merely depends on the number of years of education (Beyene &

Teklesilassie, 2018). Studying the state and trend of labor market mismatches enables policymakers to take corrective actions in the event of a high mismatch between the skills available in the economy and the skills required by the economy. Though collecting and consolidating data on the skill needs of the economy is supposed to be important for proper analysis of skill mismatches, there is a critical shortage of data on the types and levels of skills the economy requires in Ethiopia (Ibid.).

Skill mismatch is considered an important source of inefficiency in the labor market that can hinder productive capacities, which generate unemployment and underemployment (Asai, Breda, Rain, Romanello, & Sangnier, 2020). Due to the minimum industrial exposure period, graduates often face a lack of communication skills, business skills, teamwork skills, creativity, lifelong learning skills, and problem-solving skills. As a result, most graduates lack the experience demanded by industries. The mismatch of skills during industrial training and what they studied before is also the worst scenario (Azimi, Kamin, Noordin, 2018). If workers are optimally matched on the labor market, skill mismatches might still arise because of a gap between labor supply and demand (Asai, Breda, Rain, Romanello, Sangnier, 2020). A worker whose skills are below the level required by the job is classified as under-skilled; a worker whose skills are above those required by the job is classified as over-skilled (Pellizzari & Fichen, 2017).

Skill gaps may harm productivity due to lower output per worker, inflate average labor costs, affect firm-level profitability, and affect the capacity of enterprises to innovate and adapt to changing market conditions (ILO, 2017). The different concepts of skill mismatch mentioned above are quite different in terms of how they manifest themselves, their measurement, their determinants, and how their consequences have been felt. While some of the mismatches are related to those experienced by employees, others are related to employers and firm-level

difficulties. Some other skill mismatch concepts have been measured subjectively; others have been derived from existing data (ILO, 2017). Due to a lack of direct information about workers skills and job requirements, measuring skill mismatch is a challenging task (Pellizzari & Fichen, 2017). However, measures of general skills in numeracy, literacy, and problem solving have been provided by the OECD Program of International Assessment of Adult Competencies (PIAAC) (Asai, Breda, Rain, Romanello, & Sangnier, 2020).

In this literature review, skill mismatch denotes the discrepancy between skills acquired by graduates through studies at high school and the actual skills required in the labor market. It results when the available workforce lacks the skills demanded by firms or when firms fail to use optimally the skills possessed by workers. There is increasing concern about the gap between the skills and capabilities of graduates and the requirements and demands of the work environment across the world. Skill mismatch is considered an important source of inefficiency in the labor market that can hinder productive capacities, which generate unemployment and underemployment. In a skill mismatch, some skills, for example, may be underused because the workers who have those skills do not work in the firms that need them the most. There are mounting complaints about the capability of beginner employees of engineering graduates because of their inability to adapt in the industry field. If the gap between aggregate supply and demand mainly explains skill mismatch, anticipating skill needs with relevant educational and training policies is a relevant solution. Acquiring high-level skills is, for example, likely to help individuals adapt to technological change. If workers were optimally matched on the labor market, skill mismatches might still arise because of a gap between the labor supply and demand. In this situation, inadequate initial or continuous training might lead workers' skills to not fit employers' requirements.

The different concepts of skill mismatch mentioned above are quite different in terms of how they manifest themselves, their measurement, their determinants, and how their consequences are felt. While some of the mismatches are related to those experienced by employees and measured subjectively, others are related to employers and firm-level difficulties and derived from existing data. While some of these sources of mismatch can be fixed through the design of good policies, others are almost impossible to avoid.

2.8 Impact of Skill Mismatches

Mismatches between demand and supply of skills have several impacts and implications on companies and organizations. Skill mismatch impacts workers or firms that are currently employing or seeing to employ workers (ILO, 2017). For instance, at the firm or organization level, skills shortages will compromise firms' productivity, quality, and competitiveness (Oluyomi &Adedeji, 2012). It can also result in higher wages, increase recruitment costs, require more investment in current personnel, result in market losses, and could imply a greater workload and pressure on current personnel (Oluyomi &Adedeji, 2012; Strietska-Ilina, 2008). It may also result in lower company competitiveness, which, with a higher concentration at the regional and greater spread at the national level, could eventually deteriorate the overall competitiveness and prevent growth of the regional and/or national economies and investments in and development of knowledge-intensive and innovative industries (Strietska-Ilina, 2008).

It has adverse impacts on individual organizations; skill mismatches may hamper economic growth, competitiveness, and innovative capacity at the macro-economic level (Oluyomi &Adedeji, 2012). Skills mismatches result in decreasing overall productivity and competitiveness of the economy and decrease the quality of human capital by discouraging

investment in education and training by individuals. As a result, graduates of higher education face challenges in finding jobs suitable for their level and field of study (Păcurariu, 2019).

Labor market imperfections and inadequate initial training are sources of mismatch between skills required by workers and those needed by employers. While some of these sources of mismatch could be fixed through the design of good policies, others are almost impossible to avoid (Asai, Breda, Rain, Romanello, & Sangnier, 2020). Skill shortages have adverse consequences at various levels. While matching skill demand and supply is a major factor shaping economic growth, productivity, and competitiveness (Beyene & Teklesilassie, 2018), a mismatch between the type of education provided at schools and the requirements of the labor market has resulted in an increasing unemployment rate for young people who have attained higher education (Kellow, Ayele, Yusuf, 2010). Thus, studying the state and trend of labor market mismatches enables policymakers to take corrective actions in the event of a high mismatch between the skills available in the economy and the skills required by the economy (Beyene & Teklesilassie, 2018).

In sum, mismatches between demand and supply of skills have several impacts and implications on companies and organizations. Among other things, skill mismatch impacts workers or firms that are currently employing or seeing to employ workers. Skills shortages will compromise firms' productivity, quality, and competitiveness, result in higher wages, increase recruitment costs, require more investment in current personnel, result in market losses, imply a greater workload and pressure on current personnel, and may result in lower company competitiveness. With a higher concentration at the regional and greater spread at the national level, they could eventually deteriorate the overall competitiveness and prevent growth of the regional and/or national economies. More importantly, skill mismatch prevents investments in

and development of knowledge-intensive and innovative industries, hampering economic growth, competitiveness, and innovative capacity at the macro-economic level.

2.9. The Role of Higher Education in Graduates' Skill Acquisition

Higher education aims to prepare young people to become highly productive and successful in the labor market, provide employers with a choice of talent for their current and future operations, and prepare well-trained workforces that could meet employers' requirements (Branine & Avramenko, 2015). The quality of knowledge generated within higher education institutions and its availability to the wider economy are becoming increasingly critical to national competitiveness, especially in developing countries (Ibd).There has been a growing emphasis on the role of higher education institutions (HEIs) in enabling employability and graduate employment through the provision of courses, seminars, workshops, and industrial and practical training (Azmi et al., 2018; Rowe & Zegwaard, 2017).

The employability of individuals primarily depends on the knowledge, skills, and attitudes they possess; the way they use those assets and present them to employers; and the context within which they seek work (Yibeltal, 2016). In this 21st century knowledge era, higher education institutions are supposed to play a critical role in achieving both human resources and the overall social development of a nation by contributing to knowledge production through teaching, research, and the provision of community services (Azimi, Kamin, Noordin 2018). Higher education institutions should assist students in understanding how the lessons learned in school are associated with future career opportunities (Rowe & Zegwaard, 2017). They are supposed to play a key role in national development through the intensification and diversification of programs that could produce a high-level technical work force within the

context of national needs (Babalola, 2015). Thus, to meaningfully contribute to the socio-economic development of a country, higher education expansion must be aligned with market demand (Reda & Gebre-Eyesus, 2018).

2.10 Curriculum Development and Graduate Skills

Linking education with the labor market requires designing and implementing an appropriate curriculum for employment. Efficiency and a competency-based curriculum can provide graduates with the necessary qualifications to gain successful employment in the global arena (Yazdi, 2013). The curriculum should place emphasis on learning outcomes related to graduate employability attributes (Shivorois et al., 2019), including both technical and non-technical skills in their curricular and co-curricular activities (Azmi et al., 2018). Modifying the curriculum and preparing students to match expectations is an important step to bridge the gap between the academic curriculum of higher education and industry needs (Kaushal, 2016). For instance, from 2000 on, the Japanese curriculum started to implement practical industrial curriculum and integrate employable personal qualities and requirements into the academic curriculum to produce skilled engineers (Nguyen et al., 2005).

Modern engineering curricula should take the level of required knowledge and skills, professional and personal attributes, attitudes, and generic skills of the world of work into consideration (Nguyen, 1998; Pudlowski & Darvall, 1996). Parallel to developing technical and hard skills, giving attention to soft skills development is also important (Kaushal, 2016). Some of the ways in which universities adapt the educational process to the requirements of the economy include partnerships with companies, firm surveys for assessing skill needs, internships, and exposing students to lectures held by experts and professionals outside the university (Mocanu et

al., 2014). Employers' involvement in higher education curriculum development supports graduates' transition from higher education to the world of work. Employers are involved in course design and delivery by commenting on the relevance of course content to future employment prospects, providing material and ideas for student projects, and giving guest lectures (Tran, 2014).

The existence of a curriculum capable of instilling graduates with skills and attributes from diverse areas of social science, communication skills, social skills, presentation skills, interpersonal skills, and business/management makes prospective engineering graduates function effectively in a multidisciplinary environment. The existence of such a curriculum also important to equip students with leadership skills, business management skills, team-working skills, accounting skills, computer/technology, computer skills, programming skills, technical skills, design skills, mathematics/science, problem-solving skills, research and development skills, and analysis/synthesis skills (Yazdi, 2013; Yibeltal, 2016).

Integrating employability standards into the curriculum requires educators to use innovative teaching techniques. Planners should involve partner industries in designing curriculum because industrial partners can incorporate real workplace procedures and systems into instructional strategies. Incorporating this into the teaching and learning process by using innovative teaching methods and implementing authentic assessment will make students able to apply skills in real-life situations (Riebe et al., 2010). However, providing a standard curriculum to produce graduates with multi-skills and implicating the curriculum and factors supporting the career development of students are becoming challenges in higher education (Azmi et al., 2018). In addressing this problem, scholars have tried to connect the curriculum with the demands of society and the world of work (Yazdi, 2013).

In general, linking education with the labor market requires designing and implementing an appropriate curriculum for employment. Efficiency and a competency-based curriculum can provide graduates with the necessary qualifications to gain successful employment in the global arena. The curriculum should place emphasis on learning outcomes related to graduate employability attributes, including both technical and non-technical skills, in their curricular and co-curricular activities. Modifying the curriculum and preparing students to match expectations is an important step to bridge the gap between the academic curriculum of higher education and industry needs. The modern engineering curriculum should take the level of required knowledge and skills, professional and personal attributes, attitudes, and generic skills of the world of work into consideration. Parallel to developing technical and hard skills, giving attention to the development of soft skills is also important.

2.11 Learning Approaches and Graduate Skills

Studies indicate that there is a relationship between academic competences and approaches to learning (Hyytinen, Toom, & Postareff, 2018). In implementing employability skills enhancement, higher education must develop and utilize appropriate learning tools for the latest learning science and technology (Nguyen et al., 2005), require proper planning and preparation (Kamsah, 2004), and involve all stakeholders, such as the government, university system administrators, employers, and graduates themselves (Knight & Yorke, 2003). It also involves the establishment of clear mechanisms that develop students' abilities to use and deploy a wide range of skills and opportunities, which help foster their own academic learning and make them more employable.

Providing students with theoretical knowledge that is applied in practice is the preferred learning method for acquiring both field-specific knowledge and general academic skills in higher education at the same time. Providing actual or simulated case studies, either through internships or through project-based teamwork, is a key method of teaching (Humburg et al., 2013). Scholars comment that different types of learning approaches apply to enhance engineering graduates' employability. Among the other things, a vocational learning approach involving the presentation of pure professional courses in specific and independent institutions could be implemented through a school-based model, a work-based model, or a school- or work-based model (Yazdi, 2013). While project-based learning (PjBL) has been believed to develop more technical and non-technical skills, problem-oriented project-based learning (POPBL) is supposed to promote creativity, innovation, critical thinking, and analytical thinking skills among engineering graduates (Azmi et al., 2018).

To enhance the employment of prospective graduates, universities in Australia, New Zealand, and the UK are now including work-integrated learning programs in their degrees (Holmes, 2013). The term WIL captures a range of experiential and practice-based learning models like service learning, cooperative education, work-based learning, and activities such as internships, fieldwork, volunteering, project-based work, simulations, clinical placements, and practicums (Ferns, 2014). In order to be truly effective, such experiences should be embedded in the curriculum and supported by pedagogical strategies throughout a program to maximize learning opportunities. Work-integrated learning seems appropriate because it benefits stakeholders like graduates, industry, and the university (Shivorois et al., 2019).

Internships also aim to ensure a smooth transition of graduates from the world of school to the workplace (Coco, 2000). Students' engagement in internship programs helps to test

abilities, beliefs, and attitudes pertaining to specific work tasks or career pathways that are acquired by the same students and to translate theory into practice (Zopiatis, 2007). Higher education graduates participating in internship programs prior to the job are more likely to get their transitional employment easily as compared with students who do not participate in internships. As recognizing and encouraging collaboration between universities and industries will benefit both, building an interrelated relationship among academic researchers, universities, and industry should deserve attention (Azmi et al., 2018). In this way, higher learning institutions should encourage and invite industry experts to visit educational institutions to foster students' awareness about industry expectations (Rao, 2014). Faculties, students, industry, and directors of educational institutions, as well as the Training and Placement Officer, must coordinate in imparting soft skills for enhancing employability. All stakeholders should integrate and coordinate to raise awareness about soft skills that could promote and enhance graduates employability (Ibid.).

In implementing employability skills enhancement, higher education must develop and utilize appropriate learning tools for the latest learning science and technology, require proper planning and preparation, and involve all stakeholders, such as the government, university system administrators, employers, and graduates themselves. It also involves the establishment of clear mechanisms that develop students' abilities to use and deploy a wide range of skills and opportunities, which help foster their own academic learning and make them more employable. Providing students with theoretical knowledge that is applied in practice is the preferred learning method for acquiring both field-specific knowledge and general academic skills. Providing actual or simulated case studies, either through internships or through project-based teamwork, is a key method of teaching. Project-Based Learning (PjBL) has been believed to develop more technical

and non-technical skills. Problem-Oriented Project-Based Learning (POPBL) is supposed to promote creativity, innovation, critical thinking, and analytical thinking skills among engineering graduates.

2.12 Graduate Employability Stakeholders

Departments, students, course teams, personal tutors, careers and recruitment services, the center for enterprise, the department for curriculum and quality enhancement, the students 'council, and the university learning and teaching committee are at the forefront of enhancing employability skills in higher education institutions (Hughes & Gration, 2009). Considering policymakers, employers, graduates, and HEIs views of graduate employability seems very crucial, as they are employability stakeholders with a stake in the concept (Jackson, 2013).

To bridge the gap between campus and industry, faculties of higher education should encourage team-teaching that involves both the educator and the industry expert in teaching and learning sessions (Rao, 2014). In such a team learning environment, the educator places emphasis on the theory and the industry expert focuses on the application of the theoretical concepts. The academia and industry need to communicate, understand, empathize with, and appreciate the compulsions and constraints and work in harmony to produce students who are industry-compatible and employable (Rao, 2014). It has been agreed that departments, students, course teams, personal tutors, careers and recruitment services, the center for enterprise, the department for curriculum and quality enhancement, the students 'council, and the university learning and teaching committee are at the forefront of enhancing the employability skills of graduates in higher education institutions.

2.13 Factors Determining Graduate Employability

Factors determining graduate employability are classified as internal and external factors. Internal factors determining graduate employability include a lack of congruence between the current capacity of university admissions and the future needs of the labor market; a mismatch between educational content and occupational skills; a lack of success in creating and sustaining motivation for students to serve the community; and a lack of appropriate context for training scientific and applied research. External factors determining graduates include a lack job searching culture, the underdevelopment of private enterprises for job seekers to absorb graduates, the underdevelopment of associations of graduates and their inefficiency in job placement and career guidance, the large number of applicants and high competition for available jobs, the lack of a culture of promoting entrepreneurship, and the impracticality implementing employment policies and strategic plans (Yazdi, 2013).

In addition to inadequate expectations of new graduates with respect to labor market opportunities, lack of work experiences, absence of or low career guidance and counseling during the studies and after graduation are among the most important factors negatively influencing youth labor market integration (Mocanu et al., 2014). Scholars (e.g., Pool & Sewell, 2007) argue that in addition to field-specific skills and soft skills, the economic setting and supply side determine graduate employability. The low quality of pre-university education and the focus on theoretical rather than practical aspects, the absence of employers' involvement in curriculum development and delivery, the lack of fiscal policies supporting their involvement, and the and the lack of career guidance and counseling services are among the factors negatively affecting graduate employability (Mocanu et al., 2014). In other countries, graduates are facing

difficulty getting appropriate employment because the supply of graduates exceeds the demand (Branine & Avramenko, 2015).

2.14 Historical Overview of Ethiopian Higher Education

Modern and secular higher education in Ethiopia has a short history of over 7 decades (Kaysay, 2012; Woldegiyorgis, 2015). Until the establishment of Haramaya University in 1985, Addis Ababa University had remained the only university in the country (Woldegiyorgis, 2015). In 1970, the total enrollment in Ethiopian tertiary education was 4,500 for 34 million people, which was the lowest in the world. Very few skilled human resources were available to generate and guide development in the country (Saint, 2003). More importantly, Ethiopian higher learning institutions passed through rigid institutional management, conservative intellectual orientation, absence of institutional autonomy, lack of doctorate academic staff, poor education quality, weak research output, and poor linkage to the international higher education community (Brempong & Ondiege, 2011; Saint, 2003).

Widespread civil war, political unrest, and a lack of encouragement from international financial institutions such as the World Bank and IMF are attributed to the sluggish growth and expansion of higher education in Ethiopia (Woldegiyorgis, 2015). Until the last three decades, there has been a very low stock of human capital with tertiary education in Ethiopia. The critical problems of territory education in the country were the relevance of the fields of study, the curricula, and the effectiveness of pedagogy for the development needs of countries, as well as the general quality of programs and graduates (Woldegiyorgis, 2015). The educational system focused on social sciences and the humanities and a pedagogy based on what has been written in books rather than a focus on sciences, engineering, and technology that could solve practical

problems. A shortage of qualified and motivated staff that used as input indicators contributing to higher quality education was another challenge of Ethiopian higher education (Van Deuren, Kahsu, Ali, Woldie, 2013). The skill sets developed in previous tertiary institutions were less appropriate for Ethiopian development needs in an increasingly globalized world that depends on knowledge-intensive production (Brempong & Ondiege, 2011).

2.15 Higher Education Policies and Reforms in Ethiopia

Beginning in the second half of the 1990s, different policies, strategies, programs, and reforms promoting and supporting the Education for Employment agenda have been formulated and implemented in Ethiopia (Olkaba & Tamene, 2017; Yibeltal, 2016). Some of these policies, strategies, programs, and reforms are the Education and Training Policy and Strategy (1994), the Education Sector Development Program (1997–2017), the Industrial Development Strategy (2003), the Plan for Accelerated and Sustained Development to End Poverty (2006), and the Higher Education Enrollment Policy (2009). They underscore the attention given to education in reducing poverty and steering economic and social development through ensuring access, relevance, quality, and equity of education at different levels (Taye, 2013; Yibeltal, 2016).

The Education and Training Policy of 1994 and its successive implementation strategies, like the Education Sector Development Program (ESDP 1-5) aimed at meeting the country's skilled human resource needs at all levels. In all Ethiopian education policy documents, special attention has been given to higher education to assist economic development, which is supposed to be a critical prerequisite for sustained poverty reduction efforts (MoE, 2001; Olkaba & Tamene, 2017). However, few attentions have been given to the issue of graduate employability and labor market in all ESDP I-IV, PASDEP, Higher Education System Overhaul/HESO, Higher

Education Proclamation No. 650/2009, the Education and Training Policy (ETP) of 1994, the Education Sector Strategy of 1994, Proclamation No. 351/2003, and the higher education policies and strategies of Ethiopia (Yibeltal, 2016).

The need to standardize teaching, learning, and research in the Ethiopian higher education system necessitated the introduction of the higher education proclamation in 2003 (FDRE, 2003; Olkaba & Tamene, 2017). The 2003 Ethiopian higher education proclamation laid down the establishment of the Education Strategy Center (HESC) and the Higher Education Relevance and Quality Agency (HERQA) (Olkaba & Tamene, 2017). Changing the old education system in Ethiopia has necessitated allowing students to be proficient in one specific field that will qualify them to either be employed in the field of their training or create their own jobs.

Both HESC and HERQA are independent institutions with their own legal standing to ensure the relevance and quality of higher education programs offered at all public and private higher learning institutions. HERQA has the role and responsibility of controlling the quality and relevance of higher education through the evaluation and accreditation of higher education programs. It ensures institutions have the required capacity to maintain internal quality, that education and training programs offered by HEIs are consistent with the economic, social, and other relevant policies of the country, and that higher education institutions have met various standards set forth in the proclamation (FDRE, 2009). HESC has the mandate to deal with various issues at both the system and institutional level and to determine the nature and future direction of higher education (FDRE, 2009). Attempts have been made by these two institutions (HESC and HERQA) to improve the quality of educational programs, the quality of graduates, and curriculum standardization (Ashcroft, 2004).

Similar attempts have been made to improve the quality of graduates and standardize curriculum (Ashcroft, 2004). For example, following the Bologna agreement of 2000, the Ethiopian higher education system adopted the European Credit Transfer System and higher education curriculum modularization with the belief of aligning the existing curriculum or designing new academic programs with learners' capabilities so as to achieve competency-based education (CBE). This made a significant shift in curriculum thinking and design based on global and local economic needs (Gebremeskel, 2014; Olkaba & Tamene, 2017). The introduction of CBE and modularization approaches in the Ethiopian higher education system has brought about a paradigm shift from teacher-centered to learner-centered teaching and learning approaches (Olkaba & Tamene, 2017).

Competence-based education has also brought about a shift in thinking from university-based curriculum design and the traditional way of looking at curriculum as a subject matter to a world of work-based curriculum design. To this end, attempts have been made by Ethiopian higher learning institutions to align the existing curriculum with competence-based curricula by converting the previous academic programs into modules based on competencies and clustering courses to form modules based on their contribution to the required competences (MoE, 2012; Olkaba & Tamene, 2017). The supply side of job creation stipulated in the National Employment Policy and Strategy of Ethiopia gives attention to whether or not the skill levels of the available pool of persons match the type of skill that the economy requires (MoLSA, 2009).

2.16 Higher Education Enrollment and Expansion in Ethiopia

The major objectives of the current Ethiopian higher education system are to supply knowledgeable, skilled, and attitudinally mature graduates in quantity and quality with a demand-based proportional balance of fields and disciplines that make the country competitive in

global markets (Higher Education Proclamation, 2009). In response to the dire needs for higher education in the country, the government has begun expanding both public and private higher learning institutes with relevant programs since the 1990s (Brempong & Ondiege, 2011). In Ethiopia, the number of public universities rose from two at the beginning of the of the 1990s to thirty-four, while the number of private higher education providers was about 100 in 2015 (Karorsa & Polka, 2015; MOE, 2015), and the number of public higher learning institutions was elevated to 46 in 2019.

The country's higher education landscape has shown significant change in terms of enrollment, expansion, and the graduate mix program (Kaysay, 2012). The acute shortage of high-level professionals and researchers in Ethiopia necessitated doubling the number of students that enter universities by opening new programs that are consistent with the country's development strategy, like information technology, law, and basic sciences (MoE, 2002). Similarly, undergraduate enrollment at both public and private schools had shown a huge expansion, from slightly above 200,000 students in 2006/2007 to almost 500,000 students in 2011/2012, of which 55 percent were attending regular programs. In 2014, the number of regular undergraduate enrollments increased to 308,589 (MOE, 2015). At the same time, the proportion of female students and graduates at higher institutions was 25 percent and 30 percent, respectively (Kaysay, 2012). The total number of graduates in undergraduate programs from both private and government higher learning institutions has increased from 10,768 in 2005 to 102,890 in 2015. On the other hand, the total number of female graduates in undergraduate programs increased from 1,599 (14 percent) in 2005 to 29,780 (28 percent) in 2015 (Education Statistics Annual Abstract, 2015). The number of engineering graduates has also shown a drastic increase since the introduction of the 70:30 professional and program mix policy.

With the intention of enhancing the human resource base of the country in science and technology, the Ministry of Education launched the professional and program mix policy of Ethiopian public higher education in April 2008 (MoE, 2008). The policy document includes a conversion plan, including growth in annual intake and general enrollment aligned with professional and program balances. The policy clearly articulates the 70:30 undergraduate professional mix in favor of science and technology over humanities and social sciences (MoE, 2008). This means that for the past five consecutive years (2008/09–2012/13), 70 percent of the school-leaving students planned to join engineering and natural sciences faculties, and the rest, 30 percent, were supposed to join faculties of humanities and social sciences.

The policy was planned to increase the annual intake of engineering to 212,000 and of natural and computational sciences to 66,000 students at the end of 2013/14 (Birhanu, 2014; Van Deuren et al., 2013; Feleke, 2015; Kaysay, 2012). After the completion of the eleven universities being under construction in the second Gross and Transformational Plan, the government has planned to raise regular enrollment to 600,000 while continuing to prioritize the sciences and technology disciplines (Karorsa & Polka, 2015).

Despite the quantitative change in terms of the number of higher education institutions and student enrollment, the issue of the quality and relevance of higher education remains a challenge. There is a wider mismatch between the performance of higher education graduates and the needs of the labor market (Kibru, 2012; Olkaba & Tamene, 2017; Yibeltal, 2016). Though higher education enrolment in Ethiopia increased from around 34,000 in 2000 to almost 900,000 in 2018 (Ethiopian Ministry of Science and Higher Education, 2018), the labor market in the country continues to absorb a limited number of graduates (Fanta et al., 2019; Semela, 2011). Poor teaching and learning, research, and community service in line with the current

global situation became major intervention areas of Ethiopian higher education (Olkaba & Tamene, 2017). Graduate unemployment has not received sufficient attention. The study found that graduate unemployment is increasing in Ethiopia (Reda & Gebre-Eyesu, 2018).

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research design, sources of data, population, sample size and sampling techniques, data collection tools, procedures of the study, methods of data analysis employed, and ethical considerations of the study.

3.1 Research Design

Researchers (e.g., Creswell, 2014; Mitchell, 2018) claim that pragmatism and its underlying assumptions provide a philosophical justification for the mixed research approach. The philosophical movement of pragmatism emerged in the United States at the end of the 19th century. Its coiners refused to accept the idea that social science inquiry involves accessing reality only by using a single scientific method (Walsh & Kaushik, 2019**).** Pragmatism is an advanced philosophy that provides the epistemology and the logic for mixing quantitative and qualitative approaches and methods together in a single study. Such philosophy is oriented toward solving practical problems in the real world rather than built on assumptions about the nature of knowledge (Creswell, 2014; Shannon-Baker, 2015; Maarouf, 2019). For pragmatism, philosophy and human actions are never separated from experiences, and human thoughts are intrinsically linked to action. Human beings themselves are capable of shaping their experiences with the help of their actions and intelligence. The actions taken by people are often based on the possible consequences, and the results of these actions used to predict the consequences of similar actions in the future (Walsh & Kaushik, 2019).

Pragmatism is based on both realist and idealist metaphysics. This knowledge claim accepts things as existing independent of any observers and emphasizes reason and thought as the originators of elements in the external world. It takes a middle or dual position between

positivist and interpretivist ontologies (Goldkuhl, 2012)**.** Pragmatism has the interest of inquiring both what ‘is’ and what ‘might be’ and is oriented towards a prospective and not yet realized world. The concern of the pragmatism knowledge claim is an instrumental view of knowledge that is used in action to make a purposeful difference in practice (Goldkuhl, 2012**).** In order to connect theory and data, pragmatic knowledge claims rely on abductive reasoning, which involves moving back and forth between induction and deduction. It mainly converts observations into theories to assess the same theories using action. Such abductive processes are employed by researchers who combine qualitative and quantitative methods, where the inductive goals of a qualitative approach are based on the deductive results of a quantitative approach, and vice versa (Tran, 2017).

Pragmatic research is "inter-subjective," which means being both subjective and objective at the same time, which accepts the existence of one reality and allows individuals to have multiple interpretations of this reality (Maarouf, 2019**).**For pragmatists, complete ‘objectivity’ or ‘complete subjectivity’ is impossible when conducting research (Tran, 2017)**.** It gives central attention to the idea of enhancing transferability based on the strength of the relationship between cause and effect in quantitative data and the trustworthiness and reliability of the qualitative data rather than focusing on the issue of context or generality (Shannon-Baker, 2015). Based on the view that theories can be both contextual and generalizable, pragmatism aims to investigate the factors that ‘affect whether the knowledge gained could be transferred to other settings’ (Shannon-Baker, 2015). It breaks the boundary between positivists and constructivists and creates a connection between them to look for what is meaningful in both (Tran, 2017).

Pragmatism, as a research paradigm, accepts the existence of single or multiple realities that are open to empirical inquiry. It believes that an objective reality exists apart from human

experience and knowledge, and reality is based on beliefs and habits that are socially constructed **(**Walsh & Kaushik, 2019**).** As a research paradigm, it orients itself toward solving practical problems in the real world. Thus, it is a method of inquiry for more practical-minded researchers (Ibid**.**)**.** It rejects the traditional philosophy of dualism between objectivity and subjectivity and the forced dichotomies of post-positivism and constructivism. Pragmatist researchers believe that the process of acquiring knowledge is a continuum rather than two opposing and mutually exclusive poles of either objectivity or subjectivity. It suggests researchers identify genuine problems that are part of actual social situations, carefully define the problems, and then initiate the inquiry to address the same problems (Walsh & Kaushik, 2019).

As a methodological approach to problem solving, pragmatism requires the detection of a socially situated problem and the taking of adequate action to address the problem (Walsh & Kaushik, 2019). Epistemologically, research like the gap between the acquired and required skills of a higher education graduate aiming for intervention and change is located in the pragmatic school of thought because the essence of pragmatist ontology is actions and change.

This study employed multiple methods of data collection to best answer the research questions raised under the statement of the problem. Specifically, a mixed-methods research design involving both qualitative and quantitative sources of data for a complete understanding of the research problem was used in this study (Creswell, 2007; Maarouf, 2019). A mixed-methods approach has emerged from an integrated view of quantitative and qualitative research (Maarouf, 2019) and is acknowledged as the third methodological movement over the last two decades (Creswell, 2014). Such an approach is in the middle of a continuum of quantitative and qualitative approaches, representing two ends of a continuum (Creswell, 2014). It involves a mix of both qualitative and quantitative approaches in a single study or a set of related studies

concurrently or sequentially, with the assumption of getting a complete understanding of the research problem (Creswell, 2014). A mixed-methods design provides an alternative perspective in a study when a policymaker wants both the numbers and the stories about an issue under investigation (Creswell, 2007; Gay, Mills, & Airasian, 2012).

A mixed-methods design helps to harmonize the shortfalls of exclusively using a single method by triangulating or complementing one set of results with another to enhance the validity of inferences and the representativeness of the findings (Creswell, 2012; Gay et al., 2012). These complementary strengths and triangulation are the two main advantages that encouraged the researcher to employ a mixed-methods approach in this study. In complementary strengths, mixed-method researchers used the strengths of one research method to enhance or support another one. Triangulation in a mixed-methods study, on the other hand, helped the researcher employ different methods of data collection and analysis for a complete understanding of the study problems and enrich and strengthen research results. Based on the recommendation of Maarouf (2019), triangulation was used to cross-check the findings of both qualitative and quantitative methods**.** Assessing both quantitative outcomes and qualitative processes in mixed research helped the researcher get a full understanding of a complex picture of social phenomena. Such a design involves the procedure of collecting, analyzing, and mixing both quantitative and qualitative data in a single study or a series of studies for a condensed and detailed understanding of a research problem and basic questions (Creswell, 2007).

3.1.1 Designs for a Mixed Research Approach

Different scholars have tried to classify mixed-method research designs differently. Notably, the convergent parallel, explanatory sequential, and exploratory sequential mixed methods are the three research designs of the mixed research approach (Maarouf, 2019**).** Convergent parallel

mixed research design involves the collection of both quantitative and qualitative data at the same time and integrating the overall results to get a comprehensive analysis of the research problem (Creswell, 2014; Maarouf, 2019). Convergent, parallel, mixed research design has two types. One is the concurrent triangulation design, which employs two research methods, one of which is used to confirm or check on the findings of the other. The second type of convergent parallel mixed method design is the concurrent nested design, in which one main research method and another method are used to answer some research question (Maarouf, 2019).

In an explanatory sequential mixed method design, a researcher first conducts quantitative research and then proceeds to qualitative research. Here, conducting qualitative research is necessary to provide further explanation for the quantitative research results. The exploratory sequential mixed method design starts with qualitative research, followed by quantitative research. In this research design, data from the qualitative helps to build a new instrument, choose an appropriate one, or choose variables to be used in the next quantitative research phase (Creswell, 2014; Maarouf, 2019). Scholars (e.g., Creswell, 2012; Gay, 2012) classified mixed-method research design into six types. These are convergent parallel design (QUAN-QUAL model), explanatory sequential design (QUAN-qual model), exploratory sequential design (QUAL-quan model), embedded design, transformative design, and multiphase design.

The embedded type of mixed-method design was employed in this particular study. Embedded design involves the simultaneous or sequential collection of both quantitative and qualitative data, where one form of data plays a supportive role for another. The second form of data was collected to strengthen the primary one. In this study, qualitative data was collected to

support and provide additional information to quantitative data (see figure 2). Here, both forms of data were collected roughly at the same time.

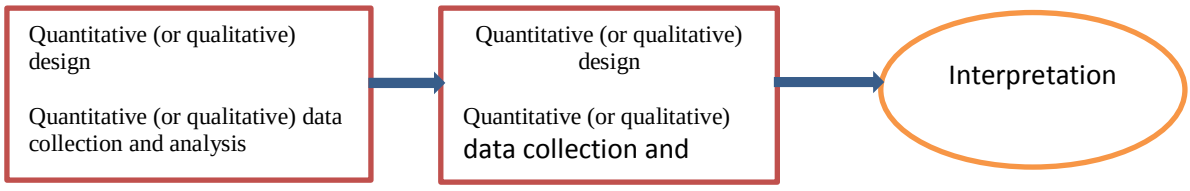

Figure 3.1: **Embedded design model**

The study of graduate skills requires securing the perspectives of different stakeholders, like graduates, employers, instructors, higher education leaders, policymakers, higher education relevance, and quality agencies, to enhance the accuracy and comprehensiveness of the findings. While quantitative data was secured from graduates, instructors, and employers, qualitative data was gathered from leaders of higher education and policymakers at the Ministry of Education of the Federal Democratic Republic of Ethiopia. Attempts have been made to merge, integrate, link, or embed both qualitative and quantitative data. In addition, some important policy documents, like the Higher Education Proclamation of 2009, were consulted as sources of data.

3.2 Sources of Data

Both primary and secondary data were used to secure the necessary information that helped to address the basic questions raised under the statement of problem. Employers of engineering graduates and employees who previously graduated in and electrical engineering over the last five years, instructors, higher education leaders, and policymakers were the main primary sources of data for the study (Creswell, 2012).

Employed graduates (employees), employers, and instructors supplied primary data through filling out the questionnaires. Leaders of higher education, selected employees, employers, and policymakers and experts at the Ministry of Sciences and Higher Education of the Federal Democratic Republic of Ethiopia took part in the provision of qualitative data through in-depth interviews. Both qualitative and quantitative sources helped the researcher provide firsthand information related to how public higher learning institutes and employers of engineering graduates are collaborating to equip graduate skills; what skills are acquired by graduates and required by employers of the same departments; and the extent to which the acquired skills match the required skills.

In addition to primary data collected using questionnaires and key informant interviews, the researcher reviewed and consulted some purposively selected policy and strategy documents, such as the Ethiopian Higher Education Road Map (2017), the Education Sector Development Program (1997–2017), the Higher Education Proclamation (2009), the Education Policy and its Implementation (2003), and the National Employment Policy and Strategy (2009).

3.3 Population of the Study

Universities with engineering programs such as Jimma University, Ambo University, Adama Science and Technology University, and Addis Ababa Science and Technology University were the population of the study on the higher education institutes side, while construction bureaus, road authorities, and electric utilities of Addis Ababa City Administration and Oromia National Regional State and private companies capable of employing large engineering graduates such as Etete Construction, Sunshine Construction, and Belayab Motors constituted the population of the

study on the labor market side. The findings of the study were generalized for these groups of organizations.

3.4. Sample Size and Sampling Techniques

Initially, government-funded universities in Ethiopia were clustered into 1st, 2nd, and 3rd generations based on establishment, from the oldest to the youngest universities, respectively. Due to their earliest establishment and better facilities and inputs, Jimma University and Ambo University were selected and included in the sample of second-generation universities in Ethiopia using simple random sampling techniques. Adama Science and Technology University and Addis Ababa Science and Technology University were purposefully selected and included in the study because they are mainly established to train science and technology graduates to meet the country's demand for science and technology graduates. Civil engineering, mechanical engineering, and electrical and computer engineering departments were purposefully selected and included in the study because the departments admit a large number of students each year and have been major priority areas of the government and universities over the last 15 years. Because of their capacity to employ a large number of civil, electrical, and mechanical engineering graduates, construction bureaus, road authorities, and electric utilities in Addis Ababa City Administration and Oromia National Regional State, private companies such as Etete Construction, Sunshine Construction, and Belayab Motors were purposefully selected and included in the study.

A total of 275 research participants, comprising employees, employers, higher education instructors, and decision-makers, took part in the study, of which 260 respondents (130 instructors of higher education, 90 employees, and 40 employers) took part in filling out the

study questionnaire. A total of 130 instructors (45 from Addis Ababa Science and Technology University, 40 from Adama Science and Technology University, 20 from Ambo University, and 25 from Jimma University) were selected using simple random sampling techniques and took part in filling out the study questionnaires. The relative abundance of the instructors recruited to fill out the study questionnaire was partly due to the large role instructors' play in curriculum development and implementation, equipping graduates with the necessary competencies, and their availability and willingness to take part in the study.

Employees who took part in filling out the study questionnaire were mainly former graduates of civil, electrical, and mechanical engineering disciplines and are currently working in different economic sectors. Employers were individuals who previously graduated in one of the three engineering disciplines mentioned above and are currently leading companies that are capable of employing engineering graduates (e.g., site supervisors of construction companies, human resource managers, personnel, team leaders, and production managers). While 18 employees and 5 employers were from Addis Ababa City Administration construction bureaus, 17 employees and 5 employers from Oromia construction bureaus, 13 employees and 5 employers from Addis Ababa Road Authority offices, 10 employees and 5 employers from Oromia Road Authority offices, and 12 employees and 5 employers from Addis Ababa and Oromia Electric Utility offices were selected and took part in the study.

While all respondent employees from Addis Ababa City Administration and Oromia National Regional State who served for 5 years and above were selected using simple random sampling and took part in filling the study questionnaires, respondent employers from the same regions were purposefully selected and took part in filling the questionnaires. In addition, 20

employees and 15 employers from private companies (8 employees and 6 employers from Sunshine Construction, 7 employees and 5 employers from Etete Construction, and 5 employees and 4 employers from Belayab Motors) were also purposefully selected and took part in filling out the study questionnaire (see table 3.1 for details on the population and samples selected for the study). For the purpose of triangulation, 15 individuals, comprised of four college deans, one from each sample university, one policymaker and one expert from the Ministry of Education, one expert from the Ministry of Labor and Skills, two team leaders from each construction and road authority bureau of both Addis Ababa City Administration and Oromia National Regional States, one technical team leader from BelayAB Motors, and two construction supervisors from Etete and Sunshine construction companies, were purposefully selected and took part in key informant interviews. The above sample size was determined by a simplified sample size determination formula developed by Yemane (1967). According to Yemane, for a 95% confidence level (p = 0.05), the size of the sample should be

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}\ (\mathrm{e2})}$$

Where N is the population size and e is the level of precision.

$$n = \frac{740}{1 + 740\ (0.05 * 0.05)}$$

Sample size (n) = 260

Table 3.1. Summary of population, sample size and sampling techniques employed

Sample organization	Population	Sample size	Sampling Technique
ASTU	128	45	Simple random sampling
AASTU	114	40	Simple random sampling
Ambo University	57	20	Simple random sampling
Jimma University	71	25	Simple random sampling
Addis Ababa City Administration	151	53	Simple random sampling
Oromia National Regional State	120	42	Simple random and purposive sampling
Sunshine Construction	40	14	Simple random and purposive sampling
Etete Construction,	33	12	Simple random and purposive sampling
Belayab Motors	26	9	Simple random and purposive sampling
Total	740	260	

3.5 Data Collection Tools

A pilot test was conducted on 25 employees, employers, and instructors prior to the commencement of actual data collection to check reliability and validity using the questionnaires. Test-retest reliability has been conducted by administering the questionnaires to the same respondents at two different moments. The closer the findings of the retested survey are to those of the first test, the greater the reliability of the instrument to ensure the validity of the survey questionnaires. The validity of the instruments was checked using a thorough analysis by experts relevant to the fields. Several cognitive interviews (thinking aloud) were conducted with employees, employers, and instructors to improve the survey instruments. A few modifications were made to the questionnaire depending on the results of the pilot study. The questionnaire was administered and collected on a face-to-face basis by the researcher, with the facilitation of paid academic staff from each faculty of the sample universities. Of the 300 questionnaires dispatched to respondents, 260 were duly filled out and returned. Thus, the return rate of the questionnaire was 87 percent.

This study attempted to collect and compare both quantitative and qualitative data pertaining to graduate acquisition of skills and labor market needs for the same set of skills from employees, employers, and instructors of higher education institutions (graduate employability stakeholders). In this study, the researcher used two types of questionnaires with similar contents (acquired and required skills-related questionnaires). In addition, in-depth interviews and document analysis were also employed, as described in the next excerpts.

3.5.1 Questionnaire

The study employed two sets of self-developed questionnaires with the same content. The first set of the questionnaire was designed to ask the extent to which higher learning institutes equip engineering graduates with discipline-specific, technical, interpersonal, and generic skills. The second set of questionnaires was designed to assess the extent to which the engineering labor market requires these skills. To develop the questionnaire, engineering graduate employability skills developed by the Malaysian, Hong Kong, and Japan Ministries of Education, a tool to test the learning and employability framework developed by INCHER (International Centre of Higher Education Research) of the University of Kassel, Germany, CHEERS (Careers after Higher Education: European Research Study Projects), literature, and national policy documents were reviewed. The questionnaires were designed in the form of a 5-point Likert scale (ranging from 1 replacing very low extent to 5 replacing very high extent). The questionnaire consisted of 34 items (10 items related to discipline-specific skills, 6 items related to technical skills, 6 items related to interpersonal skills, and 12 items related to generic skills). Each item was used to assess both levels of engineering graduates skill acquisition during study at higher learning institutes and labor market needs for the same skills after graduation.

The questionnaire had five parts. Part one of the questionnaire deals with the demographic background of the respondents. Part two addresses discipline skills. Discipline specific skills measured in terms foundation of engineering, manufacturing, and construction; operation, measurement, and control technology; applying technical fields (technical sets, machine systems, installations, and connections); planning, design, calculation, and construction (product and process-oriented); and quality control and quality assurance. Levels at which graduates acquire competences or skills like safety, health, security, and environment; applying

knowledge of science and engineering principles; being competent in a specific engineering discipline; and being competent in application and practice were also used to measure discipline specific skills. Part three of the questionnaire addresses issues of technical skills.

In this study, computer skills, the skill to plan and organize tasks, the skill to solve problems, the decision-making skill, professional skills, and seeking and developing opportunities were used to measure technical skills. Part four of the study questionnaire deals with interpersonal skills. Teamwork, client/stakeholder focus, working with people from different cultural backgrounds, communication skills, interpersonal skills, empathy, adaptability, and flexibility were used to measure interpersonal skills in the current study. Part five of the questionnaire assesses the extent to which generic skills have been acquired at higher education and are required on the labor market. In this study, generic skills were measured in terms of creative thinking, willingness to learn, leadership qualities, integrity, willingness to perform or commit, sense of responsibility, innovativeness, determination, loyalty to the institution and its objectives, ability to assert oneself, self-confidence, and independence.

3.5.2 Interview

A total of 15 key informant interviews have been conducted with purposively selected 4 college deans (one from each sample university), one policymaker and one expert from the Ministry of Education, one expert from the Ministry of Labor and Skills, two team leaders from each construction and road authority bureau of both Addis Ababa City Administration and Oromia, two technical team leader from BelayAB Motors, and two construction supervisors from Etete and Sunshine construction companies. Unstructured interview guides were prepared and utilized to collect qualitative data to substantiate the data gathered via questionnaires (quantitative data).

Key informant interview participants were asked about the kinds of competences acquired by civil, electrical, and mechanical engineering students in higher education institutions and required by employers of graduates of the same departments, and whether competences acquired by graduates of the three departments match competences that the employers require for companies' productivity.

The researcher used Amharic to ask interview guide questions. Each interview took an average of 40 minutes, during which a sound recorder was used to capture data. The researcher transcribed and translated the data used to support, substantiate, and check the data gathered using questionnaires.

3.5.3 Document Review Checklist

For the purpose of triangulation, document review check lists have been developed, and reviews of some purposively selected policy and strategy documents, such as the Ethiopian Higher Education Road Map (2017), the Education Sector Development Program (1997–2017), the Higher Education Proclamation (2009), the Education Policy and its Implementation (2003), and the National Employment Policy and Strategy (2009), were made by the researcher.

3.6 Procedures for Data Collection

Procedurally, intensive reviews of literature are followed by the development of dissertation proposals and study questionnaires. A pilot test was conducted on 25 employees, employers, and instructors prior to the commencement of actual data collection to check the reliability the questionnaires. Test-retest reliability has been conducted by administering the questionnaires to the same respondents at two different moments. The coefficients of the first and second reliability tests were 0.85 and 0.89, respectively. As the coefficients of the test-retest reliability

were closer, the questionnaire had greater reliability. The validity of the instruments was also checked using a thorough analysis by experts relevant to the fields. Several cognitive interviews (thinking aloud) were conducted with employees, employers, and instructors to improve the survey instruments. Based on the findings of the study, a few modifications were made to two items of generic skills and one item of interpersonal skill-related questionnaires.

The researcher briefed ethical issues and objectives of the study to the respondents prior to the administration of the questionnaires. The respondents were requested to respond to the extent to which the four competences used in the study have been acquired at higher learning institutes and required on the labor market simultaneously. The questionnaire was administered and collected on a face-to-face basis by the researcher, with the facilitation of paid academic staff from each faculty of the sample universities. Of the 300 questionnaires dispatched to respondents, 260 were duly filled out and returned with an 87 percent return rate. While waiting for the return of the questionnaire, the researcher conducted KII side by side. Then the researcher analyzed both data sets separately, used qualitative results to support the quantitative one, and integrated both results, from which both conclusions and recommendations were drawn.

3.7 Methods and Tools of Data Analysis

3.7.1. Quantitative Data Analysis Tools

Based on the recommendations of scholars (e.g., Atil & Unvel, 2001), the researcher made every attempt to select the statistical procedures that are appropriate for the data analysis rather than merely following the approach used by some other scientists in their field. Both descriptive statistics like mean and standard deviation and inferential statistics like one-way ANOVA, multiple comparison test, and paired sample t-test were employed to analyze quantitative data gathered using questionnaires.

The mean refers to an arithmetic average of the scores calculated by adding up all the scores and dividing that total by the number of scores. The standard deviation, on the other hand, is the most stable measure of variability and includes every score in its calculation. It provides a standardized value used to compare one set of scores to another. Knowing the mean and standard deviation of a set of scores helps to get an overall idea of what all the scores looks like (Gay, 2012). For the purpose of analysis, the five-point Likert scales were taken as interval data, and mean scores ranging from 1–1.8 represent skills not acquired or required at all; 1.8–1.60 represent skills acquired or required at a little extent; 2.61–3.4 represent skills acquired or required at a moderate level; 3.4–4.20 represent skills acquired at a high extent; and 4.21–5 represent skills acquired or required at a very high extent. Similarly, a standard deviation was used to compare the variability of higher education supply and employers needs for the four skills under scrutiny. The smaller the value of the standard deviation, the closer the score is to the mean and the less the variability between higher education skill supply and employers' needs, while the highest standard deviation value indicates the existence of a wider gap between higher education skill supply and employers' needs. The analysis and interpretations have been made for each type of skill or competence independently.

One-way analysis of variance (ANOVA) is a parametric test of significance used to determine whether scores from two or more groups are significantly different at a selected probability level. To identify whether the differences among the means represent true significant differences or chance differences due to sampling error, an ANOVA uses an F-ratio (the ratio of variance between groups to variance within groups). Between-group variance refers to how the individuals in a particular group differ from individuals in other groups, while within-group variance considers how group members vary from others in the same group. Between-group

differences are what researchers are usually interested in. If the variance between groups is much greater than the variance within groups, greater than would be expected by chance, the ratio will be large, and a significant effect will be apparent. If, on the other hand, the variance between groups and the variance within groups do not differ by more than would be expected by chance, the resulting F ratio is small; the groups are not significantly different.

In this study, a one-way ANOVA was used to compare the mean differences of independent variables and the type of respondent (employees, employers, and instructors) against each acquired and required skill or competency (Basic Questions 1.1 and 2.1). A comparison of the mean difference has been made for each aspect of skill or competence against each acquired and required. In comparing the mean differences of acquired skills, acquired competence was used as a dependent variable, and type of respondent (employee, employer, and instructor) was used as an independent variable. ANOVA uses the F-ratio of the between-group variance to the within-group variance to decide whether there are statistically significant differences between the groups or not (Lee & Lee, 2018). Using a one-way ANOVA requires meeting two basic assumptions. The first assumption is the normal distribution of residuals, which has been checked with the help of a histogram and a QQ plot. The second assumption is homogeneity of variance, which has been checked using Levene's test before running a one-way ANOVA (Lee & Lee, 2018). ANOVA is not sufficient to show the difference between treatment means using the F-test.

Multiple comparison procedures allow detecting differences among employees, employers, and instructors (independent variables). Such comparisons provide more detailed information about the differences among the means (Atil & Unvel, 2001; Gay, 2012) and help determine whether differences exist among the means of three or more groups (More, Notz, &

Fligner, 2013). One-way analysis of variance (ANOVA) is its most common analytical method. It enables researchers to know how the group differs from a certain group after a one-way ANOVA rejects the null hypothesis because the result of a one-way ANOVA does not show detailed information about the differences among the combinations of groups. Therefore, the researcher performed additional analysis for the differences between employee and employer, employee and instructor, and employer and instructor groups. Tukey, Newman-Keuls, Bonferroni, Dunnett, and the Scheffe test are several methods of multiple comparison tests used to compute the analysis of variance for the three groups when the null hypothesis (H_o) has been rejected. In this study, the Scheffe method was used to compute multiple comparison tests (Lee & Lee, 2018).

The Scheffé is a method of simultaneous joint pairwise comparisons for all possible pairwise combinations of each group mean. The Scheffé method is more conservative than the others because it controls family-wise errors in consideration of every possible pairwise combination. This method is a better test to use when the predicted difference is small and type II errors are more important than type I errors. Because the Scheffé method generates hypotheses based on all possible comparisons to confirm significance, it is preferred if there is no theoretical background that there will be differences between the groups or if previous studies have not been implemented. Hypotheses made in this way should be tested by subsequent studies specifically designed to test new hypotheses. This is important in exploratory data analysis or in the theoretic testing process. The Scheffé method allows simple or complex averaging comparisons in both balanced and unbalanced data (Lee & Lee, 2018). The type I error that occurs when each family compared is called Family-Wise Error (FWE). Thus, multiple comparisons are the methods developed to adjust the FEW (Lee & Lee, 2018).

The researcher gave due attention to selecting the best multiple comparison method for analyzing the data, understanding how to distinguish between these methods, and adjusting the P value to prevent alpha inflation while using multiple comparison tests. In using multiple comparisons, the probability of committing type I error (alpha inflation) increases with the increasing number of comparison groups. Alpha inflation could occur when the same significant level is applied to the statistical analysis between groups that belong to one and other families (Lee & Lee, 2018).

A paired sample t-test is a statistical technique used to compare two population means in the case of two samples that are correlated. It compares scores on two different variables, but for the same group of cases. Based on the recommendation of Creswell (2012), in the current study, a paired sample t-test was used to compare the mean difference between acquired and required skills. In all inferential statistical tests employed to analyze quantitative data, a preselected probability level (test of significance) of $\alpha = 05$ is used because such a confidence interval is often used by educational researchers (Gay, 2012). In conducting a test of significance, a test value greater than $\alpha = 05$ indicates the existence of a significant difference between comparison groups (real difference), while a test value less than $\alpha = 05$ (preselected probability level) reflects no statistically significant difference between comparison groups (any difference found is attributed to sampling error or chance).

3.7.2 Methods of Qualitative Data Analysis

The initial audio data was transcribed and then translated from Amharic to English. Based on the recommendations of scholars (e.g., Creswell, 2012; Gay, 2012), qualitative data have been coded, codes assigned numbers, and the number of times codes appear recorded as numeric data.

The researcher thoroughly looked through a single instance and drew meaning from it. Then data were organized and categorized into four themes, such as the role of access to education and skill training for higher education graduates success in the world of work; skills required by employers and the labor market; visible skill gaps among higher education graduates; strategies in place to overcome skill shortages; and. Lastly, generalizations about the themes were made, and the results from qualitative data were directly compared with results from quantitative data and previous studies (Creswell, 2012; & 2007). Finally, conclusions and recommendations were drawn from the major findings combined with qualitative and quantitative data.

3.8 Ethical Considerations

The data collection processes have commenced after clearance from the Addis Ababa University Department of Educational Planning and Management. Informed consent, including informing the respondents about the purpose of the study and his or her right to not participate if he or she lacks interest in participating or to stop filling out the questionnaire at any time without any preconditions, has been sought and obtained from all eligible respondents before distributing the questionnaire. While obtaining informed consent, respondents were informed about the anonymity and confidentiality of the responses they provided. Thus, the confidentiality issue has been properly addressed in all data collection processes.

CHAPTER FOUR

4. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter provides data presentation, analysis, and interpretation. The introduction of the chapter presents and analyzes the demographic background of the respondents, such as sex, levels of education, field of study, and experiences. All the demographic variables discussed are relevant and adequate for the analysis of the data, drawing valid conclusions and recommendations. Then the main data were presented and analyzed in line with core issues of the basic questions such as the extent to which graduates of engineering from Ethiopian higher learning institutes acquire discipline specific, technical, interpersonal, and generic skills; testing the existence statistically significant difference between employees, employers, and instructors in terms of perceptions of graduates' acquisition of discipline specific, technical, interpersonal, and generic skills; the extent to which employers of engineering graduates in Ethiopia need the same set of skills; testing the existence statistically significant difference between employees, employers, and instructors in terms of perception of the labor market's need similar skills. The chapter also dedicated in presenting and analyzing the match of higher education skill supply and employers skill needs; whether or no significant mean differences exist between the higher education supply of discipline-specific, technical, interpersonal, and generic skills (STEM skills) and employers' needs; whether or no higher education STEM skills supplies match labor market (employers') skill needs as perceived by employees, employers, and instructors of higher education; and testing the existence of statistically significant mean differences between higher education discipline-specific academic, technical, interpersonal, and generic skills (STEM skills)

supplies and labor market (employers) needs as reported by employees, employers, and instructors.

4.1 Demographic Background of the Study participants/ Respondents

4.1.1 Sex of the Study Respondents

The respondents to this study were broadly classified into employees, employers, and instructors. From the total 260 respondents in the study questionnaire, male and female comprised 157 and 103, respectively. In terms of respondent classifications, of the 90 employees who took part in filling out the study questionnaire, 47 were male and 43 were female, respectively. Similarly, while males constitute 19 respondents, females constitute 21 of the total 40 employers who took part in filling out the study questionnaire. Instructors comprised half (130) of the 260 respondents who filled out the study questionnaire. The relative abundance of the instructors recruited to fill out the study questionnaire is partly due to the largest share the instructors play in curriculum development and implementation, equipping graduates with the necessary competences, and their availability and willingness to take part in the study. Thus, 91 male and 39 female instructors took part in filling out the study questionnaire (see Fig. 4.2 below). All instructors were selected from government-funded universities such as Addis Ababa Science and Technology, Ambo, Adama Science and Technology, and Jimma. While 45 instructors who filled out the questionnaire were from Addis Ababa Science and Technology University, 40 and 20 instructors were from Ambo University and Adama Science and Technology University, respectively. The remaining 25 instructors who took part in filling out the study questionnaire were from Jimma University. In addition, 15 participants took part in key informant interviews (KIIs).

Because of their capacity to employ a large number of civil, electrical, and mechanical engineering graduates, Addis Ababa and Oromia construction bureaux, roads, and electric utilities were purposefully selected and included in the study. While 18 employees and 5 employers were from Addis Ababa City Administration construction bureaux, 17 employees and 5 employers who took part in filling out the study questionnaires were from Oromia construction bureaus. Similarly, 13 employees and 5 employers from the Addis Ababa Road Authority, 10 employees and 5 employers from the Oromia Road Authority, and 12 employees and 5 employers from the Addis Ababa and Oromia Electric Utility offices filled out the study questionnaires. A total of 20 employees and 15 employers from private companies (8 employees and 6 employers from Sunshine Construction, 7 employees and 5 employers from Etete Construction, and 5 employees and 4 employers from Belayab Motors) were also purposefully selected and took part in filling out the study questionnaire. Thus, a total of 260 respondents (130 instructors, 40 employers, and 90 employees) were selected from Addis Ababa Science and Technology University, Adama Science and Technology University, Ambo University, and Jimma University; the construction bureaux, road authorities, and electric utilities of Addis Ababa City Administration and Oromia National Regional State; and private companies capable of employing large engineering graduates (Etete Construction, Sunshine Construction, and Belayab Motors).

Table 4.1 Sex and type of the respondents

Type of respondents	Sex		Total
	Male	Female	
Employee	47	43	90
Employer	19	21	40
Instructor	91	39	130
Grand total	157	103	260

4.1.2 Study Respondent by Field of Study

The following table 4.1 discusses respondent type and field of study in terms of level of education. Respondents who took part in filling out the questionnaire were mainly employees, employers, and instructors specializing in civil engineering, mechanical engineering, and electrical engineering disciplines. As seen in Table 4.2, while 71 employees who took part in filling out the study questionnaire were BSC holders, the remaining 19 employees were MSC holders. On the other hand, 21 and 19 employers who took part in filling out the study questionnaire were holders of BSC and MSC degrees, respectively. It is not surprising that, due to access to education opportunities, sample instructors had a relatively higher education status than employees and employers selected to fill out the study questionnaire. The largest numbers of instructors who took part in filling out the study questionnaires were 91 MSC holders and 27 PhD/assistant professors. Only three instructors and associate professors took part in filling out the study questionnaire. While 120 respondents who took part in filling out the study questionnaire were civil engineering graduates, each mechanical and electrical engineer constituted 70 respondents. While 53 civil engineers, 27 mechanical engineers, and 21 electrical engineers who filled out the study questionnaire held BSCs, 58 civil engineers, 35 mechanical engineers, and 36 electrical engineers held MSCs. PhDs and assistant professors who took part in

filling out the study questionnaires were 8 civil engineers, 7 mechanical engineers, and 12 electrical engineers, while 1 respondent from each engineering field was an associate professor (see Table 4.2).

Table 4.2 ***Respondents' educational level/qualification and fields of study***

Education level	Respondent type			Field of study		
	Employee	Employer	Instructor	Civil	Mechanical	Electrical
BSC	71	21	9	53	27	21
MSC	19	19	91	58	35	36
PhD/Ass. Prof.	0	0	27	8	7	12
Associate Prof.	0	0	3	1	1	1
Total	90	40	130	120	70	70

4.1.3 Work Experience of the Respondents

The following table 4.2 presents the experiences of study respondents. As seen from the table, while the largest share, 122 respondents (38 employees, 24 employers, and 60 instructors) served for 6–10 years, 98 respondents (38 employees, 11 employers, and 49 instructors) served for 1–5 years. The number of respondents with service years from 11 to 15 was only 37 (14 employees, 5 employers, and 8 instructors). Only 3 instructors served for 21 years and above (see table 4.2).

Table 4.3 ***Work Experience of the respondents***

Type of respondent	Experience in year					
	1-5	6-10	11-15	16-20	≥21	Total
Employee	38	38	14	0	0	90
Employer	11	24	5	0	0	40
Instructor	49	60	8	0	3	130
Total	98	122	37	0	3	260

4.2 Presentation and analysis of HE skills supplied and demanded by employers/labor market

After referring to a couple of pieces of literature, the researcher identified four types of competences: academic, technical, interpersonal, and generic. The main focus of this study was to identify the extent to which these four types of skills and competencies were acquired by graduates during studies at higher learning institutes and the extent of demand in the labor market for these skills and competencies in an Ethiopian context.

Thus, the next sections provide detailed presentations and analyses of data collected from employees, employers, and instructors on the extent to which engineering graduates acquire academic, technical, interpersonal, and generic skills during their studies at higher learning institutes. While mean and standard deviation were used to identify levels of acquisition of these types of skills during university studies, one-way ANOVA and multiple comparisons were used to compare the mean responses of employees, employers, and instructors against employers' and labor market needs for the same skills. Respondents were asked to indicate the degree to which they acquired the various functions of this set of skills.

4.2.1. Graduates' acquisition and employers need for discipline-specific skills

Discipline-specific skill was measured in terms of 10 observed variables: foundation of engineering, manufacturing, and construction; operation, measurement, and control technology; applying technical fields, planning, design, calculation, and construction; quality control and assurance; environmental safety, health, and security; applying knowledge of science and engineering principles; skill in a specific engineering discipline; and skill in application and practice. Respondents were asked to express the extent to which higher learning institutes supply

engineering graduates with these indicators of discipline-specific skills and the extent to which employers need the same skills (see Table 4.1).

Table 4.4 shows engineering graduates from sample universities in Ethiopia acquire indicators of discipline-specific skills such as planning, designing, calculating, and construction skills (mean = 3.68; SD = 1.03) and skills of applying knowledge of science and engineering principles (mean = 3.47; SD = 0.88) to a greater extent, with the mean value lying between 3.4 and 4.20. Skills of applying technical fields (technical sets, machine systems, installations and connections) (Mean= 3.25; SD=1.03), quality control and quality assurance (Mean=3.23; SD=0.99), manufacturing and construction (Mean=3.23; SD=0.67), application and practice (Mean=3.22; SD= 0.73); foundation of engineering (Mean=3.19; SD=0.61), competence in operation, measurement and control technology (mean=3.14; SD=0.96), competence in maintaining safety, health, security and environment (Mean=2.98; SD=0.96), and competence in specific engineering discipline (Mean=2.92; SD=0.69) were moderately acquired by engineering graduates during study at higher learning institutes with mean value lying in between 2.61 to 3.4. The one-way ANOVA test result also shows a statistically significant difference between employees, employers, and instructors in acquiring discipline-specific skills ($F = 7.65$; $p = 0.00$) at the 0.05 level of confidence (see table 4.5). Multiple comparison tests were computed to test which group differs from what. Hence, the multiple comparison test result shows that there are no statistically significant differences between employees and employers (mean difference ± 0.03722 and $p = 0.875$) and employers and instructors (mean difference = ±0.15654 and $p = 0.076$) in acquiring academic skills. However, the difference between employees and instructors in acquiring discipline-specific academic skills is statistically significant (mean difference $=\pm 0.19376$; $p = 0.001$) at $\alpha \leq 0.05$ level of confidence interval (see table 4.7).

In contrast, skills of applying knowledge of science and engineering principles (mean=4.07; SD=1.12); application and practical skill (Mean=4.05; SD=1.10), competence in safety, health, security and environment (Mean=4.04; SD=1.12), competence in specific engineering disciplines (Mean=4.02; SD=1.13), competence in operation, measurement and control technology (Mean= 4.01; SD= 0.95), foundation of engineering (Mean=4.00; SD=1.01), competence in manufacturing and construction (Mean=3.92; SD=1.03), competence in quality control and quality assurance (Mean=0.92; SD=1.05), skills of applying technical fields (Mean=3.87; SD=0.96), and planning, designing, calculating and construction skills (Mean=3.8; SD=1.01) were required by employers to the higher extent with mean value lying in between 3.4-4.20 (see table 4.4). The differences between employees, employers, and instructors in responding to labor market needs for discipline-specific skills were statistically significant (F = 22.74; p 0.00) at the ≤ 0.05 level of confidence (see table 4.6). Multiple comparison tests were computed to test which group differs from what. Hence, the multiple comparison test result shows that there is no statistically significant difference between employees and employers (mean difference = ± 0.23167; p = 0.112) in labor market needs for discipline-specific academic skills. However, the difference between employees and instructors (mean difference ±0.53282 and p< 0.001) and employers and instructors (mean difference = ±0.30115; p = 0.017) was statistically significant in labor market needs for discipline specific skills at $\alpha \leq 0.05$ 0.5 level of confidence interval (see table 4.8).

Key informant interviews and reviews of policy document review reports also revealed that the recent higher learning institutes in Ethiopia give minimal attention to equipping learners with most aspects of discipline-specific, technical, interpersonal, and generic skills. Weak university-industry linkage, limited students' exposure to the real world of work, and the absence

of teaching by practitioners from industry result in a lack of technical and practical skills among engineering graduates. Higher learning institutes also marginalized strategies and tactics to prepare programs requiring intensive use of IT in teaching and learning tasks. The quality of education has shown a sharp decline; competences are not well identified in higher education curricula; the organization of modules is found to be weak; the teaching methods employed are highly dominated by the traditional lecture method; the world of work is not yet aware of the movement of HEIs towards competence-based curricula; and higher education institutions have neglected the development of employability and other lifelong learning skills in graduates. Key informant interview participant from MoE explained what has been undergone recently as follow:

> Despite couple of challenges, I see increasing policy and strategic emphasis on producing qualified engineers and natural scientists capable of understanding and utilizing appropriate technologies in growing manufacturing and service providing enterprises; developing science and technology institutions to produce highly qualified technicians, engineers, and scientists in line with the demand of the national economy; modifying the balance of the enrollment of higher education in favor of the science and technology needs of the country and conducting practical training in cooperation and collaboration with industries; and enabling the establishment of a workforce in manufacturing and service-provider enterprises with the knowledge and skills necessary to learn, adapt, and utilize technology. Ethiopia has witnessed the implementation of a modular approach that requires changing the old knowledge-based curriculum to a contemporary competency-based type of curriculum. The competency-based curriculum emphasizes the identification of professional and vocational skills, job-specific skills, and transferrable skills that higher education graduates may have after completing the curriculum **(KII, MoE, Curriculum Department, January, 2022).**

This study reveals that graduates of engineering disciplines acquired more planning, designing, calculating, and construction skills; skills of applying knowledge of science and engineering principles; skills of applying technical fields; and competence in quality control and quality assurance, while competence in manufacturing and construction, application, and practical skills; competence in operation, measurement, and control technology; competence in

safety, health, security, and the environment; and competence in specific engineering disciplines are the least acquired skills.

Table 4.4 ***Graduate acquisition and labor market needs for discipline-specific skills***

R/N	Levels of graduates Acquisition		Type of skill	Levels of labor market needs	
	Mean	SD	Discipline specific skills	Mean	SD
1	3.19	0.61	Foundation of engineering	4.00	1.01
2	3.23	0.67	Manufacturing and construction	3.92	1.03
3	3.14	0.96	Operation, measurement and control technology	4.01	0.95
4	3.25	1.03	Applying technical fields	3.87	0.96
5	3.68	1.03	Planning, designing, calculating and construction	3.86	1.01
6	3.23	0.99	Quality control and quality assurance	3.92	1.05
7	2.98	0.96	Safety, health, security and environment	4.04	1.12
8	3.47	0.88	Applying knowledge of science and engineering principles	4.07	1.12
9	2.92	0.69	Specific engineering discipline skills	4.02	1.13
10	3.22	0.73	Application and practical skill	4.05	1.10

Table 4.5 **One-*way ANOVA test to compare the difference between the mean responses of employees, employers, and instructors***

	Sum of squares	df	Mean square	F	Sig.
Between groups	2.20	2	1.10	7.65	0.00
Within groups	36.91	257	0.14		
Total	39.11	259			

Table 4.6 ***One-way ANOVA test to compare the difference between the mean responses of employees, employers, and instructors against labor market needs for discipline-specific skills***

	Sum of squares	df	Mean square	F	Sig.
Between groups	15.33	2	7.67	22.74	0.00
Within groups	86.6	257	0.34		
total	101.96	259			

Table 4.7 ***Multiple comparison test table for Acquired academic skills***

(I)Type of respondent	(J)Type of respondent	Mean d/ce (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.03722	0.07202	0.875	-0.2145	0.1401
	Instructor	0.19376*	0.05197	0.001	-0.3217	-0.0658
Employer	Employee	0.03722	0.07202	0.875	-0.1401	0.2145
	Instructor	-0.15654	0.06852	0.076	-0.3252	0.0122
Instructor	Employee	0.19376*	0.05197	0.001	0.0658	0.3217
	Employer	0.15654	0.06852	0.076	-0.0122	0.3252

Table 4.8 ***Multiple comparison test table for required academic skills***

(I)Type of respondent	(J)Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.23167	0.11033	0.112	-0.5033	0.0400
	Instructor	-0.53282*	0.07961	0.000	-0.7288	-0.3368
Employer	Employee	0.023167	0.11033	0.112	-0.0400	0.5033
	Instructor	-0.30115*	0.10498	0.017	-0.5596	-0.0427
Instructor	Employee	0.53282*	0.07961	0.000	0.3368	0.7288
	Employer	0.30115*	0.10498	0.017	0.0427	0.5596

4.2.2 Graduates' acquisition and employers need for technical skills

Technical skills are the second type of skill students are supposed to acquire during their studies at higher learning institutes. In this study, technical skill was measured in terms of the skills of manipulating computers, planning and organizing tasks, solving problems, making appropriate decisions, scheduling and coordinating, and seeking and developing opportunities.

While skill in manipulating computers (mean = 3.65; SD = 0.87) was acquired to a high level with a mean value lying between 3.4 and 4.20, all indicators of technical skills such as skills in scheduling and coordinating (mean = 3.37; SD = 0.91), planning and organizing (mean = 3.32; SD = 0.85), problem-solving skills (mean = 3.28; SD = 0.87), decision-making skills (mean = 3.20; SD = 0.77), and seeking and developing opportunities (mean = 3.04; SD = 0.77) were moderately acquired by engineering graduates with a mean value lying between 2.6 and 4.20 (see table 4.9). The one-way ANOVA test shows a statistically significant difference between employees, employers, and instructors in acquiring technical skills ($F = 11.15$; $p < 0.00$) at a ≤ 0.05 level of confidence (see table 4.10). The multiple comparison test result shows that there are no statistically significant differences between employees and employers (mean difference= ± 0.13796; p-= 0.267); and employers and instructors (mean difference= ±0.14936; p= 0.181) in acquiring technical skills. However, the difference between employees and

instructors in acquiring technical skills is statistically significant (mean difference= ±0.28732; ρ< 0.001) at $\alpha \leq 0.05$ level of confidence (see table 4.11).

Skill in manipulation of computers (mean = 4.35; SD = 0.83) was-required to a very high extent among employers of engineering graduates with a mean lying between 4.21 and 5.00. Similarly, all indicators of technical skills such as problem solving (mean = 4.18; SD = 0.91), decision-making (mean = 4.18; SD = 0.97), scheduling and coordinating (mean = 4.17; SD = 1.03), planning and organizing skills (mean = 4.10; SD = 1.12) skills and skill in seeking and developing opportunities (mean = 3.97; SD = 0.86) were required to a very high extent among employers (see Table 4.9). One-way ANOVA test results show a statistically significant difference between employees, employers, and instructors in responding to labor market needs for technical skills ($F = 6.99$; $p = 0.00$) at $\alpha \leq 0.05$ (see table 4.12). Multiple comparison tests were computed to test which group differs from what. Hence, the multiple comparison test result shows that there is no statistically significant difference between employers and instructors (mean difference = ± 0.00513; p-value = 0.999) in labor market needs for technical skills. However, the difference between employees and employers (mean difference = ±0.30926; $p = 0.036$) and employees and instructors (difference = ± 0.30413; $p = 0.002$) is statistically significant in labor market needs for technical skills at $\alpha \leq 0.05$ level of confidence (see table 4.13).

The key informant interview reports also reveal that education is important to preserve social values, adapt to a changing world, develop an active citizen who knows his or her rights and responsibilities, and use modern technologies to increase productivity. It was argued that knowledge and skills acquired through education help youths identify their talents and areas of interest in jobs and businesses. It equips learners with skills that help them achieve their job

aspirations. Education and skills training enhance the quality, quantity, and demand of industrial products in both the formal and informal sectors. It contributes to achieving youth life goals and aspirations if and only if it is based on youth needs and talents, targeted at actual skill gaps in the workplace, and focused more on practice than theory. A participant from the Ministry of Education explained his concern as follows:

> Recently, we have observed changing attitudes. However, still considering education as the only means and ways to get employment opportunities in government sectors widely persists among Ethiopians. It is also undeniable that access to education and skill training has increased over the last 15 years in Ethiopia. But education and skills training do not take the needs of the labor market into consideration. The contribution of access to education and skill training for success in employment is insufficient because employees in both formal and informal careers do not get training that is based on their interests and labor market needs. Thus, graduates are failing to benefit from existing education and training systems and policies **(MoE, KII Participant, and January, 2022).**

Table 4.9 **Graduates' *acquisition and employers need for technical skills***

R/N	Levels of graduates Acquisition		Type of skill	Levels of labor market needs	
	Mean	SD	Technical skills	Mean	SD
1	3.65	0.87	Computer skills	4.35	0.83
2	3.32	0.85	Planning and organizing	4.10	1.12
3	3.28	0.87	Problem solving	4.18	0.91
4	3.20	0.77	Decision making	4.18	0.97
5	3.37	0.91	Skills in scheduling and coordinating	4.17	1.03
6	3.04	0.77	Seeking and developing opportunities	3.97	0.86

Table 4.10 ***One-way ANOVA test for testing the mean difference between employees, employers, and instructors in the acquisition of technical skills***

	Sum of squares	df	Mean square	F	Sig.
Between groups	4.43	2	2.21	11.15	<0.00
Within groups	51.01	257	0.20		
Total	55.44	259			

Table 4.11 ***One way ANOVA for testing the mean difference between employees, employers, and instructors in responding to employers needs for technical skill***

	Sum of squares	df	Mean square	F	Sig.
Between groups	5.49	2	2.74	6.99	0.00
Within groups	100.91	257	0.04		
Total	106.39	259			

Table 4.12 ***Multiple comparison tests for acquired technical skills across employees, employers and instructors***

(I) Type of respondent	(J) Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	0.13796	0.08466	0.267	-0.0705	0.3464
	Instructor	0.28732*	0.06109	0.000	0.1369	0.4377
Employer	Employee	-0.13796	0.08466	0.267	-0.3464	0.0705
	Instructor	0.14936	0.08056	0.181	-0.0490	0.3477
Instructor	Employee	-0.28732*	0.06109	0.000	-0.4377	-0.1369
	Employer	-0.14936	0.08056	0.181	-0.3477	0.0490

Table 4.13 ***Multiple comparison test table for required technical skills***

(I)Type of respondent	(J)Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.30926*	0.11907	0.036	-0.6024	-0.0161
	Instructor	-0.30413*	0.08592	0.002	-0.5157	-0.0926
Employer	Employee	0.030926*	0.11907	0.036	0.0161	0.6024
	Instructor	0.00513	0.11330	0.999	-0.2738	0.2841
Instructor	Employee	0.30413*	0.08592	0.002	0.0926	0.5157
	Employer	-0.000513	0.11330	0.999	-0.2841	0.2738

4.2.3 Graduates' Acquisition and Employers Need for Interpersonal Skills

Interpersonal skill is the third dimension of skill graduates of civil, mechanical, and electrical engineering disciplines are supposed to have in the current knowledge-driven economy. The latent variable, interpersonal skill, was measured in terms of measurable indicators such as teamwork, client/stakeholder focus, ability to work with people from different cultural backgrounds, communication skill, empathy, adaptability, and flexibility (see Table 4.14).

As shown in Table 4.14, teamwork (mean = 3.77; SD = 0.78)**,** ability to work with people from different cultural backgrounds (mean = 3.58; SD = 1.05), and communication skills (mean = 3.43; SD = 0.97) were acquired to a greater extent with a mean value lying between 3.4 and 4.20, while empathy (mean = 3.34; SD = 0.88), adaptability and flexibility skills (mean = 3.28; SD = 0.92), and client/stakeholder focus (mean = 2.97; SD = 0.94) were moderately acquired by graduates with a mean value lying between 2.6 and 3.4. One-way ANOVA test results also indicate a statistically significant difference between employees, employers, and instructors in acquiring interpersonal skills (F = 4.78; p = 0.01) at the 0.05 level of confidence. The multiple

comparison test result shows that there are no statistically significant differences between employees and employers (mean difference = ± 0.10714; p= 0.416) and employees and instructors (mean difference= ±0.11429; p= 0.148) in acquiring interpersonal skills. However, the difference between employers and instructors in acquiring interpersonal skills is statistically significant (mean difference= ±0.22143; p= 0.017) at $\alpha \leq 0.05$ 0.5 level of confidence interval (see table 4.17).

Except teamwork skill (mean = 4.34; SD = 0.95), which is required by employers to a very high extent with a mean value lying between 4.21 and 5.00, all indicators of interpersonal skills like communication skill (mean = 4.15; SD = 1.00), empathy (mean = 4.14; 0.99), ability to work with people from different cultural backgrounds (mean = 4.13; SD = 1.02), stakeholder focus (mean = 4.11; SD = 0.88), and adaptability and flexibility skill (mean = 3.95; SD = 0.92) were required to a higher extent with a mean value lying between 3.41 and 4.20. Multiple comparison tests were computed to test which group differs from what. Hence, the multiple comparison test result shows that there is no statistically significant difference between employers and instructors (mean difference= ± 0.09148; p- value 0.637) in labor market needs for interpersonal skills. However, the difference between employees and employers (mean difference = ±0.37421; p< 0.001) and employees and instructors (mean difference =±0.46569; p< 0.001) are statistically significant in labor market needs for interpersonal skills at $\alpha \leq 0.05$ level of confidence (see table 4.18).

Table 4.14 ***Graduates' acquisition and employers need for interpersonal skills***

R/N	Levels of graduates Acquisition		Type of skill	Levels of labor market needs	
	Mean	SD	Interpersonal skills	Mean	SD
1	3.77	0.78	Team work	4.34	0.95
2	2.97	0.94	Client/ stakeholder focus	4.11	0.88
3	3.58	1.05	Working with people from different cultures	4.13	1.02
4	3.43	0.97	Communication skill	4.15	1.00
5	3.34	0.88	Empathy	4.14	0.99
6	3.28	0.92	Adaptability and flexibility	3.95	0.92

Table 4.15 ***One-way ANOVA for testing the mean difference among employees, employers, and instructors in the acquisition of interpersonal skills***

	Sum of squares	df	Mean square	F	Sig.
Between groups	1.73	2	0.86	4.78	0.00
Within groups	46.45	257	0.18		
Total	48.17	259			

Table 4.16 **One-*Way ANOVA for testing the mean difference among employees, employers, and instructors against employers' need for interpersonal skills***

	Sum of squares	df	Mean square	F	Sig.
Between groups	11.87	2	5.93	20.90	0.00
Within groups	72.94	257	0.28		
Total	84.803	259			

Table 4.17 ***Multiple comparison tests across employees, employers and instructors***

(I) Type of respondent	(J) Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.10714	0.08079	0.416	-0.3060	0.0918
	Instructor	0.11429	.05829	0.148	-0.0292	0.2578
Employer	Employee	0.10714	0.08079	0.416	-0.0918	0.3060
	Instructor	0.22143	0.07687	0.017	0.0322	0.4107
Instructor	Employee	-0.11429	0.05829	0.148	-0.2578	0.0292
	Employer	0.22143*	0.07687	0.017	-0.4107	-0.0322

Table 4.18 ***Multiple comparison test table for required Interpersonal skills***

(I)Type of respondent	(J)Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.37421	0.10124	0.001	-0.6235	-0.1250
	Instructor	-0.46569*	0.07305	0.000	-0.6455	-0.2858
Employer	Employee	0.37421*	0.10124	0.001	0.1250	0.6235
	Instructor	-0.09148	0.09632	0.637	-0.3286	0.1457
Instructor	Employee	0.46569*	0.07305	0.000	0.2858	0.6455
	Employer	0.09148	0.09632	0.637	-0.1457	0.3286

4.2.4 Graduates' Acquisition and Employers Need for Generic Skills

Generic skills are the fourth type of skills students are supposed to acquire during their studies and are needed by potential employers. Generic skills were measured in terms of creative thinking, willingness to learn, leadership qualities, integrity, willingness to perform or commit, sense of responsibility, innovativeness, determination, loyalty to the institution and its objectives, ability to assert oneself, self-confidence, and independence.

As shown in Table 4.19, graduates are highly equipped with indicators of generic skills such as willingness to perform or commitment (mean = 3.64; SD = 0.81), willingness to learn (mean = 3.55; SD = 0.83), and sense of responsibility (mean = 3.41; SD = 0.97), with the mean value lying between 3.4 and 4.20. Nevertheless, most indicators of generic skills such as loyalty to the institution and its objectives (mean = 3.31; SD = 0.93), self-confidence (mean = 3.30; SD = 0.98), independence (mean = 3.29; SD = 0.95), creative thinking (mean = 3.28; SD = 0.87), ability to assert oneself (mean = 3.27; SD = 0.91), integrity (mean = 3.19; SD = 1.02), leadership qualities (mean = 3.16; SD =1.04), determination (mean = 3.01; SD = 0.97), and innovativeness (mean = 2.80; SD = 1.16) were acquired to a moderate extent, with the mean value lying between 2.61 and 3.4. The one-way ANOVA test result reveals a statistically significant difference between employees, employers, and instructors in acquiring generic skills (F = 7.60; p = 0.00) at $\alpha \leq 05$. The multiple comparison test result shows that there are no statistically significant differences between employees and employers (mean difference= ± 0.06481; p= 0.706) and employers and instructors (mean difference= ±0.14808; p = 0.136) in acquiring generic skills. The difference between employees and instructors in acquiring generic competence is statistically significant (mean difference= ±0.21289; p= 0.001) at $\alpha \leq 0.05$ level of confidence (see table 4.23).

However, loyalty to the institution and its objectives (mean = 4.36; SD = 0.86), self-confidence (mean = 4.28; SD = 0.93), determination (mean = 4.22; SD = 0.98), and ability to assert oneself (mean = 4.22; SD = 0.93) were required on the labor market to a very high extent, with a mean value lying in between 4.21 and 5.00 while sense of responsibility (mean = 4.17; SD = 1.03), innovativeness (mean = 4.15; SD = 1.03), integrity (mean = 4.14; SD = 0.79), leadership skill (mean = 4.13; SD = 0.82), willingness to perform/commitment (mean = 4.10; SD = 1.13),

independence (mean = 4.09; SD = 1.08), willingness to learn (mean = 4.04; SD = 1.12), and creative thinking (mean = 4.03; SD = 0.89) were required to a higher extent by employers, with a mean value lying between 3.4 and 4.21. One-way ANOVA outputs also show a statistically significant difference between employees, employers, and instructors ($F = 6.65$; $p = 0.00$) in employers need for generic skills (see table 4.20). The outputs of a one-way ANOVA show a statistically significant difference between employees, employers, and instructors ($F = 20.90$; $p< 0.00$) (see table 16). The multiple comparison test result shows that there are no statistically significant differences between employees and employers (mean difference = ± 0.24907; $p = 0.066$) and employers and instructors (mean difference = ±0.02179; $p = 0.977$) in labor market needs for generic skills. However, the difference between employees and instructors (mean difference = ±0.27087; $p = 0.002$) is statistically significant in labour market needs for generic skills at $\alpha \leq 0.05$ level of confidence (see table 4.23).

According to the report of reviewed documents, the introduction of a 70:30 enrolment mix target where 70% of students enroll in science and technology and the remaining 30% enroll in social sciences beginning in 2008 was a landmark for the beginning of priority for science, technology, engineering, and mathematics education in Ethiopia. Since then, the country initiated a number of guidelines and strategies like the Concept Paper and Strategies for Improving Science and Mathematics Education in Ethiopia by Curriculum Development and Implementation Core Process; the document Strategies for Improving the Teaching and Learning of Science and Mathematics in Ethiopia; the National Pilot Project for Strengthening Mathematics and Science Education in Ethiopia; the Action Plan for Improving the teaching and Learning of Science and Mathematics in Ethiopia; SMASEE Teacher In-Service Education and Training (InSET) Guidelines prepared by the National Mathematics and Science Improvement

Centre; ESDP-IV that underscores the need to strengthen the focus on sciences and technology. Nevertheless, the National Learning Assessment results for STEM subjects in grades 4, 8, and 10 are low and below the national standard of 50%.

Table 4.19 ***Graduates' acquisition and employers need for generic skills***

R/N	Levels of acquisition		Type of skill	Levels of LM needs	
	Mean	SD	Generic skills	Mean	SD
1	3.28	0.87	Creative thinking	4.03	0.89
2	3.55	0.83	Willingness to learn	4.04	1.12
3	3.16	1.04	Leadership qualities	4.13	0.82
4	3.19	1.02	Integrity	4.14	0.79
5	3.64	0.81	Willingness to perform/commitment	4.10	1.13
6	3.41	0.97	Sense of responsibility	4.17	1.03
7	2.80	1.16	Innovativeness	4.15	1.03
8	3.01	0.97	Determination	4.22	0.98
9	3.31	0.93	Loyalty to institution and its objectives	4.36	0.86
10	3.27	0.91	Ability to assert oneself	4.22	0.93
11	3.30	098	Self confidence	4.28	0.93
12	3.29	0.95	Independence	4.09	1.08

Table 4.20 **One-*way ANOVA for testing the mean difference among employees, employers, and instructors in the acquisition of generic skills***

	Sum squares	df	Mean square	F	Sig.
Between groups	2.54	2	1.27	7.60	0.00
Within groups	42.87	257	0.17		
Total	45.41	259			

Table 4.21 **One-*Way ANOVA for testing the mean difference among employees, employers, and instructors against employers need for generic skills***

	Sum squares	df	Mean square	F	Sig.
Between groups	4.17	2	2.09	6.65	0.00
Within groups	80.53	257	0.31		
Total	84.70	259			

Table 4.22 **Multiple *comparison post hock tests for employees, employers and instructors in acquiring generic skills***

(I) Type of respondent	(J) Type of respondent	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	0.06481	0.07761	0.706	-0.1263	0.2559
	Instructor	0.21289*	0.05601	0.001	0.0750	0.3508
Employer	Employee	-0.06481	0.07761	0.706	-0.2559	0.1263
	Instructor	0.14808	0.07385	0.136	-0.0337	0.3299
Instructor	Employee	-0.21289	0.05601	0.001	-0.3508	-0.0750
	Employer	-0.14808	0.07385	0.136	-0.3299	0.0337

Table 4.23 ***Multiple comparison test table for required generic skills***

(I)Type of respondent	(J)Type of respondent	Mean difference	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Employee	Employer	-0.24907	0.10637	0.066	-0.5110	0.0128
	Instructor	-0.27087*	0.07676	0.002	-0.4599	-0.0819
Employer	Employee	0.24907	0.10637	0.066	-0.0128	0.5110
	Instructor	-0.02179	0.10121	0.977	-0.2710	0.2274
Instructor	Employee	0.27087*	0.07676	0.002	0.0819	0.4599
	Employer	0.02179	0.10121	0.977	-0.2274	0.2710

4.3. The Match between Higher Education Skill Supply and Employers or Labor Market Skill Needs

The match between higher education skill supply and labor market skill needs was investigated in terms of graduate acquisition, employers, and labor market requirements for such skills as discipline-specific academic skills, technical skills, interpersonal skills, and generic skills

4.3.1 Discipline Specific Skills

Discipline-specific skills help graduates perform tasks in the 21st century and are more relevant to one's career (Shivoro et al., 2019). In this study, discipline-specific academic skill was measured in terms of 10 variables, including the foundation of engineering, manufacturing and construction, operation, measurement, and control technology, applying technical fields, planning, design, calculation, and construction, quality control and assurance, environmental safety, health, and security, applying knowledge of science and engineering principles, skill in a specific engineering discipline, and skill in application and practice.

As seen in Table 4.25, higher learning institutes moderately equip graduates with discipline-specific skills, with a mean value of 3.23 lying between 2.61 and 3.4, while it is highly required in engineering graduate labor markets, with a mean value of 3.98 lying between 3.4 and 4.20. Compared to generic, interpersonal, and technical skills, the gap between the higher education supply of discipline-specific skills and the engineering labor market need for the same skill was narrowest (mean difference =0.74; SD = 0.68). The mean of required discipline-specific academic skills was also higher than the mean of acquired discipline specific skills. A paired sample t-test in Table 1 also confirms the existence of a statistically significant mean difference between acquired and required discipline-specific skills (mean =0.74, SD =0.68, t = 17.51, p = 0.01) at the 0.05 level of confidence.

As indicated in Table 4.26, attempts were made to identify the match between higher education skill supply and employers/labor market needs based on the reports of employees, employers, and instructors. Employees (mean = 3.14; SD = 0.44), employers (mean = 3.14; SD = 0.34), and instructors (mean = 3.32; SD = 0.34) reported that higher learning institutes moderately equip graduates with discipline-specific skills. However, the requirement for the same skills by employers and the labor market was high, as reported by employees (mean = 3.67; SD = 0.65), employers (mean = 3.91; SD = 0.49), and instructors of higher learning institutes (mean = 4.21; SD = 0.56). When compared to employees (mean difference = 0.53) and employers (mean difference = 0.74), instructors reported that graduates acquire more discipline-specific skills during studies at higher learning institutes, and employers and labor market needs for the same skill were very high. Yet, the report of the instructors (mean difference 0.89) revealed the existence of a significant mismatch between discipline-specific skills acquired at higher learning institutes (mean = 3.32; SD = 0.34) and the requirements of the same skills by employers and the labor market (mean = 4.21; SD = 0.56).

Table 4.24 ***Mean difference between acquired and required skills***

Skill types	Mean of acquired skills	Mean of required skills	Mean d/ce	SD	Paired sample t-tests		
					t	df	p
Discipline specific skill	3.23	3.98	0.74	0.68	17.51	259	<0.01
Technical skill	3.31	4.16	0.85	0.75	18.19	259	<0.01
Interpersonal skill	3.37	4.11	0.74	0.71	16.68	259	<0.01
Generic skill	3.27	4.14	0.88	0.72	19.38	259	<0.01

Table 4.25 ***Comparisons of higher education skill supply and employers and labor market needs as reported by employees, employers, and instructors***

Type of skill	Respondent	Acquired and required skill	N	Mean	SD	Mean Differences
Discipline specific skill	Employee	Acquired	90	3.14	0.44	
		Required	90	3.67	0.65	0.53
	Employers	Acquired	40	3.17	0.34	0.74
		Required	40	3.91	0.49	
	Instructors	Acquired	130	3.32	0.34	0.89
		Required	130	4.21	0.56	
Technical skill	Employee	Acquired	90	3.45	0.49	0.51
		Required	90	3.96	0.70	
	Employers	Acquired	40	3.35	0.47	0.92
		Required	40	4.27	0.54	
	Instructors	Acquired	130	3.19	0.39	1.07
		Required	130	4.26	0.59	
Interpersonal skill	Employee	Acquired	90	3.40	0.51	0.42
		Required	90	3.82	0.59	
	Employers	Acquired	40	3.44	0.44	0.76
		Required	40	4.20	0.46	
	Instructors	Acquired	130	3.34	0.49	0.95
		Required	130	4.29	0.52	
Generic skill	Employee	Acquired	90	3.35	0.50	0.65
		Required	90	4.00	0.53	
	Employers	Acquired	40	3.36	0.45	0.88
		Required	40	4.24	0.47	
	Instructors	Acquired	130	3.18	0.46	1.02
		Required	130	4.20	0.59	

Table 4.26 ***Paired sample t-test for overall acquired and required skills as reported by employee, employer and instructor***

Respondent type	Pair	Mean	Mean difference	S.D	t	df	p
Employee	Required	3.85	0.59	0.61	9.21	89	<0.01
	Acquired	3.26					
Employer	Required	4.13	0.85	0.50	10.69	39	<0.01
	Acquired	3.28					
Instructor	Required	4.24	0.99	0.58	19.32	129	<0.01
	Acquired	3.26					

4.3.2 Technical Skills

Technical skills are among the employability skills required by most employers. Graduates acquisition of these skills indicates their proficiency to perform highly in a particular job (Fitriani & Ajayi, 2022). For the purpose of this study, computer skills, the skill of planning and organizing tasks, problem-solving skills, decision-making skills, professional skills, and the skill of seeking and developing opportunities were indicators used to measure technical skills. As shown in Table 1, graduates moderately acquire technical skills, with a mean value of 3.31 lying between 2.61 and 3.4. However, its requirement in the engineering labor market is high, with a mean value of 4.16 lying between 3.4 and 4.20. The gap between the higher education supply of technical skills and the engineering labor market need for the same skills was widest (mean difference =0.85; SD = 0.75) next to generic skills. A paired sample t-test result depicts a statistically significant mean difference between technical skills acquired at higher learning institutes and employers' needs for the same skills (mean difference =0.85; SD = 0.75; t = 18.19; p =0.01) at a 0.05 level of confidence.

The reports of employers (mean = 3.35; SD = 0.47) and instructors (mean = 3.19; SD = 0.39) in Table 2 revealed that higher learning institutes moderately equip engineering graduates with technical skills, while employees (mean = 3.45; SD = 0.49) reported that higher learning institutes highly equip graduates with the same skill. The report of employees revealed that technical skills (mean = 3.96; SD = 0.70) are highly required in the engineering labor market, employers (mean = 4.27; SD = 0.54) and instructors (mean = 4.26; SD = 0.59) confirmed that the employers and labor market's need for technical skills is very high. Therefore, the reports of employees (mean difference = 0.51), employers (mean difference = 0.92), and instructors (mean difference = 1.07) confirmed the existence of a mismatch between technical skills acquired at higher learning institutes and those required by the labor market among engineering graduates. The mean difference between technical skills acquired at higher learning institutes and those required by the graduate labor market was highest for instructors, followed by employers and employees.

According to a key informant interview from BelayAB Motors, recent higher education graduates from Ethiopia have a very high CGPA with very poor conceptual knowledge. He further shared his views of the mismatch between higher education skill supply and labor market needs as follows:

> I often take part in interviewing job applicants in various technical positions. I observe that applicants often lack the knowledge and skills mechanical engineers are supposed to have. But the CGPA applicants look very high. These indicate the existence of visible gaps between what learners acquire at higher learning institutes and the needs of employers. Even TVET graduates are sometimes better at practical skills than university graduates. Most of the time, applicants who are university graduates fail to express themselves and lack experience in operating machines compared to TVET graduates **(BelayAB Motors, technical team leader, January 2022).**

There are wider gaps between higher education and the labor market in terms of skills and competencies. Most graduates lack employability skills like communication skills, entrepreneurship skills, computer skills, and leadership skills. Graduates of higher learning institutes lack psychological, emotional, and social maturities, intellectual skills, language skills, both verbal and written communication skills, accountability, readiness and motivation to learn new things, a feeling of belongingness, technical and practical skills, discipline, and life skills. New applicants often do not have basic concepts of the area they are applying for or technical things related to the work they are going to do. They need close supervision to finish their work assignments and lack practical skills due to insufficient practical attachment during studies at higher learning institutes. To fill higher education graduate skill gaps, both governmental and non-governmental organizations strive to fill the existing skill gaps. The following excerpts were taken from KII reports of site supervisors in the government construction sector:

> In both private and government firms, permanent employees are given short-term training immediately after employment to fill both their hard and soft skills gaps. The training mainly focuses on practical skills and is given by the management team of the firms and other training experts. On-the-job training is given through creating strong links with different government and private institutions. Based on performance evaluation, organizations and companies identify skill gaps that need priority and organize training in collaboration with TVET and other training institutes. In some organizations, there is also close supervision and induction for new employees. Supervisors often work towards helping and supporting novice employees in areas of skill gaps to enhance their efficiency and productivity **(KII, Addis Ababa Construction Bureau, February, 2022).**

Therefore, graduates of Ethiopian higher learning institutes need to be equipped with both soft skills and hard skills that match labor market needs. Among other things, youth need entrepreneurship skills, business planning skills, leadership skills, decision-making skills, coordination and collaboration skills, financial management skills, communication skills, innovativeness, conflict management skills, time management skills, customer handling skills, computer and IT skills, and the ability to access their own talent. Recently, computer-related

technologies have influenced global systems of business communication. In order to adapt to the current technological era, learners in higher education are supposed to be equipped with computer sandboxes.

4.3.3 Interpersonal Skills

Interpersonal skills are the ability to work in a team, communicate, and cooperate effectively with diverse colleagues and clients **(**Velasco-Martínez & Tójar-Hurtado, 2018**)**. In this study, interpersonal skills were measured in terms of teamwork, client/stakeholder focus, working with people from different cultures, communication skills (both written and verbal), interpersonal skills, empathy, adaptability, and flexibility. The findings of this study reveal that graduates moderately acquire interpersonal skills, with a mean value of 3.37 lying between 2.61 and 3.4, though the requirement in the current Ethiopian engineering labor market is high, with a mean value of 4.11 lying between 3.4 and 4.20. The gap between the higher education supply of interpersonal skills and the engineering labor market need for the same skill was the third widest (mean difference =0.74; SD = 0.71), next to technical skills. The paired sample test in Table 4.25 confirms the prevalence of statistically significant mean differences between required interpersonal skills (mean =4.11) and acquired interpersonal skills (mean = 3.37), with a mean difference of 0.74, S.D. = 0.71, t = 16.68, p =0.01 at the 0.05 level of confidence.

As depicted in Table 4.26, employees (mean = 3.4; SD = 0.51) and instructors (mean = 3.34; SD = 0.49) reported that interpersonal skill was moderately acquired at higher learning institutes, while employers (mean = 3.44; SD = 0.76) confirmed that higher learning institutes highly equip graduates of engineering disciplines with the same skill. For both employees (mean = 3.82; SD = 0.59) and employers (mean = 4.20; SD = 0.59), interpersonal skills were highly required by employers. Instructors (mean = 4.29; SD = 0.52), on their part, reported that the

requirement for interpersonal skills in the engineering labor market was very high. Employees (mean difference = 0.42), employers (mean difference = 0.76), and instructors (mean difference = 0.95) hold different views about graduate acquisition of interpersonal skills and the requirement of the same skill in the engineering labor market. These indicate the existence of a mismatch between interpersonal skills acquired at higher learning institutes and employers or labor market needs for the same skill.

According to key informant interview participants from Sunshine Construction, the type of skills required by the firm depends on the micro- and macro-economic conditions of the country, like market conditions, industrial investment growth, and the foreign exchange rate. The same participant elaborated on his views of labor market needs in the following excerpt:

> I think a decline in supply of industrial raw materials, demand for the product, the foreign exchange rate, and the market lead to a decline in labor market needs for graduates of higher education. We often need all-rounded, qualified graduates, including those with hard and soft skills obtained through education. We also need employees with punctuality, motivation, good work ethics, and good communication skills. However, graduates of the three sample departments have no such knowledge and skills. As a result, we often invest in on-the-job training to equip employees with hard and soft skills. In most employing organizations, including ours, the types of skills required are identified at working departmental levels and reported to human resource offices. In both government and private organizations, written and practical exams during employment processes are used to identify the hard skills, while interviews are used to assess the soft skills that applicants have to achieve success in the world of work **(Human Resource Director, Sunshine Construction, February 2022).**

Almost all KII participants agreed that employers often prefer employees with high commitment, who are hardworking, capable of managing their time, and who are able to complete work assignments on time. However, most employees lack soft skills like motivation, punctuality, interest, and communication skills (written and verbal communication skills), teamwork skills, integrity, leadership skills, and computer skills (computerized programming and software designing skills). Despite employers gearing towards looking for practical skills rather

than theoretical knowledge, different positions in an organization require different kinds of soft skills. But technical skills are believed to be required in all organizational positions, with varying types and degrees. Employers in engineering want graduates who can easily communicate, agree, and create positive team spirit with others. In terms of hard skills, employers want academically competent graduates with sufficient knowledge in their field of study and subject matter.

According to the report from reviewed documents, graduates of Ethiopian higher learning institutes lack oral and written communication skills in English, a medium of instruction in higher learning institutions. Thus, higher learning institutes and employers properly identify interpersonal skills and integrate them into higher education curricular and extracurricular activities that positively contribute to engineering graduates' and organizational success.

4.3.4 Generic Skills

Scholars (e.g., Asai, Breda, Rain, Romanello, Sangnier, 2020; Green, 2016) argue that generic skills are general skills that could apply to a whole range of industries and are increasingly important in modern economies. In this study, creative thinking, willingness to learn, leadership skill, integrity, sense of responsibility, innovativeness, determination, loyalty to the institution and its objectives, ability to assert oneself, self-confidence, and sense of independence are observable indicators used to measure generic skills. The aggregate mean response in the above Table 4.25 confirms that generic skills (mean = 3.27) were moderately acquired during university studies, with mean values lying in between 2.6 and 3.4. Nevertheless, the need for generic skills in the Ethiopian engineering labor market was high, with a mean value of 4.14 lying between 3.4 and 4.20. The gap between higher education supply and engineering labor market need for generic skills was the widest (mean difference =0.88; SD = 0.72) of all skill types under scrutiny. A paired sample t-test result affirms evidence of a statistically significant

mean difference between generic skills acquired at higher learning institutes and those required by employers or the labor market (mean difference = 0.87; SD = 0.72; t = 19.38; p = 0.01) at a 0.05 level of confidence.

As shown in Table 4.26, Employees (mean = 3.35; SD = 0.50) and employers (mean = 3.36; SD = 0.45) who took part in the study reported that higher learning institutes moderately equip graduates with generic skills, while the instructors affirmed that universities equip graduates with the same skills to a very high extent. With regard to employers and labor market needs, employees (mean = 4.00; SD = 0.53) and instructors (mean = 4.20; SD = 0.59) believed that generic skills were highly required in the engineering labor market. Interestingly, employers (mean = 4.24; SD = 0.47) reported that the needs for generic skills among employers and the labor market were very high. The reports of employees (mean difference = 0.65), employers (mean difference = 0.88), and instructors (mean difference = 1.02) confirmed the existence of wider gaps between generic skills acquired during studies at the university and the requirements of generic skills in the engineering labor market.

Paired sample t-tests were computed to test mean differences among employees, employers, and instructors in responding to levels of skills acquired at higher learning institutes and levels of labor market needs for the same skills. As seen in Table 4.27, there is a statistically significant mean difference between skills acquired at higher learning institutes and the mean requirement of the same skills in the labor market ($p = 0.01$; $\alpha \leq 0.05$). The mean difference was highest for instructors (mean difference = 0.99 SD = 58; t = 19.32; df = 129; p = 0.01), followed by employers (mean difference = 0.85 SD = 0.50; t = 10.69; df = 39; p = 0.01), and the lowest difference among employees (mean difference = 0.59 SD = 0.561; t = 9.21; df = 89; p = 0.01). Thus, the mean responses of employees, employers, and instructors revealed the existence of a

significant mismatch between the skills supplied by higher learning institutes and the skills required by employers in the Ethiopian context.

4.4 Discussion

Scholars (e.g., Wongnaa and Boachie, 2018) argue that discipline-specific skills are more important in STEM. Corroborating previous studies (e.g., Azmi et al., 2018; Shukla & Garg, 2016), the finding of this study reveals skills of applying knowledge of science and engineering principles, application and practical skill, competence in safety, health, security, and the environment, and competence in specific engineering disciplines had very high demand on the labor market, while competence in operation, measurement, and control technology, competence in the foundation of engineering, competence in manufacturing and construction, and competence in quality control and quality assurance were highly required. However, competence in applying technical fields like planning, designing, calculating, and construction was least required by employers of engineering graduates. Planning, designing, calculating and construction skills; and the skill of applying knowledge of science and engineering principles were the only skills highly supplied by higher education institutions and most demanded on the engineering labor market. Consistent with existing literature, competence in the application of practical skills and specific engineering disciplines was highly demanded among employers and yet least supplied by Ethiopian higher learning institutes. However, the demand in the engineering labor market for most indicators of discipline-specific skills was seemingly inconsistent with the current findings. The differences might be due to differences in the context of the current and previous studies. A study by Wongnaa and Boachie (2018**)** underscores the importance of discipline-specific skills in the fields of science, technology, engineering, and math. In contrast, the commitment of Ethiopian higher learning institutes to equip learners with

discipline-specific skills was seemingly low. This might be due to the fact that countries value discipline-specific skills and generic skills differently. Academic institutions often fail to provide the right skillsets for graduates due to weak collaboration between universities, employers, and professional accreditation bodies (Fitriani & Ajayi, 2022).

Scholars argued that discipline-specific skills are crucial in hard science fields like engineering and technology, enable graduates to secure employment in their field of studies and receive higher wages, and help graduates perform tasks in the 21st century. The findings of this study also disclosed that the need for discipline-specific skills in the engineering labor market was high while the supply of graduates with the same skills was low. The differences between scholars arguments and the findings of this study might be attributed to higher learning institutes' negligence in considering the importance of such skills in engineering graduates labor markets, the declining quality of higher education with the current increasing enrollment and graduation rates, and the absence of assessment of employers' skill needs by higher learning institutes in curriculum design, delivery, and evaluation. Such a mismatch between higher education discipline-specific skill supply and employer needs results in a scarcity of well-qualified engineers capable of applying, testing, and improving existing engineering-related scientific theories and knowledge that fit the changing technological environment. It also increases the rate of graduate unemployment, and employers opt to recruit new employees from non-graduates and are exposed to the additional cost of training.

Despite scholars (e.g., Fitriani & Ajayi, 2022) arguing that technical skills are often valued among employers and required to solve complex engineering problems at the workplace, this study identified skill in manipulating computers as the only technical skill acquired to a high extent by graduates, while skill in seeking and developing opportunities, decision-making, and

problem solving were the least acquired. Consistent with previous local studies by Siraye, Abebe, Melese, and Wale (2018) and Fanta et al. (2019), this study identified skillful manipulation of computers and problem-solving as the most demanded skills by employers while skill in making appropriate decisions, scheduling and coordinating, and seeking and developing opportunities were the most required technical skills by employers. Both existing literature (e.g., Fitriani & Ajayi, 2022) and the findings of this study underscore the importance of computer, problem-solving, and decision-making skills, as well as skills in seeking and developing opportunities for the success of graduates in the engineering labor market.

The study by Siraye, Abebe, Melese, and Wale (2018) identified technical skills such as problem-solving skills, information technology skills, adapting to change, and risk-taking skills as the skills most demanded by employers, and graduates acquisition of such skills is an indication of their proficiency to perform highly in a particular job. However, employees, employers, and instructors holding different views about graduate acquisition of technical skills and its requirement in the engineering graduate labor market indicate the existence of a mismatch between graduates' acquisition of interpersonal skills and employers' needs. The mismatch between higher education supply and employers need for technical skills indicates that higher learning institutes and employers are not closely working together in the identification of technical skills demanded by the world of work and integrating them into both curricular and extracurricular activities.

The 21st century engineering graduates should be well equipped with a broader knowledge base and diverse personal and interpersonal key skills that help them succeed in the labor market (Collet & Hine, 2015). The finding of this study reveals that graduates of engineering disciplines are highly equipped with indicators of interpersonal skills such as team

work, the ability to work with people from different cultural backgrounds and communication skills, while the ability to focus on stakeholders' needs and empathy were the least acquired. In addition to teamwork skills, written and verbal communication skills, empathy, and the ability to work with people from different cultural backgrounds were the most required, while adaptability and flexibility were the least required interpersonal skills among engineering graduates employed by companies. Local study by Getahun et al. (2020) and a study conducted by Kaushal (2016) affirmed that teamwork and communication skills are among the interpersonal skills most demanded by employing companies. Yet for scholars such as Keneley and Jackling (2011), communication and collaboration skills are least developed during university studies. Results of key informant interviews and document reviews revealed that employers often need well-rounded graduates with both hard and soft skills obtained through education. Among the other things, they need employees with punctuality, motivation, and good work ethics; good communication skills; high commitment; hard work; being capable of managing his or her time; and being able to complete work assignments on time. Employers need graduates who can easily communicate, agree, and create a positive team spirit with others.

Nevertheless, there is inconsistency between existing literature and the acquisition of communication skills at higher learning institutes. While this study reported that engineering graduates are best equipped with communication skills at higher learning institutes, previous literature claims that such skills are least acquired at higher learning institutes. Both existing literature and this study indicated that teamwork, communication and collaboration skills, and the ability to work with people from different cultural backgrounds were indicators of interpersonal skills highly demanded in the engineering labor market.

For scholars Scholars (e.g., Ahmed, Philbin, & Cheema, 2020) argue that aspects of interpersonal skills, together with other skills, determine the success of graduates in the labor market. For instance, teamwork, communication skills, the ability to work with people from different cultures, and empathy were components of interpersonal skills highly required by employers (Collet and Hine, 2015). Contrasting a previous study by Getahun et al. (2020), engineering graduates of Ethiopian higher learning institutes better develop the ability to work in teams and communication skills than other skills. Nevertheless, according to the report from reviewed documents, graduates of Ethiopian higher learning institutes lack oral and written communication skills in English, a medium of instruction in higher learning institutions. Thus, higher learning institutes and employers properly identify interpersonal skills and integrate them into higher education curricular and extracurricular activities that positively contribute to engineering graduates' and organizational success.

Higher education supply and employers needs for indicators of generic skills like willingness to perform or commitment, sense of responsibility, and willingness to learn were found to be high. For scholars (e.g., Asai et al., 2020; Green, 2016), the acquisition of general skills will translate into higher earnings and is the key to personal employability and employment security in a competitive labor market. Nevertheless, loyalty to the institution and its objectives, the ability to assert oneself, determination, and self-confidence were acquired to a moderate extent but required to a very high extent by employers of engineering graduates. Supporting the findings of scholars (e.g., Kaushal, 2016; Pang et al., 2019), indicators of generic skills such as independence, creative thinking, leadership qualities, integrity, and innovativeness were moderately supplied by higher learning institutes but highly required by employers.

For scholars (e.g., Asai et al., 2020), individuals with stronger generic competences are more widely employed outside their own field of study and easily adapt to tasks and requirements with which they are not familiar. It has also been argued that the acquisition of general skills will translate into higher earnings in a competitive labor market (Asai, Breda, Rain, Romanello, & Sangnier, 2020). Thus, generic skills are core employability skills that are more or less equally required in all organizations and critical for graduate success in the labor market and organizational competitiveness. However, higher learning institutes in Ethiopia seemingly failed to identify these key employability skills to incorporate into curricular and extracurricular tasks in the current booming higher education enrollment, graduation, and unemployment rates. Such a mismatch between higher education skill supply and employers' skill need is an indication of inefficiency in the labor market that can hinder productive capacities, which generate unemployment and underemployment, harm organizational productivity due to lower output per worker, inflate average labor costs, affect firm-level profitability, and affect the capacity of enterprises to innovate and adapt to changing market conditions.

Poor learning facilities, lack of laboratory equipment; insufficient teaching resources; poor pedagogical centers (Abdulbasit & Seyoum, 2021); absence of student-centered learning; poor culture of continuous tutorials, worksheets, and feedback provision (Hunde & Tegegne, 2010); failure to address learners learning needs; lack of higher-order thinking skills (Tesfaye, Yitbarek & Tesfaye, 2010); negative attitudes toward science; negative academic self-concept, poor teachers' capacity (Negassa, 2014); difficulty of reorienting the educational system towards problem solving and critical-thinking approaches (Abate, Michael, Angel, 2021) are causes of students' poor achievement in STEM education. Persistent mismatch between demand and supply of skills among STEM graduates is the result of insufficient attention given to equip

learners with most aspects of discipline-specific, technical, interpersonal, and generic skills; weak university-industry linkage; inadequate use of IT in teaching and learning tasks; failure to properly identify competency-based curricula; weak organization of modules; domination of traditional teaching methods; low awareness of the world of work about the movement of HEIs towards competence-based curricula; and negligence of employability and other lifelong learning skills in higher education curricula.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to investigate higher education skill supply and employers' skill demand by focusing on Ethiopian engineering graduates. To achieve its objectives, the study sought answers to such basic questions as: to what extent do graduates of engineering from Ethiopian higher learning institutes acquire discipline-specific, technical, interpersonal, and generic skills? To what extent do employers of engineering graduates in Ethiopia need discipline-specific, technical, interpersonal, and generic skills? Do the skills needed by employers match those acquired at higher education institutions? Are there statistically significant mean differences between higher education supply and employers needs for discipline-specific academic skills, technical skills, interpersonal skills, and generic skills as reported by employees, employers, and instructors? It also tested the hypothesis that there are no statistically significant mean differences between higher education supply and employers needs for discipline-specific academic skills, technical skills, interpersonal skills, and generic skills, and that the skills needs of employers do not match the skills acquired at higher education institutions as perceived by employees, employers, and instructors.

Guided by a pragmatic world view, the current study employed an embedded design model of mixed method design (QUAN-qual). Both primary and secondary sources of data were used to secure the necessary information to address the basic questions and hypotheses of the study. Both quantitative and qualitative data were simultaneously collected, which helped the researcher provide firsthand information. Qualitative data was collected to support and provide additional information for quantitative data. While primary data was collected using survey questionnaires and interviews, secondary data was secured through the review of some policy

documents. The questionnaire comprised a Likert scale and had five parts: part one addressed the demographic background of the respondents; part two addressed academic and technical skills; part three addressed issues of technical skills; part four of the study questionnaire dealt with interpersonal skills; and part five assessed generic skills. From a total of 300 copies of questionnaires distributed to sample respondents, 260 questionnaires with an 87 percent return rate were duly filled out and returned.

A total of 260 respondents (90 employees, 40 employers, and 130 higher education instructors) were selected and took part in filling out the questionnaire prepared by the researcher. The respondents were mainly recruited from four public universities (Addis Ababa Science & Technology, Adama Science & Technology, Ambo & Jimma Universities), construction bureaux, road authorities, and electric utilities of Addis Ababa City Administration and Oromia National Regional State, and private companies capable of employing large engineering graduates (Etete Construction, Sunshine Construction, and Belayab Motors). All instructors of civil, electrical, and mechanical engineering departments and employees who took part in filling out the study questionnaires were selected using the probability sampling technique (simple random sampling), while employers were selected using the non-probability (purposive) sampling technique. Five interview guides were prepared and utilized for KIIs. A total of 15 key informant interviews were conducted with purposively college deans, policymakers and experts from the Ministry of Education, experts from the Ministry of Labour and Skills, team leaders from each construction and road authority bureau of both Addis Ababa City Administration and Oromia National Regional State, technical team leaders from BelayAB Motors, and construction supervisors from Etete and Sunshine construction companies. Some purposively selected policy and strategy documents, such as the Ethiopian Higher Education Road Map (2017), the

Education Sector Development Program (1997–2017), the Higher Education Proclamation (2009), the Education Policy and its Implementation (2003), and the National Employment Policy and Strategy (2009), were reviewed and consulted for the purpose of triangulation. While data collected using a questionnaire was analyzed using both descriptive statistics (frequency, mean, and standard deviation) and inferential statistics (paired sample t-test, one-way ANOVA, and multiple comparisons), qualitative data were thematically organized and categorized for which generalizations have been made. Lastly, the results from qualitative data were directly compared and merged with the results of quantitative data, from which conclusions and recommendations were drawn, as subsequently discussed hereunder:

5.1 Summary of the major findings of the study

5.1.1 Skills acquired during studies at higher learning institutes

For the purpose of this study, the researcher identified discipline-specific, technical, interpersonal, and generic skills. Findings related to levels of acquisition of these skills during studies at higher learning institutions are summarized as follows:

5.1.1.1 Levels of graduate acquisition of discipline-specific skills at higher learning institutes

Discipline-specific skills comprise the foundation of engineering, manufacturing, and construction, operation, measurement, and control technology, applying technical fields (technical sets, machine systems, installations, and connections), planning, design, calculation, and construction (product and process-oriented), quality control and quality assurance, safety, health, security, and the environment, applying knowledge of science and engineering principles, the skill of specific engineering disciplines, and the skill of application and practice. It was found

that skills in planning, designing, calculation, and construction, as well as skills in applying knowledge of science and engineering principles acquired to a high extent during studies at the university, had a mean value lying in between 3.41-4.20. Compared to skills in planning, designing, and calculation, engineering graduates acquire better skills in applying knowledge of science and engineering principles.

However, the vast majority of aspects of discipline-specific skills like foundation of engineering, manufacturing, and construction, operation, measurement, and control technology, applying technical fields (technical sets, machine systems, installations, and connections), quality control and quality assurance, safety, health, security, and environment, and skill of application and practice were acquired at a moderate level (mean = 2.62–3.4). Compared to the remaining moderately acquired aspects of academic skills, work place safety, health and security, and skill in specific engineering disciplines were among the least acquired skills across graduates of civil, electrical, and mechanical engineering (mean <3.00).

In addition to the mean and standard deviation used to identify levels of acquired academic skills, a one-way ANOVA test was used to test whether or not a statistically significant difference was found across employees, employers, and instructors in acquiring academic skills. The difference among employees, employers, and instructors of engineering graduates in acquiring academic skills was found to be statistically significant ($F = 7.654$; $p = 0.00$) at the 0.05 level of confidence. On the other hand, the multiple comparison test results computed to compare differences among groups revealed that the difference between employees and instructors in acquiring academic skills was also statistically significant (mean difference = ±0.19376; $p = 0.00$) at the $\alpha \leq 0.05$ level of confidence. However, there are no statistically

significant mean differences between employees and employers (mean difference =± 0.03722; p = 0.875) and employers and instructors (mean difference =±0.15654; p = 0.076) in acquiring discipline-specific skills.

5.1.1.2 Levels of graduates acquisition of technical skills during studies at higher learning institutes

In this study, technical skills include the skills of manipulating computers, planning and organizing tasks, solving problems, making appropriate decisions, scheduling and coordinating, seeking and developing opportunities, and professional skills. The study found that graduates of engineering disciplines (civil, electrical, and mechanical engineering) moderately acquire almost all aspects of the technical skills mentioned above (mean = 2.62–3.4). Skill in manipulating computers is the only technical skill acquired to a high extent (mean = 3.65) by engineering graduates during university studies. Compared to other moderately acquired technical skills, skills in seeking and developing opportunities, decision-making, and problem-solving skills were the least acquired during studies at Ethiopian higher learning institutes.

Based on one-way ANOVA test results, a statistically significant mean difference was found among employees, employers, and instructors in acquiring technical skills ($F = 11.145$; $p < 0.00$) at $\alpha \leq 0.05$ level of confidence. Similarly, based on a computed multiple comparison test to identify group differences, the difference between employees and instructors in acquiring technical skills was statistically significant (mean difference = ±0.28732; $\rho < 0.00$) at $\alpha \leq 0.05$. But no statistically significant differences were found between employees and employers (mean difference =± 0.13796; p = 0.267) and employers and instructors (mean difference =±0.14936; p = 0.181) in acquiring technical skills.

5.1.1.3 Levels of graduates acquisition of interpersonal skills at higher learning institutes

In this study, interpersonal skill is the third dimension of skill graduates of civil, mechanical, and electrical engineering disciplines are supposed to have in the current knowledge-driven economy. Interpersonal skills are believed to encompass the ability to work in a team, the ability to focus on stakeholders or clients' needs, the ability to work with people from different cultural backgrounds, skills in communication, interpersonal skills, empathy, adaptability, and flexibility. The finding revealed that aspects of interpersonal skills like teamwork and communication skills were acquired to a high extent (mean = 3.41 to 4.20) during studies at the university. In contrast, the ability to focus on stakeholders' or clients' needs, empathy, the ability to work with people from different cultures, and adaptability and flexibility skills were moderately acquired (mean = 2.62–3.4) during studies at t the university. Moderately acquired interpersonal skills, the ability to focus on stakeholders' or clients' needs, and empathy were the least acquired by graduates of engineering.

The one-way ANOVA test result revealed a statistically significant mean difference among employees, employers, and instructors in acquiring interpersonal skills ($F = 4.779$; $p = 0.01$) at $\alpha \leq 0.05$ level of confidence. Similarly, multiple comparison test results revealed that the difference between employers and instructors in acquiring interpersonal skills was statistically significant (mean difference = ±0.22143; $p = 0.017$) at $\alpha \leq 0.05$ level of confidence. However, there are no statistically significant differences between employees and employers (mean difference = ± 0.10714; $p = 0.416$) and employees and instructors (mean difference = ±0.11429; $p = 0.148$) in acquiring interpersonal skills.

4.1.1.4 Levels of graduates acquisition of generic skills at higher learning institutes

In this study, generic skills comprise creative thinking, willingness to learn, leadership qualities, integrity, willingness to perform or commit, sense of responsibility, innovativeness, determination, loyalty to the institution and its objectives, ability to assert oneself, and self-confidence.

The findings of this study revealed that willingness to learn, willingness to perform, commitment, and sense of responsibility were acquired to a high extent (mean = 3.41 to 4.20) during studies at Ethiopian higher learning institutes. Willingness to perform and commitment have been highly acquired, followed by willingness to learn and a sense of responsibility, respectively. However, creative thinking, leadership skills, integrity, innovativeness, determination, loyalty to institutions and objectives, the ability to assert oneself, self-confidence, and independence were moderately acquired (mean = 2.61-3.40) by engineering graduates during their studies at university. While moderately acquired generic skills, loyalty to an institution and its objectives are acquired better, innovativeness is the least acquired generic skill. The one-way ANOVA test result shows the existence of a statistically significant difference among employees, employers, and instructors in acquiring generic skills ($F = 7.602$; $p = 0.00$) at $\alpha \leq \leq .05$. Concomitantly, multiple comparison results revealed the existence of a statistically significant difference between employees and instructors in acquiring generic skills (mean difference = ± 0.21289; $p = 0.000$) at $\alpha \leq 0.05$ level of confidence.

5.1.2 Levels of employers/labor market needs for skills

This part of the dissertation presents major findings pertaining to employers/labor market needs in terms of academic, technical, interpersonal, and generic skills, as follows:.

5.1.2.1 Levels of employers need for discipline-specific skills

It was found that aspects of discipline-specific skills such as foundation of engineering, manufacturing and construction, operation, measurement and control technology, applying technical fields, planning, design, calculation, quality control and quality assurance, workplace safety, health and security, applying knowledge of science and engineering, and skill in specific engineering disciplines are highly required (mean = 3.41 to 4.20) among potential employers of engineering graduates. Applying knowledge of science and engineering, work place safety, health and security, and operation, measurement, and control technology were the most required academic skills (mean >4.0) by employers compared to the remaining aspects of discipline-specific skills (mean<4.0).

The one-way ANOVA test result revealed the existence of statistically significant mean differences among employees, employers, and instructors in the labor market that need to discipline specific skills ($F = 22.743$; $p \leq 0.001$ at α $\alpha \leq 0.05$ level of confidence). Similarly, the multiple comparison test result reaffirmed the statistically significant mean difference between employees and instructors (mean difference = ±0.53282; $p < 0.001$) and employers and instructors (mean difference = ±0.30115; $p = 0.017$) at $\alpha \leq 0.05$ 0.5 level of confidence in responding to labor market needs for discipline-specific skills. Nevertheless, there was no statistically significant mean difference between employees and employers (mean difference = ± 0.23167; $p = 0.112$).

5.1.2.2 Levels of employers needing technical skills

Except for the for the skill in computer manipulation that is reportedly required to a very high extent (mean = 4.35), all aspects of technical skills such as skill in planning and organizing tasks,

skill in solving problems, skill in making appropriate decisions, professional skills, and skill in seeking and developing opportunities are highly required among engineering graduates employing companies (mean = 3.41–4.20). In addition to computer manipulation skills, skill in solving problems, skill in making appropriate decisions, and skill in seeking and developing opportunities are the most required technical skills among engineering graduate employers. As to the one-way ANOVA test result, there was a statistically significant mean difference among employees, employers, and instructors in responding to labor market needs for technical skills ($F = 6.988$; $p = 0.001$) at $\alpha \leq 0.05$. Multiple comparison tests also revealed that the difference between employees and employers (difference $=\pm 0.30926$; $p = 0.036$) and employees and instructors (mean difference $=\pm 0.30413$; $p = 0.002$) is statistically significant in responding to levels of labor market needs for technical skills at $\alpha \leq 0.05$ level of confidence.

5.1.2.3 Levels of employers need for interpersonal skills

Teamwork skills are reportedly required to a very high extent by employers of engineering graduates (mean = 4.34). It is the most required interpersonal skill among employing companies. Similarly, aspects of interpersonal skills such as the ability to focus on stakeholders' or clients' needs, working with people from different cultures, empathy, communication skills (both written and verbal), adaptability, and flexibility were highly required. Next to teamwork, written and verbal communication skills, empathy, and the ability to work with people from different cultural backgrounds were the most required interpersonal skills among engineering graduates employing companies (mean > 4.00), while adaptability and flexibility were the least required (mean < 4.00).

A one-way ANOVA was used to compare differences across employee, employer, and instructor respondents in acquiring interpersonal skills. Its output shows a statistically significant mean difference among employees, employers, and instructors ($F = 20.904$; $p < 0.00$). The multiple comparison test results also showed statistically significant mean differences between employees and employers (mean difference = ±0.37421; $p < 0.00$) and employees and instructors (mean difference = ±0.46569; $p < 0.00$) at $\alpha \leq 0.05$ level of confidence. However, there was no statistically significant difference between employers and instructors (difference = ± 0.09148; $p = 0.637$) in labor market needs for interpersonal skills.

5.1.2.4 Levels of required generic skills

It was found that generic skills such as loyalty to an institution and its objectives, the ability to assert oneself, and self-confidence are required to a very high extent by employers (mean = 4.21–5.00). Loyalty to an institution and its objectives was the most required of all generic skills among employers of civil engineering graduates. Similarly, creative thinking, willingness to learn, leadership skills, integrity, willingness to perform/commitment, sense of responsibility, innovativeness, and determination are generic skills highly required by employers next to the above three aspects (mean = 3.41-4.20). Ability to work independently is the only generic skill required by employers at a moderate level (mean<3.4). One-way ANOVA output showed a statistically significant mean difference among employees, employers, and instructors ($F = 6.654$; $p = 0.00$) in employers needing generic skills. The difference between employees and instructors was statistically significant in labor market needs for generic skills (mean difference = ±0.27087; $p = 0.002$) at $\alpha \leq 0.05$ level of confidence. But no statistically significant difference was found between employees and employers (mean difference = 0.24907; $p = 0.066$) or employers and instructors (mean difference = 0.02179; $p = 0.977$).

The qualitative study found that employers often need all-rounded qualified graduates in both hard and soft skills that they obtained through education. Among other things, they need employees with punctuality, motivation, good work ethics, good communication skills, high commitment, are hardworking, capable of managing their time, and are able to complete work assignments on time. Employers in engineering want graduates who can easily communicate, agree, and create positive team spirit with others. In terms of hard skills, employers want academically competent graduates with sufficient knowledge in their field of study and subject matter. Despite employers gearing towards looking for practical skills rather than theoretical knowledge, different positions in an organization require different kinds of soft skills. But technical skills are believed to be required in all organizational positions, with varying types and degrees.

However, graduates of the three sample departments have no such knowledge and skills. They often lack soft skills like motivation, punctuality, interest, and communication skills (written and verbal communication skills), teamwork skills, integrity, leadership skills, and computer skills (computerized programming and software designing skills). As a result, employers invest in on-the-job training to equip employees with hard and soft skills. In most employing organizations, the types of skills required are identified at working departmental levels and reported to human resource offices. In both government and private organizations, written and practical exams during employment processes are used to identify the hard skills, while interviews are used to assess the soft skills that applicants have to achieve success in the world of work.

5.1.3 The difference between skills acquired at higher learning institutes and skills required by employers or the labor market

A paired sample t-test was computed to test the mean difference between skills acquired at higher learning institutes and those skills required by employers or the labor market. Based on employees, employers, and instructors responses, there was a statistically significant mean difference between skills acquired at higher learning institutes and the mean of employers' need for the same skills ($P<0.001$; $\alpha \leq 0.05$). The mean difference was highest for instructors (mean = 0.98590), followed by employers (mean = 0.85239), and lowest for employees (mean = 0.58816). Thus, the mean responses of employees, employers, and instructors revealed a significant mismatch between skills supplied by higher learning institutes and those required by employers in the Ethiopian context.

5.1.3.1 Comparison of means of each acquired and required skill

The Paired sample t-test was mainly used to test the existence of statistically significant differences between each skill acquired at higher learning institutes and required by employers. The mean differences of all four types of skills show the existence of wider gaps between the supply of these skills in higher education and the needs of employers for the same skills.

5.1.3.1.1 *Mean difference between acquired and required discipline-specific skills*

The mean of required discipline skills was higher than the mean of acquired discipline-specific skills. This indicates that there was evidence of a statistically significant mean difference between acquired and required discipline-specific skills (mean =0.74346; S.D. =0.68469; t = 17.509; $\rho<0.00$) at $\alpha \leq 0.05$ level of confidence. aspects of discipline-specific skills, skills in application and practice; work place safety, health, and security; applying knowledge of science

and engineering; skills of specific engineering disciplines; operation, measurement, and control technology; and the foundation of engineering were more highly required by employers than other aspects of the same skills. Despite the higher need of employers for academic skills, the higher education supply of graduates with the same skill was not at the required level. However, the gap between labor market needs and higher education supply of academic and technical skills (mean = 0.743460) was narrower than the gaps between higher education supply and labor market needs of generic skills (mean = 0.87019) and technical skills (mean = 0.84551).

5.1.3.1.2 The mean *difference between acquired and required technical skills*

Analysis of the descriptive statistics shows that all aspects of technical skills were moderately acquired during studies at higher education institutions but highly required by employers. The gap between acquired and required technical skills was the second-widest (mean difference =0.84551) next to generic skills (mean difference =0.87019). Similarly, the difference between technical skills acquired at higher learning institutes and the needs of employers for the same skills was statistically significant (mean difference =0.84551; SD = 0.74935; t = 18.194; $\rho<0.00$) at $\alpha\leq0.05$ level of confidence.

5.1.3.1.3 The mean *difference between acquired and required interpersonal skills*

This study found that all aspects of interpersonal skills acquired at a moderate level during study at higher learning institutes are highly required by employers. The difference between required interpersonal skills (mean = 4.1126) and acquired interpersonal skills (mean = 3.3742) was statistically significant (mean difference =0.73846; S.D. = 0.70616; t = 16.682; $\rho<0.001$) at the $\alpha\leq0.05$ level of confidence. However, the mean difference between required and acquired

interpersonal skills was smaller (the narrowest gap) compared to the remaining three types of skills (academic, technical competence, and generic skills).

5.1.3.1.4 The mean *difference between acquired and required generic skills*

Compared to other types of skills, the gap between acquired and required skills was widest for generic skills. Aspects of generic skills were moderately acquired at higher learning institutes but highly demanded by employers. Similarly, the paired sample t-test shows a statistically significant mean difference between generic skills acquired at higher learning institutes and those required by employers or the labor market (mean difference = 0.87019; S.D. = 0.72386; t = 19.384; $\rho<0.001$) at e $\leq$0.05 level of confidence.

Key interview participants argued that education and training equip learners with skills that help them achieve their job aspirations and enhance the quality, quantity, and demand of industrial products in both the formal and informal sectors. It contributes to the achievement of graduates' life goals and aspirations if and only if it is based on their needs and talents, targeted at actual skill gaps in the workplace, and focused on practical skills rather than theoretical knowledge. It was argued that knowledge and skills acquired through education help youths identify their talents and areas of interest in jobs and businesses.

Despite recent changing attitudes, most Ethiopians consider education the only means and way to get employment opportunities in government sectors. However, education and skills training do not take the needs of the labor market into consideration. The contribution of access to education and skill training for success in employment is insufficient because employees in both formal and informal careers do not get training that is based on their interests and labor

market needs. Graduates are failing to benefit from the existing education and training system and policies.

Hence, there are wider gaps between higher education and the labor market in terms of skills and competencies. Most graduates lack employability skills like communication skills, entrepreneurship skills, computer skills, and leadership skills. Graduates of higher learning institutes lack psychological, emotional, and social maturities, intellectual skills, language skills, both verbal and written communication skills, accountability, readiness and motivation to learn new things, a feeling of belongingness, technical and practical skills, discipline, and life skills. New applicants often do not have basic concepts of the area they are applying for or technical things related to the work they are going to do. They need close supervision to finish their work assignments and lack practical skills due to insufficient practical attachment during studies at higher learning institutes.

Therefore, graduates of Ethiopian higher learning institutes need to be equipped with both soft skills and hard skills that match labor market needs. Among other things, youth need entrepreneurship skills, business planning skills, leadership skills, decision-making skills, coordination and collaboration skills, financial management skills, communication skills, innovativeness, conflict management skills, time management skills, customer handling skills, computer and IT skills, and the skill to access their own talent. Recently, computer-related technologies have influenced global systems of business communication. In order to adapt to the current technological era, learners in higher education are supposed to be equipped with computer sandboxes.

5.2 Conclusions

This study investigated the higher education skill supply and employers' skill demand in Ethiopia, focusing on engineering graduates. The findings disclosed wider mismatches between levels of higher education supply and labor market needs for indicators of discipline specific, technical, interpersonal, and generic skills. While higher education moderately equips engineering graduates with the majority of indicators of these skillsets, labor market needs for the same skills remain high. The gap between the higher education skill supply and labor market need was widest for generic skills, followed by technical skills and interpersonal skills, but narrowest for discipline-specific skills. The study further disclosed that employees, employers, and instructors have different views related to graduates' acquisition and employers' need for all types of skills under scrutiny. While employers and instructors believe that engineering graduates moderately acquire technical skills, employees believe that higher learning institutes well equip graduates with the same skill. For employers and instructors, technical skills are highly required in the engineering graduate labor market. Similarly, paired sample t-test results depicted a statistically significant mean difference between higher education supply and the labor market (employers' need for discipline-specific, technical, interpersonal, and generic skills as reported by employers, employees, and instructors). Such mismatch could also hinder productive capacities, generate unemployment and underemployment, inflate average labor costs, affect firm-level profitability, and affect the capacity of enterprises to innovate and adapt to changing market conditions, impacts workers or firms that are currently employing or looking to employ workers, compromises firms' productivity, quality, and competitiveness, results in higher wages, increases recruitment costs, requires more investment in current personnel, results in market losses, implies a greater workload and pressure on current personnel, may result in lower

company competitiveness, and prevents investments in and the development of knowledge-intensive and innovative industries, which hamper economic growth, competitiveness, and innovative capacity at the macroeconomic level. The identified skill mismatch positively influences the quality and effectiveness of STEM education by informing the need to design viable strategies to mitigate the prevailing negative attitudes towards STEM education, reform the existing curricula to make science and engineering more accessible and attractive, improve the learner-centered teaching approach, force the government to allocate sufficient budget to equip science and technology laboratories, libraries, and workshop rooms with equipment, and strengthen public-private partnerships between industry, primary and secondary schools, and tertiary institutions. It also strengthens the focus on the expansion of science and technology institutions to produce highly qualified technicians, engineers, and scientists in line with the demands of the national economy. It pinpoints the need for higher education to conduct real practical training in cooperation and collaboration with industries and evaluate whether or not the existing competency-based curriculum emphasizes professional and vocational skills, job-specific skills, and transferrable skills that higher education graduates need for labor market entry.

Recommendations

Based on the major findings and conclusions drawn, the study makes the following recommendations:

1. The government should give special attention to education quality rather than graduates' quantity because education quality has declining with an increasing number of graduates.
2. The current volatile labor market requires frequent assessment of skills capable of meeting its demand. Training institutions should produce competent graduates that meet the new market demand. To produce competent graduates, these institutions should conduct frequent needs assessments and update their training styles according to the needs of the labor market.
3. There should be a high attachment between industry and universities (training institutes). The training institutes should expose students to an outside working environment that could enhance their practical skills. The government should prepare a law that requires private organizations to link with universities and invite learners' work-based learning and practice.
4. The training should consider the maturity and ability levels of the learners and be directly linked to fields of specialization. Education and training institutes should shift the priority from theoretical knowledge to practical work-related skills that meet the needs of employers. The training should also include how to solve problems if any occur in their field of specialization in the real world of work.

5. Designing and implementing project-based and problem-oriented project-based learning to promote students' creativity and innovative, critical, and analytical thinking for future employment prospects should get prime priority in higher education.
6. Employers need employees with diversified knowledge and skills that fit different positions. Universities should conduct empirical research on the skill gap employees have in different firms and organize on-the-job training to solve those problems. They are expected to incorporate soft skills training like communication skills and work ethics into the training curriculum to enhance graduates' competencies in the world of work.
7. The government should ensure that the skills of university graduates align with what the labor market and employers need. It should supervise the number of graduates who graduated in the specific field and how much they are needed in the labor market.
8. Education policy should be modified in a way that helps students create their own work rather than waiting to be employed by government and private companies.
9. Future research should focus on the skills employees acquire at work through experience and the factors that contribute to the mismatch between the supply of higher education skills and labor employers' needs by including prospective graduates in sample selection.

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APENDIX A

Addis Ababa University
College of Education and Behavioral Studies
Department of Educational Planning and Management

Study questionnaire

I am Asmera Teshome Negeri, a PhD Candidate in Educational Policy and Leadership at Addis Ababa University. Currently, I am conducting a Doctoral Dissertation titled " Higher education skill supply and employers skill need: a study on Ethiopian engineering graduates." You are being requested to participate in this research project because you are believed and trusted to provide realistic and dependable data. You were selected by chance because your participation in answering the study questions plays key role for the success of the study objectives.

The results of this survey will be valuable for the management of higher education institutions, students, graduates, university teachers, the management of hiring companies, planners and policy makers, parents and the community at large to understand the competences and skills graduates acquire at higher education and the actual skills required in the labor market of the contemporary knowledge driven economy.

The researcher assures you that your replies will be used only in the framework of this research project. Your identity and responses will be kept confidential, which means the researcher will remove anything that could identify you as taking part in this study, such as names and place of work.

Contact Address: *Asmera Teshome Negeri, PhD candidate, phone number, 0917158943, email address:ateshomenegeri99@gmail.com; Dr. Jeilu Omar (Associate Profeessor), Addis Ababa University (Internal Supervisor), Phone number, 0929366787, email, ohjeilu@ymail.com; Dr. Paula Mahlck (Associate professor), Stockholm University, Sweden (External Supervisor), email, paula.mahlck@edu.su.se*

Part one: Background of the respondent

1. Sex: 1. Male 2. Female
2. Level of education: 3. BSc. 4. MSc.
3. Field of study (specialization): 1. Civil engineering 2. Mechanical engineering
   3. Electrical engineering 4. Other
4. Respondent type
   1. Employee 2. Employer 3. Instructor
5. Where you are currently working?
   1. In the head office/ central unit of the company/ organization
   2. A branch the company/ organization
6. For how long you served in this organization or company?
   1. 1-5 years 2. 6-10 years 3. 11-15 years 4. 16-20 years 5. Above 20 years

Part Two: Academic skills

Questionnaire under this part is designed to identify the extent to which academic skills acquired at higher learning institutes and required by employers. Please, indicate the extent to which the following academic skills are acquired by graduates and required by employers using five point likert scale (1= Not at all, 2= little, 3= Moderate, 4= To High extent, 5= To very high extent).

Acquired					Academic skills	Required				
1	2	3	4	5		1	2	3	4	5
					Foundation of Engineering					
					Manufacturing and construction					
					Operation, measurement and control technology					
					Applying technical fields (technical sets, machine systems, installations and connections)					
					Planning, design, calculation and construction (product and process oriented)					
					Quality control and quality assurance					
					Safety, health, security and environment					
					Applying knowledge of Science and engineering principles					
					Skill in specific engineering discipline					
					. Skill in application and practice					

7. If there are others, please, list and specify the extent to which they are required and acquired

_____

_____

_____

Part Three: Technical skills

Questionnaire in the following table aims to assess technical skills acquired at higher learning institutes and that required by employers. Please, indicate the extent to which the following technical skills are acquired by graduates and required by employers using five point likert scale (1= Not at all, 2= Little, 3= Moderate, 4= To High extent, 5= To very high extent).

Acquired					Technical Skills	Required				
1	2	3	4	5		1	2	3	4	5
					. Computer skills					
					. Planning and organizing tasks					
					. Problem solving skills					
					. Decision making					
					. Professional skills					
					. Skills of seeking and developing opportunities					

8. If there are others, please, list and specify the extent to which they are required and acquired

_____

_____

Part Four: Interpersonal skills

Questionnaire in the following table aims to assess interpersonal skills acquired at higher learning institutes and that required by labor market. Please, indicate the extent to which these skills are acquired by graduates and required by employers using five point likert scale (1= Not at all, 2= Little, 3= Moderate, 4= To High extent, 5= To very high extent).

Acquired					Interpersonal skills	Required				
1	2	3	4	5		1	2	3	4	5
					. Team work					
					. Client/ stakeholders focus					
					. Working with people from different cultural backgrounds					
					. Communication skills					
					. Interpersonal skill					
					. Empathy					
					. Adaptability and flexibility					

9. If there are others, please, list and specify the extent to which they are required and acquired

_____

_____

_____

_____

Part Five: Generic skills

Questionnaire in the following table aims to assess generic skills acquired at higher learning institutes and that required by labor market. Please, indicate the extent to which these skills are acquired by graduates and required by employers using five point likert scale (1= Not at all, 2= Little, 3= Moderate, 4= To High extent, 5= To very high extent).

Acquired					Generic skills	Required				
1	2	3	4	5		1	2	3	4	5
					. Creative thinking					
					. Willingness to learn					
					. Leadership qualities					
					. Integrity					
					. Willingness to perform					
					. Sense of responsibility					
					. Innovativeness					
					. Determination					
					. Loyalty to institution and its objectives					
					. Ability to assert oneself					
					. Self confidence					
					. Independence					

10. If there are others, please, list and specify the extent to which they are required and acquired

_____

_____

_____