IMPROVING DETERMINANT FACTORS TO FACILITATE CONSTRUCTION INDUSTRY DEVELOPMENT IN ETHIOPIA

Thesis

Submitted in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

DESALEGN GIRMA MENGISTU

Under the Guidance of

Dr. GANGADHAR MAHESH

DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA,

SURATHKAL, MANGALORE – 575 025

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D E C L A R A T I O N

I hereby declare that the Research Thesis entitled **"Improving Determinant Factors to Facilitate Construction Industry Development in Ethiopia"** which is being submitted to the National Institute of Technology Karnataka, Surathkal in partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy in Civil Engineering, is a bonafide report of the research work carried out by me. The material contained in this Research Thesis has not been submitted to any University or Institution for the award of any degree.

Desalegn Girma Mengistu
Register No.165084CV16F07
Department of Civil Engineering
NITK, Surathkal

NITK, Surathkal
August 14, 2019

C E R T I F I C A T E

This is to certify that the Research Thesis entitled **"Improving Determinant Factors to Facilitate Construction Industry Development in Ethiopia"** submitted by Mr. Desalegn Girma Mengistu (Register Number: 165084CV16F07) as the record of the research work carried out by him, is accepted as the Research Thesis submission in partial fulfilment of the requirements for the award of degree of Doctor of Philosophy.

Dr. Gangadhar Mahesh
Research Guide
(Signature with date and seal)

Chairman - DRPC
(Signature with date and seal)

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ABSTRACT

Facilitating construction industry development is important to maximize its contribution to national development. It is even much more important in developing countries considering that higher portion of their annual budget goes for infrastructure development and the industry faces more challenges. This study has focused on developing improvement frameworks for manpower development, enhancing competitiveness and harmonized industry practice which were identified as recurring factors affecting Ethiopian construction industry so as to facilitate development of the industry. The objectives set include understanding the factors (their nature and interrelationship with the business environment), challenges of the industry, improvement of the factors and key performance indicators for monitoring and tracking the improvement.

The study first developed a conceptual framework and categorized the variables affecting the determinant factors based on their presumed sources. Mixed methods approach was adopted for data collection. Quantitative data was collected through questionnaire survey while semi-structured interview and document analysis were used to obtain the qualitative data. The findings indicate that the factors and characteristics of the business environment are mutually interdependent. The major challenges identified from their respective sources were; construction industry development policy implementation and corruption from role of government, weak capacity of contractors and consultants from resource related variables, lack of collaboration and professionalism from nature of the industry and lack of benchmarking construction industry development practice from industry's vision for development. Based on the improvement assessment of the factors, improvement frameworks and key performance indicators were developed. It was found that improvement of the industry needs strengthening the existing institutions for effective coordination, aligning the applicable regulatory tools with industry specific development strategies and establishing some implementation systems. Though the study focus is context specific the findings could be extended to other similar developing countries.

Keywords: construction industry, construction industry development, business environment, manpower development, enhancing competitiveness, harmonized industry practice

TABLE OF CONTENTS

LIST OF TABLES

Table No. **Title** **Page No.**

LIST OF FIGURES

ACRONYMS

BE	Business Environment
CI	Construction Industry
Ci3	Construction Industry Institute India
CIB	International Council for Building
CIC	Construction Industry Council
CID	Construction Industry Development
CIDB	Construction Industry Development Board
CII	Construction Industry Institute
CIRC	Construction Industry Review Committee
ECPMI	Ethiopian Construction Project Management Institute
FDRE	Federal Democratic Republic of Ethiopia
GDP	Gross Domestic product
GTP	Growth and Transformation Plan
HRM	Human Resource Management
IT	Information Technology
ILO	International Labor Office
KPIs	Key Performance Indictors
MoC	Ministry of Construction
MoFED	Ministry of Finance and Economic Development
MUDC	Ministry of Urban Development and Construction
NPC	National Planning Commission
PASDEP	A Plan for Accelerated and Sustained Development to End Poverty
SPSS	Statistical Package for the Social Sciences
WEF	World Economic Forum

CHAPTER 1

INTRODUCTION

This chapter presents background of the study, problem statement, objectives of the research, scope of the study, its significance and provides an overview of the thesis.

1.1 Background

The construction industry (CI) contributes to national development through its contribution to Gross Domestic Product (GDP), backward linkages to other industrial sectors, direct demand for labor and contribution to national capital formation (ILO 1987). It affects and is affected by the economy (Hillebrandt 1985) and there is a cyclic relationship between them (Ofori 1980). This relationship and its linkage with different sectors of the economy indicate its multiplier effect on socioeconomic development. Despite having these importance, the industry has an unimpressive record in terms of performance (WEF 2016) and it suffers from a negative image (Rameezdeen 2007).

The industry faces multifaceted challenges confronting its performance and development. Although, challenges faced by CI vary in nature and extent in different contexts, no country is free of major problems (Ofori 1980). To overcome these challenges and improve the performance of the CI, different nations have taken different initiatives (Egan 1998; ISR 1999; C21 1999; CIRC 2001; PSIB 2004; Ci3 2016). While the nature of the determinant factors and objectives of those initiatives vary depending on the local context they faced, the ultimate aim was to improve the performance and development of the industry. This was to be achieved by improving the determinant factors, thereby maximizing CI's contribution to national development.

CI comprises of government, consultants, clients, contractors and the supply chain involved in the process of construction works. These wide segments of the industry and the ever-changing requirements of improvement make management of

construction industry development (CID) challenging. According to CIB TG29 (1998), CID is "a deliberate and managed process to improve capacity and effectiveness of the CI to meet the national economic demand for building and civil engineering products and to support sustained national economic and social development objectives". This needs understanding the industry and devising improvement mechanisms that suit the context.

1.2 Problem Statement

Most construction management studies focus on project and organization level issues. These studies indicate performance of the project/organization in their particular focus area. However, some recommendations given as solutions are not efficient because their implementation calls for coordinated effort of parties or the industry at large which is beyond their focus area. Hence, industry level studies are necessary to give integrated solutions to problems arising at different levels. Industry level studies will help to understand nature of the problems, their extent and interrelationship.

Even though CI of all countries face problems, the challenges and problems of developing countries are different in that developing countries face industry specific challenges alongside the general socioeconomic stress, chronic shortage of resources, institutional weakness and inability to handle key issues (Ofori 2000). Therefore, the importance of promoting CID with integrated solutions for problems arising at different levels is much higher in developing countries. Ethiopian CI also faces different challenges that impede its development like most developing countries (Mengesha 2004). This has resulted in growing concerns for improvement of CID (MUDC 2013a). In supporting this growing concern, it is important to identify and understand the determinant factors to indicate potential intervention areas and suggest the way forward.

Factors affecting CID are identified by reports of different CID initiatives and seminal researches in the area and are discussed in detail in Chapter 2. These factors are; manpower development, enhancing competitiveness, harmonized industry practices, sustainable investment in the industry, capturing alternative markets and industry performance measurement practices. With the aim of identifying the persisting factors

in Ethiopian CI three national plans; A Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2005/6-2009/10), Growth and Transformation Plan I (GTP I) (2009/10-2014/15) and GTP II (2015/16-2019/20) were reviewed and the review has indicated that the recurring major themes are related to manpower development, enhancing competitiveness and harmonized industry practice. In addition, it was also found that the three plans lack continuity. However, as the development trends of different country's CI indicates, performance improvement requires long period of time (Wolstenholme 2009; Ofori et al. 2011). Requirements of improvement initiatives take different form depending on the time scale under consideration (Ofori 1980; Fox 2003). Hence, it has to be planned for long period of time with clear targets and there has to be continual performance measurement and improvement practice.

Facilitating development of the industry by improving the determinant factors requires: (1) understanding the determinant factors, (2) understanding challenges of the industry and (3) assuring sustainable improvement. These help to capture specific trends as well as current opportunities and constraints which enable and impede performance and development of the industry. These lead to the following key research questions:

- What is the relationship between the recurring factors affecting development of the construction industry?
- What are the challenges of Ethiopian construction industry affecting its development?
- How to create and sustain continuous improvement of recurring factors to facilitate development of the industry?

1.3 Research Objectives

The aim of this research is to develop improvement frameworks for recurring factors affecting Ethiopian construction industry and propose measurement metrics so as to facilitate development of the industry. With this as major aim, the following specific objectives were set:

- To understand factors affecting construction industry development (nature, interdependence and interrelationship with the business environment)
- To develop a conceptual framework to improve the business environment for construction industry development
- To identify challenges of construction industry development in Ethiopia
- To develop frameworks for improvement of manpower development, enhancing competitiveness and harmonized industry practice to facilitate development of Ethiopian construction industry
- To develop key performance indicators for monitoring and tracking improvement of manpower development, enhancing competitiveness and harmonized industry practice

1.4 Research Scope

The research mainly focuses on three determinant factors affecting CID; manpower development, enhancing competitiveness and harmonizing industry practice. The fourth, industry performance measurement practice is considered as integral part of CID; hence it was one objective of the research. As the factors are interrelated, the remaining two factors, sustainable investment in the industry and capturing alternative markets, are also discussed indirectly elsewhere. It is obvious that improvement of factors will improve performance of the industry. However, given time and data constraints, the research has delimited studying performance of the industry in terms of output; productivity, cost, quality, safety issues, etc. to be beyond its scope. The research has addressed wide range of relevant issues associated with the three determinant factors such as:

- Role of academic institutes in manpower development
- Role of the industry organizations (HRM practices) in manpower development
- Construction management practices in the industry
- Application of Information Technology (IT) in the industry
- Technology development in the industry
- The role of trade and professional associations for CID
- Regulatory system in the industry

1.5 Significance of the Research

Outputs of this study are nature of the factors, the current challenges of the industry, status of the determinant factors (the perceived improvement requirement level), improvement framework and key performance indicators (KPIs) for measuring the improvements. These outputs will indicate the concerned stakeholders their part in improvement of the industry performance: (i) for government as a regulator, promoter and major client it will indicate priority areas of intervention, (ii) for industry organizations, especially contracting and consulting firms, it will inform how to exploit the benefits out of interventions and how to improve their current competitiveness, and (iii) for academic and research institutes it will indicate potential areas of improvement in delivering manpower and also indicate areas requiring further research. While all these are specific to Ethiopian CI, they are transferable with contextualization to other countries.

In addition to its contextual contribution, this study adds value to the area of CID, specifically construction in developing countries, as an additional case study. The classification and dimensions of the factors adopted, e.g. the practices and the facilitating institutional systems under one heading 'harmonized industry practice', and three dimensions of 'manpower development'; role of government, academic institutions and the industry organizations will simplify understanding of the factors and prioritization for critical intervention. Similarly, understanding the relationships also has similar benefit for appropriate interventions.

1.6 Overview of the Thesis

The outline of this thesis report is as follows:

Chapter 1: Introduction

This chapter introduces background of the study, problem statement, objectives of the research, scope of the study and its significance.

Chapter 2: Literature Review

This chapter presents review of literature on factors affecting CID and concept of business environment. In addition, major problems and recurring factors in Ethiopian CI are highlighted.

Chapter 3: Conceptual framework

This chapter presents two separate frameworks and hypotheses on relationship of the research constructs. The first framework shows the adopted view of this study that summarizes the relationship of the factors and interrelationship between the factors and the business environment. The second indicates the conceptual framework to improve the business environment for CID.

Chapter 4: Research Methodology

In this chapter, the adopted research approach is discussed in relation with the research objectives. Mixed methods approach is adopted for data collection. Quantitative data is collected through questionnaire surveys, while semi-structured interviews and document analysis are used to obtain the qualitative data. Justification on the adopted research approach is outlined and subsequently discussion is given on validity of the adopted research design.

Chapter 5: Challenges of Construction Industry

In this chapter, challenges of the industry are identified through analysis of survey responses, relevant documents and interview transcripts. Major challenges identified from the survey analysis are: (i) CID policy implementation and corruption, (ii) weak capacity of contractors and consultants, (iii) lack of collaboration and professionalism and (iv) lack of benchmarking CID practice from role of government, resource related variables, nature of the industry and industry's vision for development respectively. In the document analysis part, gaps and overlaps in powers and duties of the statutory bodies and the shortfalls in regulatory tools are discussed. Findings from analysis of interview transcripts is used to supplement discussion and as a means of triangulating the survey findings.

Chapter 6: Factors and Characteristics of the Business Environment

In this chapter, relationship among the factors, among characteristics of the business environment, between the factors and characteristics of the business environment and among the different sources of variables affecting the factors are identified through analysis of the survey responses. Findings indicate that there is significant correlation between the factors and characteristics of the business environment. It is also found that there is significant correlation among the factors and among characteristics of the business environment.

Chapter 7: Status and Improvement of the Determinant Factors

In this chapter, assessment of the required improvement level of the three factors is conducted through analysis of survey responses and interview transcripts. In the survey analysis, assessment of improvement requirement level of the factors is conducted under different dimensions: manpower development is assessed under the role of government, academic institutions and the industry organizations. The dimensions of enhancing competitiveness are: technical capacity, financial capacity and management practice of the industry organizations. Harmonized industry practice has two aspects: the practices and facilitating institutional systems. The practice areas assessed are technology development and IT application (where management practice is considered under enhancing competitiveness), and facilitating institutional systems were regulatory system and institution building (involvement of trade and professional associations). The assessment shows that there is room for improvement in all aspects in all the factors.

Chapter 8: Improvement Frameworks and Key Performance Indicators

This chapter covers improvement frameworks for the respective factors and the KPIs for monitoring and tracking the improvements. The proposed framework for manpower development shows improvement mechanisms to produce competent entry level professionals and maintain competence of the experienced professionals for development of the industry. The proposed framework for enhancing competitiveness shows the role of the firms and the government. The last framework indicates the roles of the facilitating institutional systems to improve efficiency and effectiveness

of practices in the industry. Based on proposed improvement frameworks and considering the relevance, 19 KPIs are proposed to measure improvement of the factors, and the business environment.

Chapter 9: Conclusions and Recommendations

This chapter presents conclusions of the study. It also delineates implications and limitations of the study together with scope for further studies.

CHAPTER 2

LITERATURE REVIEW

This chapter presents review of literature on factors affecting CID, concept of business environment in relation to CID and major issues faced by Ethiopian CI. While the review presented here primarily focuses on understanding the factors, additional literature in terms of management practices and KPIs is presented elsewhere in appropriate chapters.

2.1 Factors Affecting Construction Industry Development

Factors affecting CID have been widely researched and classified by way of seminal researches and development initiatives (Ofori 1980; Egan 1998; ISR 1999; C21 1999; CIRC 2001; PSIB 2004; Ci3 2016). These are summarized in Table 2.1. The differences in different jurisdictions and/or perceptions of researchers in terms of the classification of factors are mainly the contextual definition given to the factors. The different nomenclatures are: improvement measures (CIRC 2001), contributing factors (Fox 2003), drivers of change (Egan 1998), strategic thrust areas (C21 1999), etc.

The target objective in a particular context has influence on the definition and classification of the factors. The difference could be in extent of level of improvement requirement and/or in terms of scope. For example, as observed in Table 2.1, importance of manpower development as a factor affecting CID is indicated in one way or another in all of the studies and initiatives, the difference lays in the description given to express it, for example, in Ofori (1980) it is indicated as manpower development, in Business Roundtable (1983) as plugging the gaps in training and education, in ISR (1999) as training and skill development, in CIRC (2001) as nurturing professional workforce, in C21 (1999) as rising skills level and in Ci3 (2016) as human capital and productivity. Similarly, improving industry practices is indicated with differences in description as improving industry practice and

techniques (C21 1999), promotion of IT application (ISR 1999), efficient, innovative and productive industry (CIRC 2001), technology development (Ofori 2015) and adoption of new technologies, materials and tools (WEF 2016).

Analysis and synthesis of the factors indicated in the table to account for similarities, antecedents and precedents etc. whittled down the factors affecting CID to: (i) manpower development, (ii) enhancing competitiveness, (iii) harmonized industry practice, (iv) sustainable investment in the industry, (v) capturing alternative markets and (vi) industry performance measurement practice. This does not mean that other factors are excluded from consideration. They are variables which affect one or more of these determinant factors as indicated in subsequent sections.

Table 2.1 Summary of factors affecting construction industry development as identified by different researches/ reform initiatives

(Ofori 1980) Strategies (Developing countries: Ghana)	(Ofori 2015) Components of CID (Developing countries)	(Business Roundtable 1983) What needs to be done (strategies) (USA)	(Aniekwu 1995) Factors affecting CI (Nigeria)	(Egan 1998) Drivers of change (UK)
1. Economic growth and stability 2. Government recognition 3. Planning demand 4. Revision of Procedures, codes and documents 5. Development of Materials 6. Manpower development 7. Adoption of appropriate Technology 8. Contractors development	1. Technology development 2. Corporate development 3. Institution building 4. Materials development 5. Human resource development 6. Documentation, procedures and practices 7. Operating environment	1. Sharpening management's tools and techniques 2. Plugging the gaps in training and education 3. Harnessing research and technology 4. Maximizing worker productivity 5. Lifting government involvement	1. Contracting and contract administration practices 2. Business environment of the construction industry 3. Capacity and efficiency of the contractors; 4. Capable institutions to cater for the progress of the industry 5. Research and Development	1. Committed leadership 2. A focus on the customer 3. Integrated processes and teams 4. A quality driven agenda 5. Commitment to people
(ISR 1999) Action Agendas (Australia)	**(C21 1999) Strategic thrust area (Singapore)**	**(CIRC 2001) improvement measures (Hong Kong)**	**(CII 2008) Strategic directions (Hong Kong)**	**(Fox 2003) Factors facilitating CID *(International)***
1. Innovation and research 2. Promotion of IT application 3. Regulation and standards 4. Project delivery and business improvement 5. Environment issues 6. Training and skill development 7. Exports	1. Enhancing professionalism of the industry 2. Raising the skills level 3. Improving industry practice and technique 4. An integrated approach to construction 5. Developing an external wing 6. A collective Championing Effort for the Construction Industry	1. Fostering a quality culture 2. Achieving value in construction procurement 3. Nurturing a professional workforce 4. Developing an efficient, innovative and productive industry 5. Improving safety and environmental performance 6. Devising a new institutional framework to drive the implementation of the change program for the industry	1. Formulating an industry-specific long-term vision and policy 2. Developing favorable factor conditions and resources 3. Fostering a best practice culture 4. Enhancing technical competency	1. Industry-led better practice and culture 2. Financial resources and investor confidence 3. Human skills and culture of transparency 4. Government policies and strategies supporting construction business 5. Research and development for construction 6. Self-reliant construction culture 7. Institutional support 8. Supportive attitudes from aid agencies.
(WEF 2016) Transformation areas *(International)*	**(WB 2007) Major challenges (Pakistan)**	**(Ci3 2016) Action Items (India)**	**(Wolstenholme 2009) Big themes for future action (UK)**	**(NRC 2009) Opportunities for breakthrough improvements (USA)**
1. Technology, materials and tools 2. Processes and operations 3. Strategy and business model innovation 4. People, organization and culture 5. Industry collaboration 6. Joint industry marketing 7. Regulation and policies 8. Public procurement	1. Business environment 2. Human resource 3. Plant and equipment 4. Materials 5. Institutional capacity (Client, contractor and consultant)	1. Identification and formulation of Key Performance Indicators 2. Construction Project Time & Cost Reduction Strategies 3. Design processes and Technology adoption 4. Design codes and standards 5. Human capital and productivity 6. Construction client's charter 7. Institutional platform	1. Understand the built environment 2. Focus much more on the environment 3. Find a cohesive voice for our industry 4. Adopt new business models that promote change 5. Develop a new generation of leaders 6. Integrate education and training 7. Procure for value 8. Suppliers to take the lead	1. Identification of activities that could lead to breakthrough improvements 2. Widespread deployment and use of interoperable technology applications 3. Improved job-site efficiency through more effective interfacing of people, processes, materials, equipment, and information 4. Greater use of prefabrication, preassembly, modularization, and off-site fabrication techniques and processes 5. Innovative, widespread use of demonstration installations 6. Effective performance measurement to drive efficiency and support innovation

2.1.1 Manpower Development

Most CI problems are directly or indirectly associated with competence and availability of manpower in the industry. Therefore, improving the performance of CI needs nurturing and retaining capable and committed workforce (CIRC 2001), and ensuring attainment of manpower demands of the industry.

Elements of manpower development are planning, production (producing competent entry level professionals and continual professional development) and monitoring. There has to be coordination between these elements (Ray 1979). Planning involves identification of all occupational groups and forecasting the demand. Manpower development is a long term activity and therefore, there has to be a sound mechanism for projecting the requirement to facilitate the process of its development (Wong et al. 2012). As CI comprises different stakeholders, for effective manpower planning, all concerned parties should collaborate in collating and compiling manpower statistics (CIRC 2001); for example, as indicated by CII (2008), in Australia various ministries relating to construction industry form taskforces to propose strategic directions and closely monitor manpower development needs. Similarly, in Singapore, multi-departmental approach is applied and it is an integral part of economic strategies (Osman-Gani and Tan 1998).

Similar to planning, production also needs involvement of different stakeholders; mainly there has to be coordinated effort of academic institutions, the industry organizations and government. After identification of the requirements (quality and quantity), production needs continuous monitoring and periodic review of the objectives as circumstances change to ensure continual development (Ofori et al. 2013).

In producing competent entry level professionals, academic institutes bear the major responsibility, the main focus of academic institutes being to equip the students with the required knowledge and skills (Bhattacharjee et al. 2013; Naveed et al. 2017). This needs assuring the inclusion of required skills and knowledge in the curriculum and making the education practice based and relevant to the industry (further

discussion is provided in Section 7.1.2). Industry organizations are also responsible in producing entry level professionals as they are required to coordinate with academic institutes in designing appropriate internship programs and providing internship opportunities.

In maintaining competence of manpower in the industry, human resource management (HRM) practices of industry organizations play an important role. As indicated by Osabutey et al. (2012), despite the existence of strong link between manpower development and CID, there is negligence of manpower development by most construction firms in both developed and developing countries. According to Loosemore et al. (2003), the consequence of ignoring human needs and focusing on organization and project requirements are employee dissatisfaction, increased turnover, reduced commitment, industrial conflict, de-professionalization, more accidents and a continued poor public image. This organization level consequence will ultimately affect manpower development of the industry at large.

In improving the overall practice towards effective manpower development, especially in the context of developing countries, government needs to play a central role in setting polices that integrate the initiatives of all concerned parties (Osabutey et al. 2012). It can influence manpower development through different mechanisms: regulations (registration systems) and facilitating collaboration between industries and universities. Specifically, coordination of manpower planning and monitoring in the industry is determined by commitment of government. This needs understanding challenges associated with existing manpower development practices and the contextual scenario.

According to WEF (2016), manpower related challenges facing CI in the years ahead are prospective scarcity of skilled labor, increasing sophistication of technology which needs broader skills and high volatility of workforce demand. Similarly, Deku (2014) has identified challenges to manpower development within the construction industry as lack of financial resources, lack of central development and regulatory agency, lack of appreciation of the role of human capital in organizational performance, cost of manpower development, slowness to change, high employee

mobility, low level of education, and fragmentation of the industry. And also according to Wong (2006), factors affecting manpower demand at industry level are construction output, technological change and wage level.

In general, manpower development should take into account the contextual scenarios and it has to be dynamic to cope up with the ever changing needs of the CI. Also, there has to be coordinated efforts from academic institutions, industry organizations and the concerned organs of government.

2.1.2 Enhancing Competitiveness

Competitiveness is a powerful ability that enables sustainable development of the industry (Lu 2006) and enhancing competitiveness of firms will lead to competitiveness of the industry. There is no generic definition and measurement for competitiveness and factors affecting competitiveness change with time and context (Ericsson et al. 2005). After extensive review of literature, Lu (2006) defined contractor competitiveness as *"it refers to the ability of a firm to bid successfully for construction projects, to provide construction services with superior quality, lower costs, and with shorter time than its domestic and international competitors, and in the long-run to consistently achieve superior firm performance".*

Enhancing competitiveness needs identification of its dimensions, the determinant factors and devising effective improvement mechanisms. Ofori (1999) explained that contractors development program has to give opportunity for the firm to mature and enable to develop commercial skills, managerial and administrative skills, credibility in commercial circles, and experience in pricing complete contracts while accepting increasingly greater risk and contractual responsibility. Lu (2006) in his study on development of competitiveness assessment model categorized different factors of competitiveness in to clusters as project management skills, organization resources, organization structure, relationships, competitiveness strategy, marketing ability, bidding techniques, technology and, research and development (R&D). In general, these factors of competitiveness can be discussed under three dimensions: technical capacity, financial capacity and management practices.

Technical capacity refers to the equipment owned and related operational staff (adequacy and skills) to efficiently utilize the equipment, expertise in work methodology (level of standardization) and the ability to foresee technological adoptions to maintain reputability. Financial capacity is the ability to finance projects and arrange financial resources to run the business. Management practice is the application of broad range of skills, management knowledge and experiences for efficient and effective delivery of the process (further discussion is provided in Section 7.2.3).

Above dimensions of competitiveness are interrelated (Bajracharya et al. 2018) and are affected by different external factors (Tang and Ogunlana 2003). Similarly, they are affected by different internal factors. According to Wong and Ng (2010), common causes for failure of construction companies are human/organizational capital issues, macroeconomic issues, adoption to market conditions and budgetary issues. Problems of local contractors in developing countries are lack of qualified manpower, limited access to working capital, shortage of materials, machinery, and weak use of modern technology (Hillebrandt 1999; IGC 2012). At industry level, major institutional challenges facing contractor development are legal framework governing contractors, limited training institutions, management know-how, lack of drive to learn, timely payment of contractors by clients, procurement expertise, absence of reliable credit facilities, absence of equipment pools, corruption syndrome, limited research and information, and occupational health and safety concerns (Kiggundu 1999).

The mechanism of enhancing competitiveness depends on the situation under consideration. According to Ofori (1999), forms of assistance practiced by different countries for small scale contractor development programs are finance, providing projects, training and advice and supplying resource (material and equipment). Similarly, intervention areas for contractor development identified by ILO (1987) are access to work, improvement of the business environment and training and advisory services. Creative project packaging and integrated management is also helpful for personnel training and organization development programs (Kumaraswamy 1998).

In addition to the mechanisms and arrangements indicated above, involvement of foreign contractors from developed construction markets is also considered as a means for enhancing competitiveness. But according to Ofori et al. (1999), the major factor determining local contractor development is the role of government and not the involvement of foreign contractors. They also emphasized that such help by government should not create much dependency and it should be monitored and adjusted as the context changes. Characteristics of good contractor development program are identification of expertise required, who can provide the expertise, what is expected from the different categories of contractor, good training program, evaluation of methods of performance monitoring, assessing their progress, feedback mechanism, penal mechanism and ensuring that deserving contractors are engaged (Ogbogbaidi 1999). The program should necessarily incorporate the development of all levels of construction organizations and material suppliers to enhance competitiveness comprehensively (Kumaraswamy 2006).

In addition to facilitating, promotional and supporting efforts of the government, organizations also have to make their share of effort in enhancing competitiveness to cope with the changing business environment. Organizations should continually review and utilize critical factors to improve their success (Abraham 2003).

2.1.3 Harmonized Industry Practice

State of the adopted and applied practices determines performance of construction industry. Improving and maintaining continual improvement of practices in the industry needs developing effective facilitating institutional systems. Practices in the industry are applications of knowledge and skills for efficient and effective delivery of processes and the facilitating institutional systems are the structures and mechanisms used to diffuse the said practices to the industry and regulate the associated processes. Major practices indicated in CI performance improvement are: improving technology development (Ofori 2015), IT application (ISR 1999) and different management tools (Egan 1998; Kumaraswamy 1998, 2006; CIRC 2001; EC Harris 2013; Behera et al. 2015). Facilitating institutional systems include better regulation (Ofori 1980; ISR 1999) and institution building (participation of

professional and trade associations) (Wolstenholme 2009; Ofori 2015; Osabutey and Croucher 2018).

Improving these practice areas and the facilitating systems are indicated as a factor of CID by many studies in one way or the other as shown in Table 2.1. In this study, construction management practice is considered as one dimension of competiveness and is covered in detail in section 7.2.3, while technology development, IT application, institution building and better regulation are covered in detail in subsequent paragraphs.

Different definitions of construction technology have been given by authors. Tatum (1988) provides four components for classification: materials, applied resources (including equipment, tools, information and skills), construction process and 'project requirements and constraints'. Grosse (1996) has referred three types of technology defined in business and management literature: product technology, process technology and management technology. This classification is adopted by Osabutey et al. (2014) to the context of construction considering the product technology as hard elements (construction outputs, materials, plant and equipment) and management technology as soft elements (skills, knowledge, organization) and process technology combines product technology with management technology to produce outputs. In this study, technology refers to the definition adopted by Osabutey et al. (2014). However, IT application, which is more a part of soft elements, is discussed separately and technology development includes improving construction methods for improved efficiency and standard practices, and availability/accessibility of materials and equipment.

In the context of developing countries, technology adopted is more of technology transfer than innovation. According to Ofori (1994a), different vehicles to transfer technology are joint ventures, supply of plant and equipment, subcontracting, strategic alliances, counterpart training, licensing, contracting R&D, government-level technical aid and attendance of conferences and seminars. The sources could be international contractors, manufacturers, government and non-government bodies. Osabutey et al. (2014) emphasized that, effective technology transfer needs working

together at project level. Similarly, Mengesha (2017) emphasized that technology transfer in CI has to be transferee centered. However, stakeholders do not have equal role in transferring technology to local industry. Contractors often have little say on technology selection; whereas, clients often can strengthen the adoption through contractual incentives (Loganathan et al. 2017). Appropriate policy and incentives at all levels: governmental, organizational and project help to drive the transfer process (Kumaraswamy and Shrestha 2002).

IT has benefits in improving performance of the industry as it plays an important enabling role in construction (Yang et al. 2012). It facilitates data sharing at project and industry level. In addition, it also helps to reduce conflict through better communication, fast transferability of information and improved decision making process (Sommerville and Craig 2006). However, its implementation is constrained by factors emanating from individual, organization and project (group) levels (Peansupap and Walker 2006; Samuelson and Björk 2013). Individual level constraints are budget limit, commitment of project participants, issues of standardization and security. Organizational level constraints are experience, time availability, awareness (clear benefits of IT use). Constraints at the group level are time available to share information, quality of personal contact and geographical distance. Miller et al. (2009) have highlighted that perception of the value, benefit and usability determines effectiveness of the implementation. It is also indicated that implementation is affected by hierarchy of innovation-related needs (Singh and Holmström 2015). Therefore, it is important to avoid constraints limiting its wider application to optimize its benefit for development of the industry.

Typical nature of the CI is the involvement of different stakeholders. Hence, effective and sustainable change in the industry needs concerted effort of these stakeholders. In most countries, there are professional and trade associations in the industry representing the stakeholders. Their active involvement has importance for development of the industry. Trade associations have significant importance in improving industry practices in indicating challenges of the industry for policy intervention and strategy setting, diffusing practices to the industry (e.g. technology transfer) and regulating the standard practice. Professional associations influence

through developing professional excellence, raising awareness, set standards in their fields and promote high standards of quality (NAS 2005). They also help the industry in maintaining and monitoring educational and professional qualifications for professionals and supporting continuous professional development (CPD) (Warren and Wilkinson 2008; Green 2015). These institutional systems, i.e. associations and the regulatory system support and affect each other. Hence, it is important to strengthen the associations and create conducive environment to maximize their contribution for development of the industry. If the associations are strengthened and provided representation in CID, with time the industry will achieve strong self-regulation (WB 2007).

Performance of CI is majorly dependent on efficiency of the regulatory system (Egan 1998; ISR 1999). Governments in CI act as a regulator, as a major client and as a promoter of the industry (Fox et al. 1999; CIRC 2001) and hence it can intervene through different mechanisms to improve industry practices. In PSIB (2004), the taskforce after studying different country's initiatives indicated the importance of effective regulation in improving industry practice by exemplifying Singapore's case to promote IT systems in the CI. The report also emphasized on the importance of procurement system as a means of permanent driver of reform for shaping industry practices by incorporating past performance as a factor of selection by citing the cases of Hong Kong and Australia. Similarly, Aniekwu et al. (2015) have indicated that, being a major client, government can diffuse best practices to the industry through procurement systems: aligning prequalification and other contractual requirements with industry specific development strategies. In addition, compulsory registration is another tool through which regulation helps to raise standards and change behavior in the industry.

Sustaining the force of change throughout the value chain in the industry requires common purpose and institutional reform that creates conducive environment for the stakeholders to act in concert in order to improve the collective interest of the industry (CIRC 2001). This can be achieved through establishing statutory institute that can monitor and follow the overall practice in the industry (Ofori 1985). It also helps to

reduce conflicting objectives. As indicated in Ofori et al. (2011), in Singapore BCA is playing such important role for implementation of recommendations of C21.

Similarly, different countries have institutes (CID bodies) with different nature of formations, for example, CII in USA (CII 2016), Ci3 in India (Ci3 2017), CIC in UK (CIC 2017), CIDB in Malaysia (CIDB-Malaysia 2017), CIDB in South Africa (CIDB-South Africa 2017). Some of them have statutory power (Singapore, Malaysia and South Africa) and some do not (USA, India and UK). Role of such institutes should be properly defined, functions clearly delineated together with the nature of the organization, its power, duties, organization structure, and its relationship with the industry. In addition to the establishment of the statutory institute, Governments should set long term strategy having a set of prioritized activities in the form of rolling plan and the strategy should be monitored continually and reviewed periodically (Ofori 1994c).

In general, adopting efficient practices that enable the industry to meet its development objectives needs an effective facilitating institutional system. Such improvement will help to change image of the industry, and attitude and perception of stakeholders towards CID.

2.1.4 Sustainable Investment in the Industry

For sustainable development of CI, demand and supply fluctuation should be minimized (Ofori 1980; Wong et al. 2010). It needs centralized planning body to strategically plan the overall output of the industry (Wong et al. 2010). Also, a planning unit requires efficient data collection, commitment of government officials, enforcement mechanisms for implementation and qualified personnel to implement (Ofori 1980).

Information about the future demand and capacity of the industry is vital in planning the resources and skills to match the demand and also for formulating policy, strategy and business plan. As the experience of UK and South Korea indicates, this can be achieved by developing forecasting models (CII 2008). The planning process depends on the governance structure of the nation. Challenges for planning are absence of

strong systems and protocols for collecting and analyzing data, absence of central planning and coordinating institution, use of information technology, less investment in R&D and absence of qualified manpower.

According to Weddikkara and Devapriya (2001), factors that affect demand condition in CI are government policies, economic condition, construction price/inflation, population growth/urbanization, foreign aid/loans and grants and global and regional economic co-operation. Supply side factors affected by the demand side change are: project procurement arrangements, role of the contracting firm, project delivery processes, technological applications, and usage of construction materials. Their recommendations to cope with the changing supply condition due to change in demand side are corporate development, institutional reforms and capacity building, financial resources development, and material and manpower development. In fact, the focus of their study was on identifying the causal factors that result in the present globalization trend and their impact on the domestic CI. They have highlighted the changing role of government in the present globalized environment from being a major client to facilitator. Also, they predict that private led demand will increase in the future which will result in change in demand conditions leading to changes on the supply side. Considering above, governments of developing countries should encourage private investment as a long-term plan to maintain demand.

2.1.5 Capturing Alternative Markets

As CI matures, capital investment of a country shifts to repair, maintenance and urban renewal works. In addition, there are some factors which affect the volume and market condition of the industry such as the CI becoming globalized, reduction in local demand and economic fluctuations. These changes call for export services and diversification of business for maintaining sustainable market. Export service support is one of the government policies adopted by different developed economies for reinventing CI (CII 2008).

Firms need to diversify to maintenance and exports to cope with the changing situation. Establishing a competitive position in international market needs long term strategic plan. Therefore, the industry has to build this through greater innovation and

R&D, greater use of information technology, sharper focus on environmental sustainability and building a critical mass to export successfully (ISR 1999). As the market changes, e.g. major capital work to maintenance work, the nature and challenges of the job differs requiring different skills and techniques. Therefore, appropriate adjustment and timely diversification in business model is crucial to survive in competitive environment (Ofori 2003; CII 2008).

2.1.6 Key Performance Indicators for Monitoring and Tracking of Improvement of Construction Industry development

As CID is time taking and factors affecting it change with time, monitoring and controlling the progress is important to ensure continual development. Performance improvement action needs a measurement system as if it is not measured, its status cannot be determined. According to Ofori (2001), one of the reasons for lack of improvement of CI in developing countries even after implementing specific recommendations and initiatives is absence of measurable targets in CID programs to monitor and track their implementation. He emphasized the importance of setting key performance indicators and the need for their amendment over time to cope with the changing nature of the factors to maintain their appropriateness.

KPIs should help to monitor and track improvement of the industry performance. CIC (2015) indicated the expected attributes of KPIs as: relevance and importance to the industry, quantifiable, supply of data should be recurrent, should reflect future development and should be able to improve external accountability and verification. Detailed discussion on this topic is provided in Section 8.2.

2.1.7 Variables Affecting the Determinant Factors

Variables affecting the determinant factors gathered by above discussion are summarized in Table 2.2. In the table, the letters designate the respective determinant factors as described under the table. As shown in the table, factors share the variables which show their relationship. Further classification of the variables and discussion on the relationship is provided in Chapter 3.

Table 2.2 Variables affecting the determinant factors

Variables affecting the factors *(described as variables/problems/factors in different literature)*	**References**																							
	(Ofori 1980)	(ILO 1987)	(Uwakweh and Maloney 1991)	(Aniekwu 1995)	(Egan 1998)	(ISR 1999)	(Kiggundu 1999)	(Ofori et al. 1999)	(Ofori 2000)	(CIRC 2001)	(Momaya 2001)	(Weddikkara and Devapriya 2001)	(Fox 2003)	(Loosemore et al. 2003)	(Wong 2006)	(Lu 2006)	(Kumaraswamy 2006)	(CII 2008)	(Aniekwu and Ozochi 2010)	(Wong et al. 2010)	(Osabutey et al. 2012)	(Deng et al. 2013)	(Deku 2014)	(Aniekwu et al. 2015)
Central coordinating institution	S			H						M H										S			M	
Policy advocacy/ intervention strategy	H	E									E	S	H					A	M					
Image of the industry	H												M											
Fragmentation of the industry				H																			M	
Workers registration scheme										M														
Contractual requirement				H						M														H
linkage between academics and industry										M									M					
Training and Education	M		M							M													M	
Management style/ skills/practice					H		E			H	E			M		E	H				M	E		
Technology development/ IT Application			M				E				E				M		H						M	
Demand stability /fluctuation of workload	S		M								E				M			A				E		
Regulatory framework					H	H	E																	
Registration and qualification of firms							H			H E			H											
Access to working capital/ financial resource							E																M	
Market instability/ economic condition												S				E		A						
Corruption							E										H							H
HR development/ manpower availability											E											E		

Table 2.2 Variables affecting the determinant factors (Continued)

Variables affecting the factors *(described as variables/problems/factors in different literature)*	(Ofori 1980)	(ILO 1987)	(Uwakweh and Maloney 1991)	(Aniekwu 1995)	(Egan 1998)	(ISR 1999)	(Kiggundu 1999)	(Ofori et al. 1999)	(Ofori 2000)	(CIRC 2001)	(Momaya 2001)	(Weddikkara and Devapriya 2001)	(Fox 2003)	(Loosemore et al. 2003)	(Wong 2006)	(Lu 2006)	(Kumaraswamy 2006)	(CII 2008)	(Aniekwu and Ozochi 2010)	(Wong et al. 2010)	(Osabutey et al. 2012)	(Deng et al. 2013)	(Deku 2014)	(Aniekwu et al. 2015)
Research and development							E				E		H			E								
Statutory requirement													H											
Procurement system							E																	H
Dependency on Foreign aid / economic cooperation												S												
Globalization								E	H			A												
Relationship/Collaborative culture in the industry										H						E		M						
Industry performance measurement practice													H											
Wage level															M									
Availability of resource (materials &equipment)																E								
Capacity of firms				H																			M	
Influence of Culture									H								H							

H=Harmonized industry practice, E=Enhancing competiveness, M=Manpower Development
S= Sustainable investment, A= Alternative Markets

2.2 Characteristics of Business Environment

Business environment is the aggregate of all conditions, events and influences that surround and affect business (Davis and Blomstrom 1975). The general business environment covers political, economic, social-cultural, legal and technological aspects (Worthington and Britton 2006). CI is not out of this general business environment realm. However, it is important to describe it in the context of CI to understand the influences and effects. The identified factors can be traced to these dimensions, e.g. Technology development and the regulatory system from 'harmonized industry practice' are related to 'legal and technological aspects'.

According to Porter (1990), business environment is shaped by factor conditions, the strategy, structure and rivalry of domestic competition, demand conditions, and related and supporting industries coupled with government and chance. It is commonly named Porter's diamond framework. Flanagan et al. (2005) have framed this to hexagon to suit the context of CI. Dimensions of the hexagon are: factor conditions, demand conditions, government, industry characteristics, human resources, firm strategy and management with chance and culture as exogenous dimensions. The identified factors, discussed in the previous subtopics, are directly or indirectly aligned with dimensions framed by Flanagan et al. (2005). Favorability of the determinant factors will improve performance of the industry.

Influences and effects of the factors are expressed through nature of the interaction between business environment and organization. The interaction between organization and the business environment is revealed through different ways: exchange of information, exchange of resource and exchange of influence and power (ICAI 2006). The interaction is affected by characteristics of the business environment. Change in the business environment changes the inputs, transformation process and outputs of the industry (Worthington and Britton 2006). The inputs to the business in the form of manpower, finance, physical and other required resources are drawn from the environment. The business converts these resources into output of products or services. In the course of this process, the environment offers

opportunities, incentives and rewards on the one hand and sets constraints, threats and restrictions on the other.

Characteristics of the business environment are measured by four dimensions: degree of munificence, dynamism, complexity and diversity (Chi et al. 2009). Oyewobi (2014) adopted these dimensions to suit the context of CI as; munificence, dynamism, complexity and competitive intensity. ***Munificence*** refers to the degree to which an environment can offer sufficient resources to organizations that operate in it to support their growth, ***Dynamism*** refers to the uncertainties in the business environment, ***Complexity*** explains whether the components in the business environment are analogous to one another or different and it is measured with items relating to the management of supply chain, knowledge about needs of construction clients and the extent of market segmentation in the industry. ***Competitive intensity*** is defined as a situation where competition is fierce due to the number of competitors in the market and lack of potential opportunities for further growth. Therefore to smoothly run the business: constraints, threats and restrictions imposed by the environment should be minimized thereby creating conducive business environment, i.e. the determinants become collectively favorable.

For the purpose of this study, Conducive Business Environment (CBE) refers to the condition in which the determinants are favorable to ensure performance improvement and continual development of CI. The determinant factors and characteristics of the business environment are mutually interdependent. The relationship between the factors and impact of the factors on the business environment are discussed in Chapter 3.

2.3 Construction Industry in Ethiopia

Ethiopia's economy has been showing rapid growth in the past decade and it is expected to show similar performance in the near future (NPC 2016a, 2016b). The growth of CI is associated with the general economy; hence, its growth is also increasing. As indicated in NPC (2016a), between 2009/10-2014/15 the CI has raised its GDP share from 4% to 8.5 %. The demand is high in all subsectors:

housing, road projects, airports, railway, irrigation and hydropower projects and development of industrial parks.

Ethiopian CI has passed through different periods facing challenges associated with political ideologies and perception of the governments towards the industry (Desta 2015). Recent trends also indicate that the governance structure of the industry has been changing. In 2015, Ministry of Construction (MoC) was established as a central statutory body dedicated to CID, separated from Ministry of Urban Development and Construction (MUDC) (FDRE 2015); however, in 2018 it was merged back to MUDC. Such dynamism in the governance structure, various readjustments of the regulatory authorities and institutes, create difficulty in achieving continual development of the industry. Though the current governance structure of the CI is not predictable and stable, the concern for improving of CI is growing. CID policy framework was launched in 2013 (MUDC 2013a). In the same year, Ethiopian Construction Project Management Institute (ECPMI) was established with the objective of facilitating development of the industry through building project management capacity of the key stakeholders (FDRE 2013). Construction Industry Council (CIC) was established in 2017 with the general objective of creating a stakeholders forum which would engage in developing and facilitating practical implementation of policies, programs, laws and strategic issues that would lead to an efficient CI. Government has a vision to build internationally competitive CI by 2025.

The industry faces different challenges that impede its development like most of the developing countries. Ethiopian CI has not been assessed comprehensively to a level that enables one to understand the industry (Ethiopian Economic Association 2008). Different studies have been conducted majorly focusing on project and some organization level issues. The studies conducted indicate poor performance in different aspects of performance measures: time, cost, quality (Kifle 2013; Haile 2016; Anshebo 2017; Tagesse 2017). Different causes are identified for the poor performance: management practice related (Yimam 2011; Desta 2017; Sinesilassie et al. 2017), corruption (Plummer 2012), applicable standards (general conditions) (Gezahegne 2011) and weak capacity of the organizations (Mustefa 2015). According

to Mengesha (2004, 2016), the factors contributing to low performance of public projects in the country are policy, capacity, attitude and force majeure related issues.

All the problems can be mapped to the factors affecting CID discussed in the previous subtopics. Three national plans: 2005/6-2009/10, 2009/10-2014/15 and 2015/16-2019/20 that addressed CID were reviewed to identify the recurring major factors and they are discussed below.

2.3.1 A Plan for Accelerated and Sustained Development to End Poverty

Major objectives set on the national plan concerning CI during this period, PASDEP (2005/6-2009/10), were: to enhance the quality and efficiency of production of construction materials, improve competitiveness of the industry, and build technical and managerial capacity, to create adequate capacity within the government to plan and monitor and create a conducive environment for the domestic industry through capacity building program (MoFED 2006a; MoFED 2006b). Elements of the program were:

- Review and formulation of all policies, systems, and regulations to create a productive enabling environment;
- Development of standards and quality guidelines;
- Building the potential of existing construction SMEs and providing training;
- Providing a stakeholder's forum and capacity-building programs for large and medium-scale contractors;
- Conducting need assessment and then developing a full short and medium-term training programs – for technical as well as managerial skills;
- Curriculum reform and development;
- Reviewing and revising the licensing system;
- Developing a legal framework for quality management, and development and implementation of construction standards; and
- Strengthening associations in the construction industry to enable them to play a proactive role.
- Promoting research and development

At the end of the plan period major achievements reported were: issuance of 752 new licenses to contractors with training, 147 experts organized as 43 new consultants, equipment and machineries provided on credit bases and importing major construction materials by the government to sustain the fast growing construction industry (MoFED 2010a).

2.3.2 Growth and Transformation Plan I

In this period, GTP I (2009/10-2014/15), the objective was to create conducive environment for the development of the industry to ensure construction works are completed to the standard required, build the capacity of the domestic CI to fully meet local demand, enable the industry to make a significant contribution to the sustainable growth of other sectors and national economy, as well as improve its productivity (MoFED 2010a; MoFED 2010b). The dimensions set to meet the targets were: increase in number of competent construction companies at national and international level, improve the supply of constructional materials, strengthen human resource development and improve regulatory system.

Major achievements reported apart from the increase in share of GDP are launching of policy framework specific to the industry, the establishment and operationalization of Ethiopian Construction Project Management Institute and increased number of domestic contractors from 20 to 41 and consultants from 10 to 35 which are considered as internationally competent (NPC 2016a).

Major challenges identified during this plan period were: weak performance of contractors and consultants and prevalence of rent seeking (corruption) which has affected the overall performance of the industry.

The policy framework has indicated challenges of the industry and set 10 targets to meet vision of the CI (MUDC 2013a). The indicated challenges are: poor implementation capacity, regulatory framework problems (poor implementation and lack of revaluing practice), skill and knowledge gap in the industry, lack of manpower forecasting, registration and certification, poor capacity of stakeholders, poor

involvement of business and professional associations and poor information management in the industry. The targets are:

- Creating conducive environment to deter corruption and unethical practices
- Manpower development
- Establishing a system that can ensure effectiveness and create competitiveness
- Establishing an institute to facilitate project management and technology development
- Establishing supply chain system for sustainable materials
- Establishing modern systems to provide financial and equipment resources
- Setting direction that facilitates collaboration of stakeholders for industry development
- Strengthening building design, construction supervision and usage permissions
- Establishing a system of planning for cross sectorial issues along with construction
- Preparing detailed engineering and construction works program and legal framework package for implementation

Generally, the provisions in the policy has covered wide spectrum of issues. However, effectiveness of the tools and coordination mechanism should be revalued to meet the required change.

2.3.3 Growth and Transformation Plan II

For this period, GTP II (2015/16-2019/20), the objectives are capacity building of CI, strengthening human resource development of the sector, developing legal frameworks, rules, regulations and procedures to develop the capacity of CI (NPC 2016a *;* NPC 2016b). Five programs are set as strategies:

A. Construction professionals, contractors and consultant's capacity building program
B. Construction equipment and technology capacity building and construction materials delivery program

C. National construction project management capacity building and technology transfer program
D. Construction industry structure and organizational improvement program
E. Construction industry competency approval, registration and employees' health and environmental safety care system improvement program

Review of the three national plans indicate the recurring major themes considered for improvement of CID are related to manpower development, enhancing competitiveness and harmonizing industry practice. Hence, they are considered to be the focus areas of this study. As indicated in Section 3.1, the factors are dynamic in nature, in the sense, improvement of one impacts the other and the requirement levels are changing over time. Achieving desired outcomes requires monitoring and tracking improvement of the factors. However, this is not clearly indicated in the national plans.

Therefore, for further amendment of the targets to suit the changing context, developing KPIs for each factor is necessary. This will build the practice of measuring performance of the industry development program and create a link among different plans. This will help to measure effectiveness of the efforts taken by the government and other stakeholders, and actual progress towards the targets.

2.4 Summary of the Chapter

Factors affecting CID are generally similar across countries. However, there are differences in terms of the classification of the factors in terms of the contextual definition given to the factors. The identified factors are: manpower development, enhancing competitiveness, harmonized industry practice, sustainable investment in the industry, capturing alternative market and integrating industry performance measurement practice.

These factors determine characteristics of the business environment, hence, the interaction between the organization and the business environment. Industry organization interacts with business environment through: exchange of information, exchange of resource and exchange of influence. Improvement of the factors will

improve the characteristics of the business environment: munificence, dynamism, complexity and competitive intensity.

The major factors in Ethiopian CI are: manpower development, enhancing competitiveness and harmonized industry practice. Effective manpower development needs concerted effort of the government, academic institutions and the industry organizations. Enhancing competitiveness has to improve: technical capacity, financial capacity and management practice of the industry organizations. Harmonizing the industry practices needs understanding the practices and developing effective facilitating institutional systems. Major practices in CI are: technology development, IT application and management practice. Facilitating institutional systems are regulation and building institution (participation of professional and trade associations).

CHAPTER 3

CONCEPTUAL FRAMEWORK

This chapter presents two separate frameworks and hypotheses on relationships of the research constructs that serve as general framework for data collection, analysis and discussion of the results. The first framework shown in Figure 3.1 shows the adopted view of this study and summarizes relationships of the determinant factors and interrelationships between the factors and the business environment (BE). The second framework illustrated in Figure 3.3 indicates the general conceptual framework to improve the BE for CID.

3.1 Relationships among the Factors

The determinants are mutually dependent because the effect of one often depends on the state of others (Porter 1990; Flanagan et al. 2005), i.e. improvement of one of the factors will improve the others, for example, enhancement of manpower development improves competitiveness of the firm and improvement of competitiveness of the firm in turn enhances industry practices as competitive firms will have the capability to adopt good practices. Variables affecting the respective determinant factor as identified from literature are summarized in Table 3.1 (it is a summary of Table 2.2). As indicated in the table, the determinant factors share common variables which indicate their relationships. Considering the number of common variables as criteria for determination of strength of the relationship among the factors, manpower development, enhancing competitiveness and harmonized industry practice are strongly related. The relationships are illustrated in Figure 3.1.

In Figure 3.1, the pentagon indicates the interdependence among the factors. As discussed earlier in Section 2.1.6, improvement requirement of the determinant factors varies over time which needs continual monitoring and updating. Hence, the circle that enclosed the pentagon signifies importance of the performance measurement and improvement practice to maintain appropriateness of the factors to

the targets of CID. The arrow towards the inner circle (business environment) represents impact of the factors on the business environment which is further discussed in the subsequent subtopic and illustrated in Figure 3.2.

Improvement of the factors is aggregate of improvement of variables. For example, manpower development could be improved by improving industry academic linkage, improving registration system for professionals' and improving human resource management practices in the industry. The variables emanate from different sources and as the factors share the variables, they share the sources too. Hence, to better understand the relationships and identify challenges of the industry, source wise classification was adopted.

The variables are categorized into four groups based on their presumed sources and are as shown in Figure 3.1: (i) variables emanating from role of government, (ii) resource related variables, (iii) variables emanating from nature of the industry and (iv) variables emanating from vision for industry development. Similar to the classification of factors, this classification is also not mutually exclusive because some variables can be related to more than one source. In these cases, the concerned variable is placed in a group where it can be better represented.

Table 3.1 Summary of variables affecting the factors

Variables affecting the determinant factors	**HIP**	**EC**	**MD**	**Demand**	**Market**
Central coordinating institution	√		√	√	
Policy advocacy/ intervention strategy	√	√	√	√	√
Image of the industry	√		√		
Fragmentation of the industry	√		√		
Workers registration scheme	√		√		
Contractual requirement	√		√		
linkage between academics and industry	√		√		
Training and Education			√		
Management style/ skills/practice	√	√	√		
Technology development/ IT Application	√	√	√		
Demand stability /fluctuation of workload		√	√	√	√
Regulatory framework	√	√			
Registration and qualification of firms	√	√			
Access to working capital/ financial resource		√	√		
Market instability/ economic condition	√	√		√	√
Corruption	√	√			
HR development/ manpower availability	√	√			
Research and development	√	√			
Statutory requirement	√				
Procurement system	√	√	√		
Dependency on Foreign aid / economic cooperation				√	
Globalization	√	√			√
Relationship/Collaborative culture in the industry	√	√	√		
Industry performance measurement practice	√				
Wage level			√		
Availability of resource (materials and equipment)		√			
Capacity of firms	√		√		
Influence of Culture	√				

HIP=Harmonized industry practice, EC=Enhancing competiveness, MD=Manpower Development
Demand= Sustainable Investment, Market= Alternative Markets

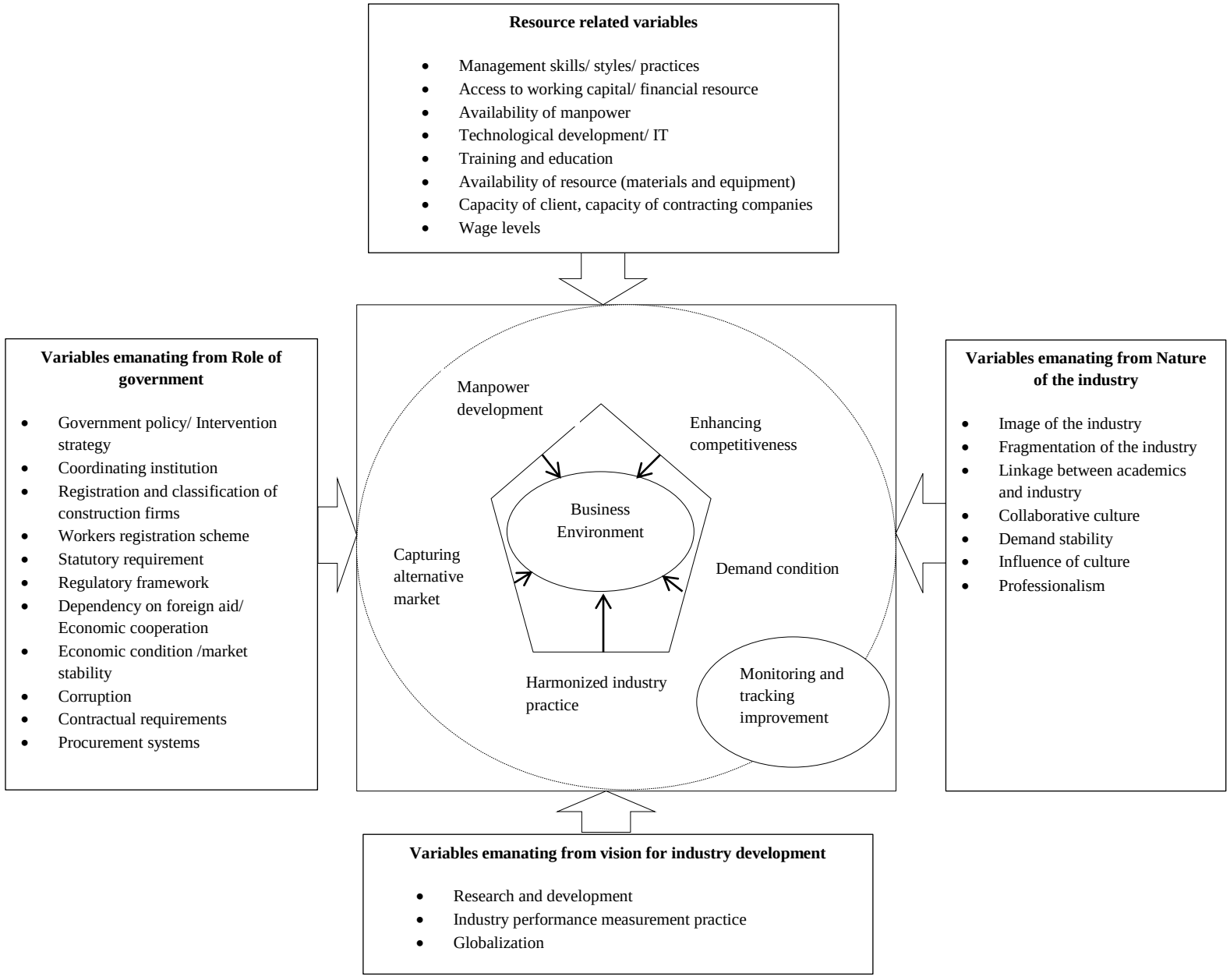

Figure 3.1 Conceptual framework of the study

3.2 Impacts of the Factors on the Business Environment

As discussed earlier in Section 2.2, status of the factors determines characteristics of the business environment. Change in characteristics of the business environment affects components of the system: the inputs, transformation process and outputs of the industry. Input means all forms of resource for CI, process is the business process and output means the deliverables in the form of product/service.

Manpower being key resource to the industry it is input of the system. Competitiveness is a capability, which also integrates resources and majorly affects process of the system, i.e. efficiency and effectiveness. Since, components of a system are dependent to each other; both, manpower and competitiveness finally determine quality of the output (product and/or service). Components of harmonized industry practice, technology development and IT application, majorly affects process. Similarly, other component, facilitating institutional systems, affects the whole system: input, process and output. Impact of the determinant factors on CI as a system is conceptualized as shown in Figure 3.2. The arrow from the factor towards a particular component of the system (input, process and output) indicates impact of the factor on that component of the system.

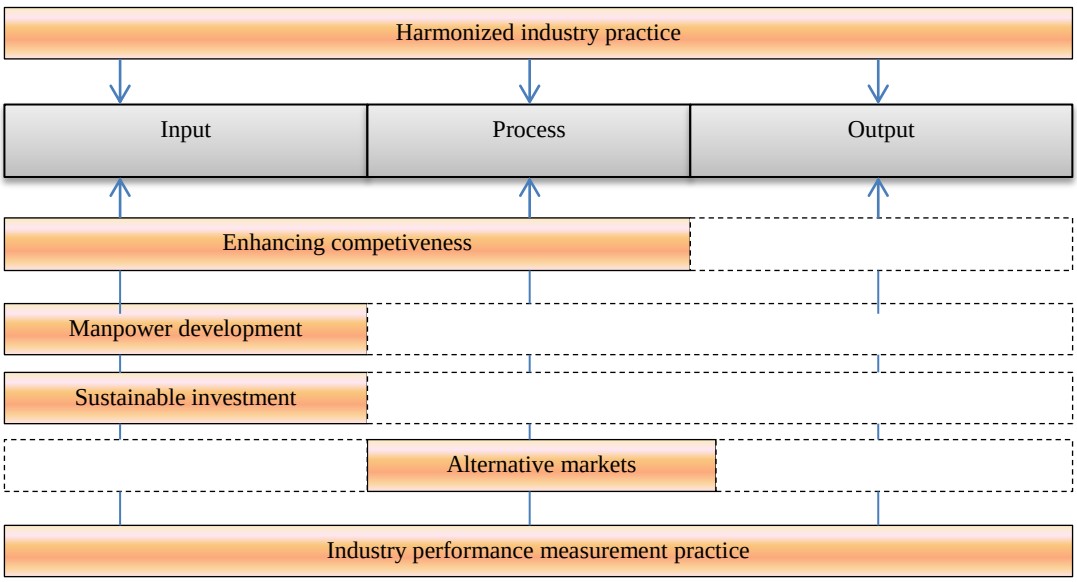

Figure 3.2 Impacts of the factors on the business environment

Factors that affect majorly one component may not affect the other component of the system equally. In the figure, the shaded portion of the box indicates the factor has

relatively higher impact on component of the system parallel to it, whereas the broken box indicates less impact. Factors are also affected by characteristics of the business environment. Mutual interdependences between the factors and characteristics of the business environment are further discussed in Chapter 6. The aim here is to understand the factors while nature of the interaction is discussed in Chapter 6.

3.3 Conceptual Framework to Improve the Business Environment for Construction Industry Development

As defined earlier in Section 2.2, Conducive Business Environment (CBE) for CID refers to the condition in which the determinant factors are favorable to ensure performance improvement and continual development of CI. Similarly, as discussed so far, the requirements to improve the BE for CID are: continual qualified manpower supply, creating competent parties, harmonizing industry practice, making the demand predictable, strategies for alternative markets and developing KPIs for monitoring and controlling the improvement.

These can be achieved through improvement of different dimensions of the factors. The dimensions for manpower development are: role of government, role of academic institutes and HRM management practices in organizations. The dimensions for enhancing competitiveness are improving financial capacities, technical capacities and management practices. The practice dimensions for harmonizing industry practices are: technology development and application of IT and the facilitating institutional systems are: institution building and better regulation. From above discussion and the previous chapter, a conceptual framework to create CBE for CID is developed analytically as shown in Figure 3.3.

The conceptual framework shows the importance of assessing the contextual scenario, setting targets and improvement mechanisms (improving each dimension of the factors) and integrating continual monitoring and controlling of the improvement of factors (setting and implementing KPIs) as part of CID program. The plan has to be an integrated plan and the KPIs should be developed for short and long term to ensure continual improvement and account for the interrelationship among the factors.

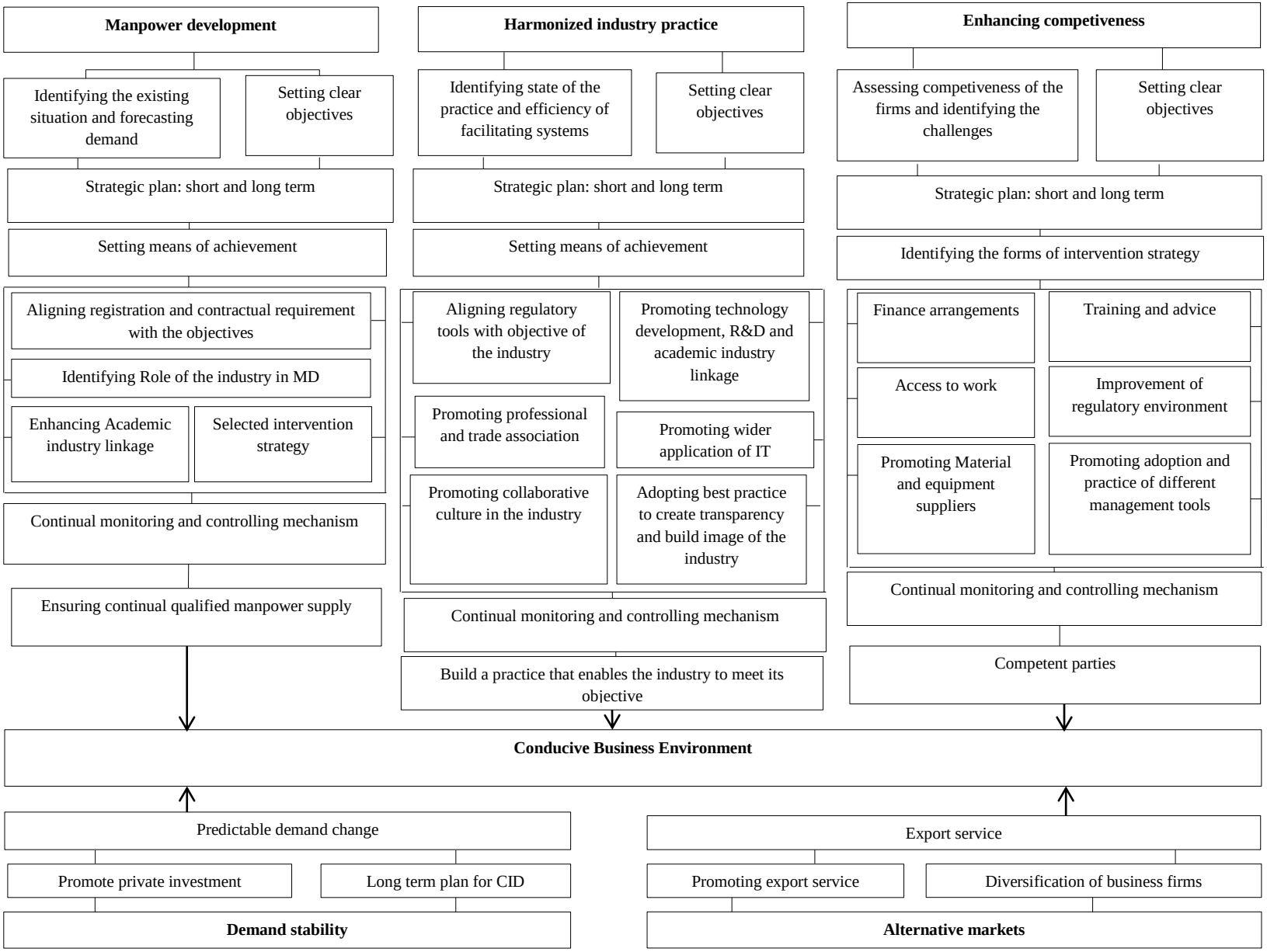

Figure3.3 Conceptual framework to improve the business environment for construction industry development

3.4 Hypotheses on Relationships

As determined earlier, focus of this study is on three factors: manpower development, enhancing competitiveness and harmonized industry practices. Relationship among the factors being a research question, the following hypotheses were developed concerning relationships among the research constructs and are tested in Chapter 6.

H1: The factors have direct and significant relationship with sources of the variables

H2: There is a significant relationship among the factors

H3: Characteristics of the business environment has significant relationship with the factors

H4: Sources of the variables have significant relationship

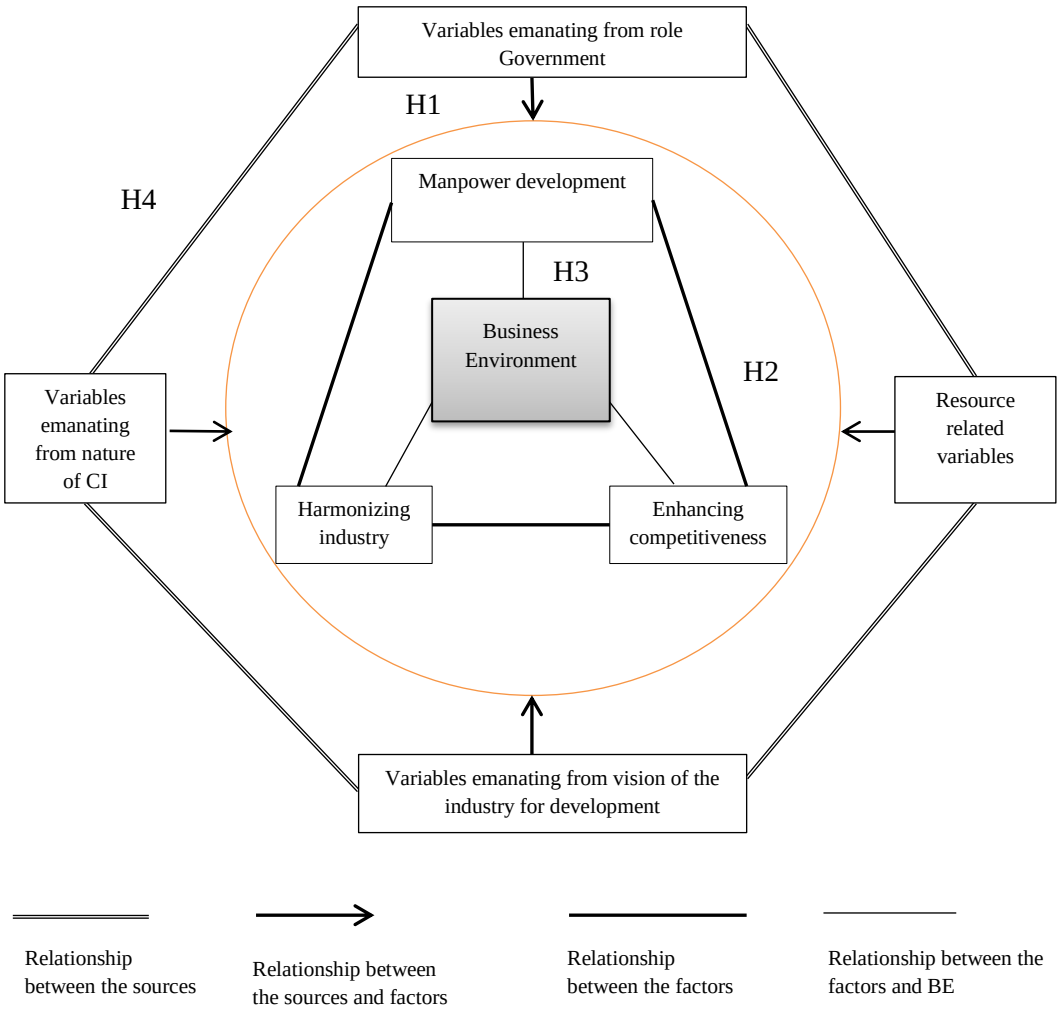

Figure 3.4 Hypotheses on relationships of the research construct

3.5 Summary of the Chapter

This chapter presented the general association among the research constructs. Variables affecting the respective factors, identified from the previous chapter, were classified based on their presumed sources (where Chapter 5 presents challenges of the industry based on sources of the variables), and the relationships are hypothesized for further discussion (Chapter 6 presents the hypothesis test). It is also indicated that developing improvement framework requires assessing the contextual scenario (Chapter 7 presents status of the determinant factors), devising improvement mechanisms and integrating monitoring and controlling system (Chapter 8 presents detailed frameworks for respective factors and the KPIs).

CHAPTER 4

RESEARCH METHODOLOGY

The focus of this chapter is to present the research methodology adopted in achieving the objectives and provide justifications for the same. In this regard, this chapter introduces the research approach adopted, explains the nature of the objectives together with research methods employed. Finally, validity and reliability of the research design is discussed.

4.1Research Approach

Generally, research design is driven by research questions. Data collection methods and analysis techniques have to be determined to answer the question validly, accurately and reliably. Hence, research process should be designed critically to select appropriate methodologies which shall be used as a framework for the research work (Fellows and Liu 2015).

There are different classifications of research. According to Yin (2009), categories based on purpose of research are: descriptive, exploratory and explanatory. Descriptive research describes characteristics of a phenomenon under consideration; it does not establish cause of occurrence of a phenomenon. Exploratory research is a type of research often conducted to explore aspects of constructs under study and explanatory studies explain the causal relationship among variables. Categories based on approaches are quantitative and qualitative (Kothari 2004). This classification concerns the methods adopted for data collection and analysis (Fellows and Liu 2015). The approach to be adopted depends on nature of the enquiry which will dictate the methods to be used for data collection and analysis.

Different methods of research have their own limitations. In balancing weaknesses of the methods, a combination of methodologies and collecting different types of data on the same phenomenon is assumed to be important. This approach has many aliases (Tuuli 2009), in this study the name mixed methods approach is used. Mixed methods

approach helps to gain broader understanding of the phenomenon (McKim 2017) and supports validation of research findings (Love et al. 2002). Particularly, in construction sector, combining methodological perspectives is persuasive in order to gain richer insights and a more complete understanding of the phenomena (Dainty 2008). Love et al. (2002) have also indicated that triangulation approach is suitable for extending scope of theory in construction management research. Different types of triangulation could be used in doing evaluation: data source triangulation, investigator triangulation, theory/perspective triangulation and methodological triangulation (Patton 2002). Triangulation encourages the researcher to use different alternatives with the aim of corroborating the same fact or phenomenon (Yin 2009).

There are different strategies to mixed methods appraoch: sequential procedures, concurrent procedures and transformative procedures (Creswell 2003). Sequential procedures is the case in which findings of one method are elaborated or expanded with the other method. Concurrent procedures is the case in which quantitative and qualitative data are converged inorder to provide a comprehensive analysis of the research problem. Transformative procedures is the case in which theoretical lens is used as an overarching perspective within a design that contains both quantitative and qualitative data.

Based on nature of objectives and above discussion, mixed methods approach is adopted to this study in which both qualitative and quantitative methods were used for data collection. Also, shown in Figure 4.1 a combination of sequential and concurrent procedures was adopted.

General objective of the study was enhancing CID which needs exploring different aspects. The first two objectives were understanding the determinant factors and developing conceptual framework to improve the business environment for CID. The conceptual framework and the hypotheses indicating the relationships were developed through literature review, while quantitative approach was adopted for testing the hypotheses.

The third objective was assessing challenges of the industry. This majorly requires descriptive exploration of the industry in different aspects and explanatory

investigation to identify challenges and intervention areas pertaining to sources of the variables. Questionnaire survey, semi-structured interviews and document analysis were adopted for data collection to achieve this objective.

The fourth and fifth objectives were developing improvement frameworks for the factors and developing KPIs for monitoring and tracking of their improvements. Prior to development of the improvement framework, status of the determinant factors (level of improvement requirement) was measured for which questionnaire survey and semi-structured interview were adopted for data collection. Results of the improvement requirement and findings of the previous objectives were used as inputs to develop improvement frameworks analytically and the measurement metrics were proposed based on literature review. Flowchart of the adopted methodology is illustrated in Figure 4.1 and details of methods of data collection and analysis techniques for both quantitative and qualitative approach are discussed subsequently.

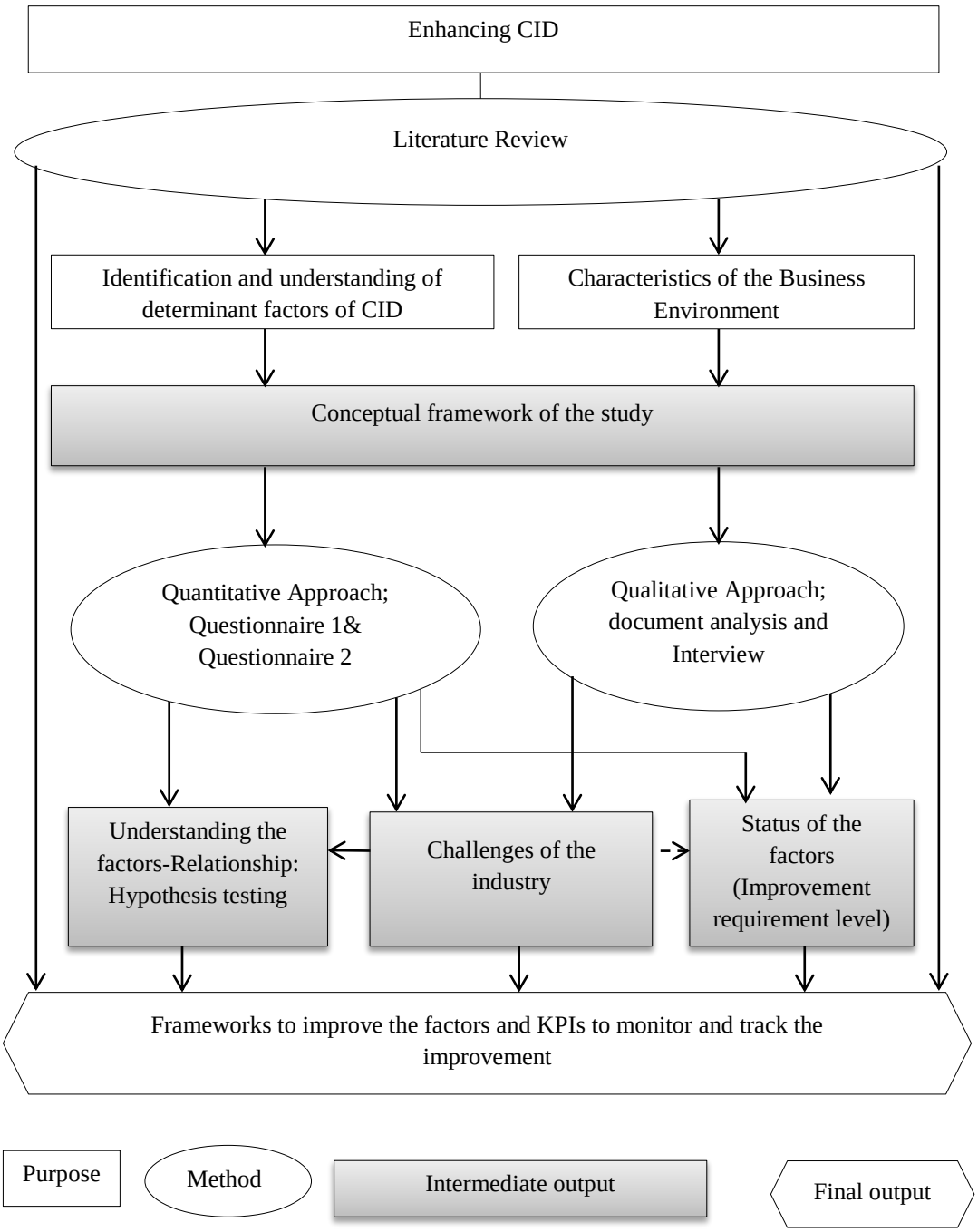

Figure 4.1 Flowchart of the adopted research methodology

4.2 Quantitative Approach

Quantitative approach adopted for this study includes: questionnaire development, sampling, data collection methods and analysis techniques.

4.2.1 Questionnaire Development

Questionnaire is the most commonly used data collection technique that demands a self-administered response. It helps to reach large number of respondents working at different locations. Three causes may result in failure of survey questionnaires in achieving desired outcomes which are: (i) failing to know what to find out, (ii) poor construct validity and (iii) little external validity where respondents do not represent the target population (Mitchell and Jolley 2009). Clear, concise and well-designed questionnaire and subsequent reminders help in improving rate of response and exploiting advantages of a questionnaire survey.

In this study, two questionnaires were developed: questionnaire one covering all objectives of the study and questionnaire two focused on 'construction education' as part of manpower development. Hence, here, the discussion on questionnaire two is limited to its specific objectives and its structure, and further discussion including profile of respondents of questionnaire two is covered in Section 7.1.2.

Development of questionnaire one was based on the variables summarized in Table 3.1 (variables affecting the determinant factors). The questionnaire was aimed to measure impact of the variables on progress of the industry, characteristics of the business environment and improvement requirement level of the factors. Hence, the variables were operationalized to align with specific objectives of sections of the questionnaire, specifically; impact of the variables (for identification of the challenges) and identification of status of the factors (for improvement requirement level of the factors). For example, in manpower development, the variables were operationalized to align with the role of the parties in reference with the discussion given in literature review section. Government's role was considered as a promoter (policy support), regulator (registration) and client (through prequalification). Academic institutes' role is primarily equipping students with the required skills and knowledge, and providing R&D support and training to the industry. Roles considered for industry organizations are promoting CPD and improving image of the industry by improving their human resource management practices (their role in internship is considered under primary role of academic institutes).

Concerning characteristics of the business environment, the adopted measurement variables have been employed in main stream business management studies and also employed by Oyewobi (2014) in the context of CI. Discussion on this is given in Section 6.2. Similarly, discussion on construction management practice areas is covered in Section 7.2.3.

Questionnaire two was developed through critical review of previous studies mainly the work of Bhattacharjee et al. (2013) and Naveed et al. (2017) in identifying the required knowledge and skills for CI, and Moore and Plugge (2008) in identifying the perceived benefits of internship. Specific objectives of the questionnaire were: (i) evaluating knowledge and skills level of students, (ii) assessing perception of students and the industry organizations towards benefits of internship and (iii) assessing effectiveness of internship programs and their coordination.

As discussed above, questionnaires were aimed at measuring the perception of the respondents towards impact, improvement requirement level of the variables and characteristics of the business environment. Hence, a 5-point Likert scale was adopted to measure perception as it is used in personality and attitude measurement in which respondents describe their intensity of feeling towards the variable (Nunnally and Bernstein 1994). Definition of the scale varies depending on specific objectives of the section, e.g. Very Low [1] to Very High [5] in measuring impact and improvement requirement and Strongly Disagree [1] to Strongly Agree [5] in measuring agreement level of competitiveness enhancement mechanisms.

4.2.1.1 Structure of the Questionnaire

Questionnaire one had three parts with different subsections. Part I had the objective of getting respondents profile, their affiliation (type of organization), organizations area of establishment and years of experience. Part II had three subsections with different objectives; the first objective was identifying the level of impact of different variables affecting CI, i.e. identifying challenges of the industry. The second objective was assessing the level of impact of the factors on CID. The third objective was assessing characteristics of business environment pertaining to CI. In Part III the objective was assessing the required improvement level of each dimension of the

factors. Similarly, questionnaire two had three parts: (i) general information, (ii) rating knowledge and skills level of students (self-evaluation and evaluation by supervisors) and (iii) assessing perception of internship benefits and assessing effectiveness of internship coordination. Questionnaire one can be referred to in Appendix I and questionnaire two in Appendix III.

4.2.1.2 Pretesting the Questionnaire

Pretesting questionnaire helps to eliminate difficulties that respondents might encounter in answering the questions (Fellows and Liu 2015). It also eliminates threats to internal validity of data that need clarification and refinement (Saunders et al. 2009). In this study, draft questionnaire link was mailed to research scholars and experienced PG students in India and 10 responses were received with comments and suggestions. In addition, the draft questionnaire was mailed to three senior professionals in Ethiopia for feedback, as it is necessary to consider the contextual scenarios and two of them provided suggestions. Finally, focus group discussion was held with three professionals. Feedbacks were used to refine and clarify some of the questions.

4.2.2 Sampling

In a study having a large population size, it is obviously impractical to collect data from the whole population. So, it is important to select a sample that can be representative to the population. Hence the objective of sampling is to provide a practical means that facilitates data collection and processing whilst ensuring that the sample is representative (Fellows and Liu 2015).

Studies at industry level need to include, at least, the major stakeholders in the industry. Purposive sampling method was used in this study to obtain informed respondents and good response rate. As the industry encompasses wide segments, professionals from stakeholders form the unit of analysis for the survey. Professionals included in the survey are from Employers, Contractors, Consultants and Academics.

As the unit of analysis is individual professionals, the total population size is unknown. Hence, to ascertain minimum number of participants the iterative formula used by Ankrah (2007) and Oyewobi (2014) was adopted:

$$ss = \frac{z^2 p(1-p)}{c^2}$$

Where: ss = sample size z = standardized variable p = percentage picking a choice, expressed as a decimal c = confidence interval, expressed as a decimal

Similarly, the assumptions made by those studies were adopted: to determine a sample size with a given degree of accuracy the worst case percentage picking choice of 50% (0.5), 95% confidence level with a significance level of α = 0.05; z = 1.96 at 95% confidence level, and a confidence interval (c) of ±10% (0.1) was taken:

$$ss = \frac{1.96^2 x 0.5(1-0.5)}{0.1^2}$$

$ss = 96.04$, *the minimum sample size was taken as 100.*

Considering the trend of people not willing to respond to questionnaires from unfamiliar researchers and mobility of professionals in the industry, personal contacts were collected through chain of friends. Working experience and affiliation were used as selection criteria and minimum two years of experience was considered. Similar sampling approach was used by Deng et al. (2013). In construction industry, the response rate for questionnaire survey is low 20%-30% (Ankrah 2007; Oyewobi 2014). However, as the contacts were collected through chains of friends and the planned duration for the data collection was long, 40% of responses were expected and therefore, the questionnaire was forwarded to 250 professionals.

4.2.3 Questionnaire Administration and Collection

Questionnaire survey data collection can be conducted in different ways: administered by hand, postal mail, email and web surveys. In this research, mainly web survey was used as it is helpful to reach large number of respondents at different locations. The questionnaire survey was prepared in Google Form and the link was forwarded to the

respondents. Reminders were made through email and phone calls to obtain good response rate. A workshop organized by Addis Ababa Construction Bureau, '1st construction profession week', held between August 31st to September 3rd, 2017 also provided a good opportunity to meet professionals and facilitate appointments for interviews and reminded some professionals to complete the questionnaire. The questionnaire was kept open from August to December, 2017 for five full months and minimum two reminders were sent to the respondents.

4.2.4 Analysis and Interpretation

Adopted analysis techniques were: descriptive statistics (mean and standard deviation), Factor Analysis, correlation and different statistical tests wherever necessary. IBM SPSS version 21 software was used for the analysis.

4.2.4.1 Descriptive Statistics

Mean and standard deviation were utilized i.e., to rank variables in measuring the intended objectives. In some cases, wherever necessary, to test the agreement between groups of respondents, Spearman's rank order correlation was utilized. For example, to test the agreement between perceptions of the stakeholders on challenges of the industry the ranking was done for three groups: Clients, Contractors and Consultants, and Spearman's rank order correlation was utilized to test the agreement between the groups. Independent sample T-test was conducted to test significance of the mean difference where variable wise discussion was required (Kang et al.2018) as in Section 7.2.3. Similarly, one sample T-test was used to identify the significant variables considering hypothetical mean value of three with 95% confidence (Tripathi and Jha 2018).

4.2.4.2 Factor Analysis

Factor analysis is a statistical approach that helps to analyze the interrelationships among a large number of variables and explain the variables through the underlying dimensions, its objective being reduction of large variables to small set of dimensions through grouping (Hair et al. 2010). Factor analysis can be used to determine: (i) grouping or clustering of variables, (ii) how strong the variables belong to the group,

(iii) number of dimensions needed to explain the relationship among the variables and (iv) a frame of reference to describe relationship among the variables (Nunnally and Bernstein 1994).

There are two approaches to factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is carried out to extract factors from a set of variables, generating the underlying dimensions. CFA, as the name indicates is used to test predefined constructs, i.e., how well the dimensions are explained by the variables. In this study, EFA was used to identify the underlying dimensions of different research constructs, for example, to identify the underlying dimension of the sources of variables as in Chapter 5.

The objective in determining the number of factors to retain in factor analysis is to choose factors that can adequately represent the data while eliminating statistically or theoretically irrelevant factors (Fabrigar et al. 1999). There are different selection methods: Kaiser Criterion, Scree Plot, Variance Extracted and Multiple Criterions (Beavers et al. 2013). The criterion to be used for factor extraction should not ignore theoretical sense of the factors, the factor structure should be meaningful, useful and conceptually sound (Pett et al. 2003). It is important to rely on multiple criteria when deciding on the appropriate number of factors (Fabrigar et al. 1999). Comparing the initial extraction with multiple criterion method is important to decide on the factors to retain (Costello and Osborne 2005; Schonrock-Adema et al. 2009). In this study Kaiser Criterion (Eigenvalue exceeding one), the most commonly used method, was adopted. Multiple criteria method was also adopted as in Section 7.2.3 (improving management practices).

Variables' loading under each factor (component) indicates only correlation of the variables to the individual component but not importance of the extracted component. Hence, factor score formula for factor score ranking was used to identify relative importance of the components (Fan and Fox 2009; Oladinrin and Ho 2015; Ogbu 2018) as shown below.

$$F_i = \frac{\sum_{j=1}^{n} A_{ij}}{n}$$

Where F_i=factor score; A_{ij}=mean score of the j^{th} variable of factor i and n=the number of variables associated with the factor.

4.2.4.3 Correlation Analysis

Correlation is used to measure the relationship between two variables, it ranges from +1 to -1 where zero indicates no relationship and (+) or (-) indicates the direction of relationship (Evans and Basu 2013). In Chapter 3, relationship among the different constructs was hypothesized. Correlation analysis was conducted to understand nature of these relationships among the factors and characteristics of the business environment.

4.3 Qualitative Approach

4.3.1 Interview

Interviews as a research method create an opportunity to interact with the respondent. Generally, interview method utilizes different approaches (Fellows and Liu 2015), i.e. structured where it comprises a list of pre-determined questions in a rigid order; semi-structured, where the interviewer comes up with a framework of probing questions to guide the interviewing process with flexibility to get in-depth information through follow up questions, and unstructured which is characterized by an entirely informal setting and the area of interest and concern is general.

In this study, semi-structured interview guide was set with the objective of identifying challenges of the industry and to get opinion of professionals on improvement mechanisms of the determinant factors. The interview structure is shown in Appendix II. Interviews were held with 21 professionals with minimum of 10 years' experience. Interviewees were from different background and the profile of participants is as shown in Appendix IV, and the general framework adopted for the interviews is as shown in Figure 4.2. Interview data was analyzed based on predefined subthemes, namely, the source of challenges and improvement of the determinant factors.

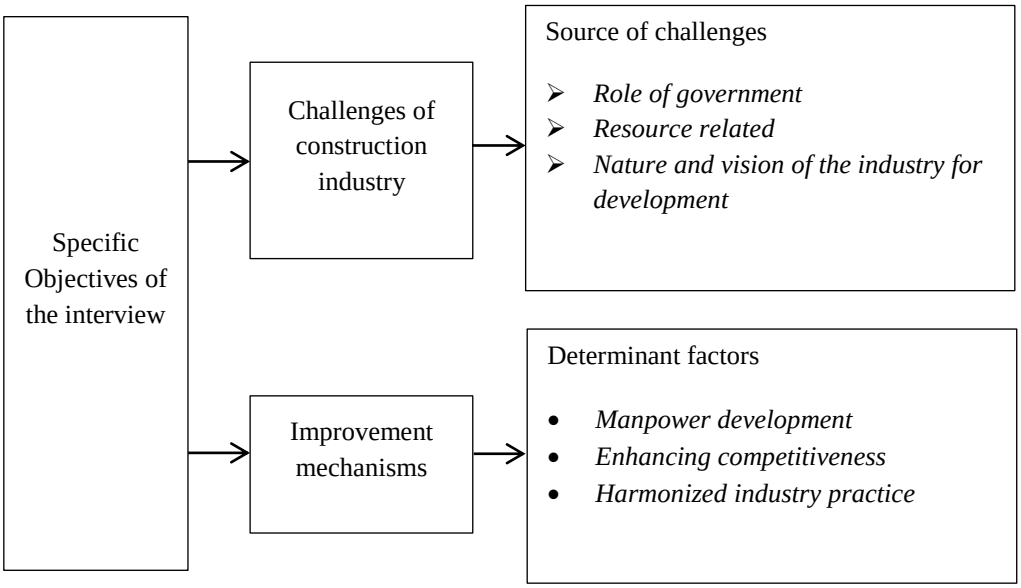

Figure 4.2 Framework for interviews

4.3.2 Document Analysis

Document analysis is a qualitative research method that encompasses reviewing and evaluating both printed and electronic archives as a source of research data. It involves skimming, reading and interpretation of the documents to organize the information in categories related to the research objectives. While using document analysis as a method, authenticity and credibility, original purpose of the document and the intended audience should be considered. As there is subjectivity in interpreting data, the researcher has to make the process of analysis as rigorous and as transparent as possible (Bowen 2009).

Different documents that were collected and are discussed are proclamations pertaining to construction industry, CID policy, registration directives, and curricula of construction related undergraduate programs. It was used to link findings from the questionnaire survey, raise discussion points in the interviews and to help contextualize improvement suggestions. The adopted framework for the document analysis is indicated in Chapter 5 (Figure 5.2).

4.4 Validity and Reliability of the Research Design

In addition to data triangulation (questionnaire, interview and document analysis), techniques adopted to ensure quality of the research are discussed in this section.

4.4.1 Quantitative Approach

Content validity and reliability were ensured through different mechanisms. Content validity refers to the extent to which the questionnaire items represent all facets of the constructs being measured (Oyewobi 2014). As discussed earlier, measurement variables used in the questionnaire were collected through extensive review of literature and also pretested to ensure content validity.

Reliability is concerned with the ability of an instrument to measure consistently (Clark and Creswell 2014). The commonly adopted statistical test for internal consistency is Cronbach's alpha (α). It is used to establish the reliability of scores and is also a prerequisite to ensure validity (Oyewobi 2014). A Cronbach's alpha value of greater than or equal to 0.7 is considered acceptable to be reliable (Hair et al. 2010). The value of alpha is affected by test length (number of variables in a construct) (Nunnally and Bernstein 1994). If the test length is too short, the value of alpha is reduced and vice versa. A low value of alpha could also be due to poor interrelatedness between items. In such cases, items with low correlations (approaching zero) should be discarded (Tavakol and Dennick 2011).

Hence, Cronbach's alpha (α) test for internal consistency of the data was conducted in this study. Cronbach's alpha for all research constructs are summarized in Table 4.1. In case of Cronbach's alpha value less than 0.7 (minimum acceptable value), correlation analyses were conducted to test interrelatedness between the variables. The correlation results indicate that the variables under the constructs are significantly correlated. Therefore, lower alpha values may be due to small number of items under the construct. Higher values may be due to high number of items, for example, there are 28 items in management practice. Though some of the constructs have small number of items, the alpha value is higher where there is high correlation between the items, for example, institution building has four items and the alpha value is 0.950.

Table 4.1 Cronbach's alpha (α) value of the research constructs

Questionnaire Section	Measured Constructs	Alpha Value (α)
Source of Variables	Variables emanating from role of government	0.851
	Resource related variables	0.874
	Variables emanating from nature of the industry	0.843
	Variables emanating from vision of the industry for development	0.848
Determinant Factors	Manpower development	0.617
	Enhancing competitiveness	0.915
	Harmonized Industry practice	0.932
Dimensions of the Business Environment	Environmental Munificence	0.677
	Environmental Dynamism	0.639
	Environmental Complexity	0.683
	Environmental Competitive intensity	0.594
Manpower Development	Role of government	0.963
	Role of Academic institute	0.943
	Human Resource Management Practice	0.973
Enhancing Competitiveness	Financial Capacity	0.930
	Technical capacity	0.969
	Management practice	0.987
	Mechanism for enhancing construction organization competitiveness	0.867
Harmonized Industry Practice	Technology development	0.963
	Wider application of IT	0.967
	Institution building	0.950
	Better regulation	0.959
	Improving psychosocial factors	0.892

In testing appropriateness of the data for factor analysis, Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity were conducted. Minimum suggested standards for KMO is 0.5 (Hair et al. 2010; Field 2013). Bartlett's test shows whether the correlation matrix is significantly different from an identity matrix. The data to be suitable for analysis, Bartlett's Test of Sphericity has to be significant (Field 2013). In addition, Hair et al. (2010) suggested a factor loading of 0.50 for a sample size of 120, in this study the sample size is 127, therefore, a factor loadings greater than 0.50 were retained for the analysis. Results of KMO and Bartlett's Test of Sphericity are summarized in the respective chapters where factor analysis results are presented.

4.4.2 Qualitative Approach

Results from different sources: questionnaire survey, interview and document analysis have helped in triangulation and validation of the results. The interview questions were framed based on the preliminary findings from quantitative approach and document analysis to ensure validity and reliability.

4.5 Profile of Respondents

Totally 127 duly completed responses were collected which accounts for 50.8% response rate. Responses represented different stakeholders, i.e., Employers, Contractors, Consultants and Academics. It has also covered different establishment areas as indicated in Chapter 5 (registration of firms): building construction, road construction, waterworks construction and general construction. Overall profile of respondents of questionnaire one is summarized in Table 4.2, while that of questionnaire two is discussed in subtopic 7.12. Main stakeholders are fairly included with their possible areas of establishment. It also reflects a wide range of experience with 70.07% having experience of six years and above. As the responses are experience based opinions, the data was expected to better reflect the intended enquiry.

Table 4.2 Profile of the respondent

Description		**Response (%)**
Respondents affiliation (Type of organization)	Client/ Employer	16.54
	Consultant	35.43
	Contractor	32.28
	Acadamc	12.60
	Regulatory Authority	3.15
Organization area of establishment (Sector)	Building Construction	31.5
	Road Construction	14.17
	Water Works Construction	7.87
	General (All infrastructure)	35.43
	Others	11.02
Experience of respondents	=2	16.54
	3-5	13.39
	6-10	48.82
	11-15	11.02
	16-20	3.15
	21-25	4.72
	>25	2.36

4.6 Summary of the Chapter

Research design is driven by research questions. Considering that the objectives of this study are different in nature, a mixed methods approach was adopted. Mixed methods approach also acts as a means for validation of research results. Quantitative data was collected through structured survey questionnaires. Purposive sampling method was used to select the respondents to account for the major stakeholders and subsectors of the industry. Questionnaire One was forwarded to 250 selected professionals and 127 valid responses were collected which accounts for 50.8% response rate. The respondents are from different backgrounds and have wide range of experience, 70.07% of the respondents have experience of six years and above. IBM SPSS version 21 software was used for statistical analysis: descriptive analysis, factor analysis and correlation.

Qualitative data was collected through analysis of relevant documents and semi-structured interviews. Document analysis was conducted based on predefined themes extracted from the literature review. Semi-structured interview guide was set with the objectives of identifying challenges of the industry and getting opinion of professionals on improvement mechanisms. Interviews were held with 21 professionals with a minimum of 10 years' experience. Analysis of semi-structured interviews took the form of thematic analysis, the themes being the specific objectives.

CHAPTER 5

CHALLENGES OF THE CONSTRUCTION INDUSTRY

This chapter presents challenges of CI identified through quantitative analysis of survey responses, document analysis and interviews. As discussed in conceptual framework of the study (Chapter 3), to identify challenges of the industry, variables affecting the determinant factors were categorized based on their presumed sources. Descriptive analysis was conducted to identify the level of impact of the variables and perception of the stakeholders towards the challenges. Spearman's rank correlation coefficient test was conducted to determine stakeholders' general perception towards the level of the challenges while one sample T-test was conducted to identify the significant variables.

The significant variables were subjected to factor analysis to identify underlying dimensions of the sources. Factor analysis was conducted using principal component analysis with varimax orthogonal rotation and Kaiser Criterion method (Eigenvalue exceeding one) was used to select the factors. Results of KMO and Bartlett's Test of Sphericity are summarized in Table 5.1. In the document analysis part, gaps and overlapping powers and duties of MoC and shortfalls in regulatory tools are discussed. Additionally, discussion is provided on findings from interviews and these findings are also used as a means of triangulating survey findings.

Table 5.1 Test for appropriateness of the challenge's data for factor analysis

Sources of the variables	KMO	Bartlett's Test of Sphericity
Variables emanating from role of government	0.839	Significant
Resource related variables	0.825	Significant
Variables emanating from nature of the industry	0.882	Significant
Variables emanating from vision of the industry for development	0.791	Significant

5.1 Variables Emanating from Role of Government

Mean values, the rankings and one sample T-test results are summarized in Table 5.2. Spearman's rank order correlation test shows that there is consensus on the level of impact of the variables between contractors and consultants (with $\rho=0.611$ and $p<$

0.05) and between clients and consultants (with $\rho = 0.525$ and $p<0.05$). The test between clients and contractors rankings indicates no agreement, which shows that there is difference in perception of clients and contractors on challenges of the industry, and this might be due to the difference in the nature of their business establishments. However, mean values of most of the variables being greater than three implies the difference is only on extent of the impact.

Aggregate results shows that the top three variables in terms of impact are: corruption and lack of transparency, delay in formulation and appropriate implementation of CID policy and economic cooperation. One sample T-test indicates that except three variables: *taxation system applicable to construction industry, government promoting labor-intensive methods to create employment* and *government policy in supporting capacity building of organizations,* the other variables are statistically significant.

The significance test results reflect the contextual scenario, i.e., to encourage private investment, exemption from the payment of customs duties and other taxes levied on imports is granted to capital goods, such as plant, machinery and equipment and construction materials (FDRE 2012). Hence, contractors are beneficiaries of the existing taxation scheme. It is self-evident that capacity building programs will not negatively affect development of the industry. Similarly, as most local contractors are involved in building sector, effects of promoting labor-intensive methods may not be significant.

Table 5.2 Descriptive statistics of variables emanating from role of government

Variables emanating from role of government	Clients		Contractors		Consultants		Total		One sample T-test
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Sign
Delay in formulation and appropriate implementation of CID policy	3.81	2	3.61	3	3.36	4	3.64	2	.000
Adequacy of Ministry of Construction as regulatory body	3.48	3	3.12	12	3.13	8	3.23	11	.030
Effective coordination between the concerned government departments	3.29	11	3.32	10	3.16	7	3.33	5	.006
Capacity of regulatory bodies, i.e. relevant government departments	3.38	6	3.00	14	3.31	5	3.25	10	.020
Taxation system applicable to construction industry	3.29	10	3.07	13	2.71	15	3.12	13	.258
Efficiency of registration system (firms and professionals)	3.38	5	3.32	9	3.18	6	3.29	7	.006
Efficiency of the applicable regulations, codes and standards	3.33	9	3.22	8	3.09	9	3.22	12	.046
Suitability of contract forms and contracting practice	3.33	7	3.49	5	2.91	12	3.30	6	.005
Suitability of the applicable Procurement system to improve CID	3.43	4	3.41	6	2.91	11	3.28	8	.009
Conflicting statutory requirement	3.10	13	3.39	7	3.07	10	3.28	9	.002
Corruption and lack of transparency	4.33	1	4.46	1	4.24	1	4.39	1	.000
Economic cooperation i.e. dependency on foreign aid	3.33	7	3.78	2	3.60	2	3.61	3	.000
Economic Condition	3.19	12	3.59	4	3.38	3	3.45	4	.000
Government promoting labor-intensive methods to create employment	2.43	15	2.88	15	2.89	13	2.91	15	.357
Government policy in supporting capacity building of organizations	2.90	14	3.15	11	2.87	14	2.99	14	.938

As indicated in Table 5.3, factor analysis of the significant variables has yielded three components with 62.72% cumulative variance explained. To represent the variables converged together, the components are named as: component 1 *(regulatory system),* component 2 *(CID policy implementation and corruption)* and component 3 *(dependency on foreign aid).*

Table 5.3 Factor analysis of variables emanating from role of government

Variables emanating from role of government	Component		
	1	2	3
Delay in formulation and appropriate implementation of CID policy		.823	
Adequacy of Ministry of Construction as regulatory body	.732		
Effective coordination between the concerned government departments	.768		
Capacity of regulatory bodies, i.e. relevant government departments	.807		
Efficiency of registration system (firms and professionals)	.769		
Efficiency of the applicable regulations, codes and standards	.803		
Suitability of contract forms and contracting practice	.809		
Suitability of the applicable procurement system to improve construction industry development	.872		
Conflicting statutory requirement			.579
Corruption and lack of transparency		.725	
Economic cooperation i.e. dependency on foreign aid			.728
Economic Condition	.507		
Variance explained %	39.78	11.64	11.30
Cumulative Variance explained %			62.72
Factor Score	3.29	4.02	3.45

Regulatory system

Effectiveness and efficiency of a regulatory system is majorly dependent on capacity of the regulatory authority and the regulatory tools. Capacity can be expressed in institutional organization structure and adequacy of the authority. Concerned statutory authorities (MoC including its regional affiliates and related bodies) should be adequately organized in a way that they can implement the strategies set in the policy, timely and effectively. Role and functions of the statutory authority should be clearly defined for its effective performance. Regulatory tools also have to be aligned with strategies of CID. However, as discussed later (section 5.5) in the document analysis part, powers and duties of the statutory authority and the regulatory tools have shortfalls. Adequacy of establishment implies inclusiveness of the coordinating institute. As construction industry encompasses wide spectrum of stakeholders, the coordinating body should represent all industry stakeholders. In this regard, the newly established construction industry council may create an active forum of stakeholders, unless constrained by bureaucracy and lack of commitment from members.

CID policy implementation and corruption

Policy should be set considering contextual problems arising at all levels of the industry and cross cutting issues. Concerning developing countries CI policy, Ofori (1994b) has indicated five scenarios for persistence of problems: (i) wrongly adopted polices, (ii) correct in principle but inappropriate for the context, (iii) correct but not competently implemented, (iv) not implemented and (v) correct and properly implemented but will take time to show the result as CID is a long term activity. Ethiopian CID policy framework was developed in 2013 (MUDC 2013a) and the provisions have covered wide spectrum of relevant issues. However, practical implementation is at its early stage and most practices of the industry are continuing without much improvement. Hence, delay in implementation of the policy is identified as one of the major challenges in the industry. Similarly, building proclamation and regulation were enacted in 2009 and 2011 respectively (FDRE 2009a, 2011) but it is not fully implemented (MoC 2017). The delay in implementation of policy and regulations allow problems of the industry to persist. This situation of the CID policy and building regulations indicate that, scenarios (iii) and (iv) are mainly revealed in the case of Ethiopian CI. These scenarios are associated with capacity of the implementing authorities; as discussed in section 5.6 in interview part, there are shortfalls in capacity of the regulatory authority. In addition, as discussed earlier in section 2.3, there is dynamism in the governance structure of the industry. Hence it is important to focus on strengthening capacity of regulatory and coordination authorities.

The other main variable under this factor is corruption and lack of transparency which is also indicated in the CID policy as a major challenge for the industry. Causes of corruption in Ethiopian CI are: deficiencies in accountability, capacity, and trust (Plummer 2012). The causes are as indicated in Figure 5.1. It can be reduced through improvement of the causal environment, e.g. improving transparency in the industry through disclosure of project information. Federal public procurement and property administration agency (FPPA) insists procuring entities to disclose project information on its website (MFED 2010). However, most reports of Construction Sector Transparency (CoST Ethiopia) indicate that there is accessibility issue with

project information from both the client and the Consultant. Hence, the practice needs to be strengthened to scale-up disclosure of project information.

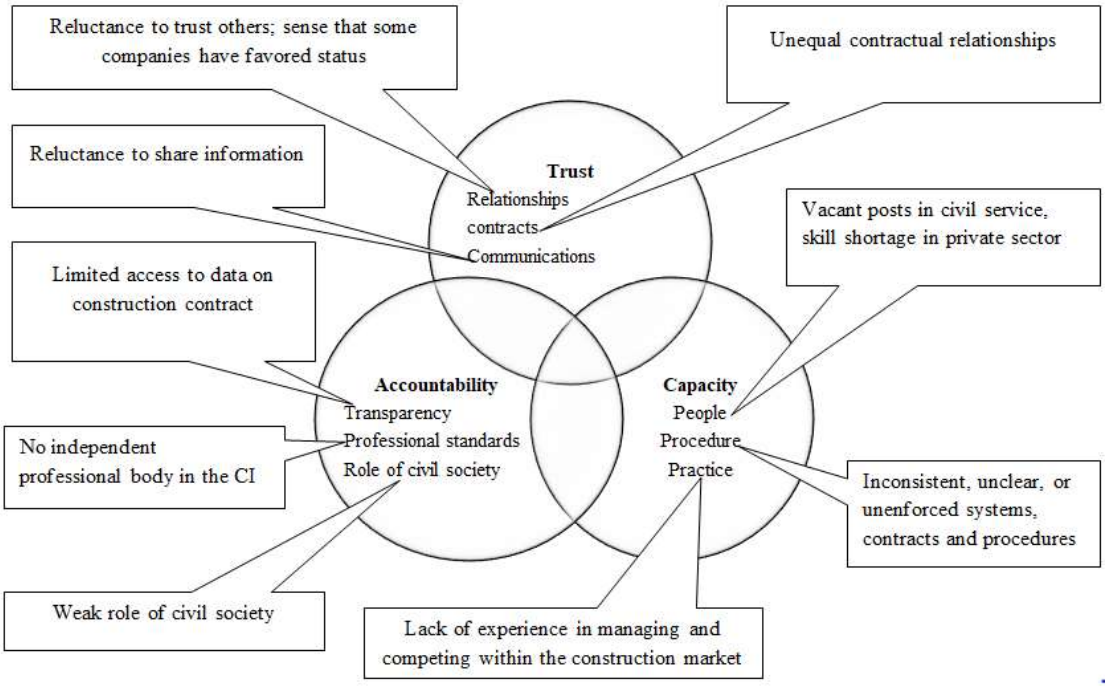

Figure5.1Causes of corruption risks in Ethiopian construction industry (Source: Plummer (2012))

Dependency on foreign aid

Cooperation of developed countries through bilateral and multilateral financial assistance is vital for social and economic change in developing countries as gross domestic savings are not generally sufficient (Moavenzadeh 1978). Therefore, infrastructure development in developing countries is highly associated with foreign aid, Ethiopia being no exception. Financiers' requirement to some extent poses difficulty on the industry as local firms are challenged to fulfill capacity and experience requirements to win projects (Desta 2015). This is one of the factors that show the influence of the general economy on construction industry.

5.2 Resource Related Variables

Results with respect to resource related variables are summarized in Table 5.4: mean values, rankings and one sample T-test. Spearman's rank order correlation indicates strong agreement among the rankings of clients and contractors (with ρ= 0.850 and

p<0.01), contractors and consultants (with ρ=0.784 and p< 0.01) and clients and consultants (with ρ= 0.868 and p<0.01). Aggregate results shows the major challenges are weak capacity of contractors, limited management skills and lack of access to working capital. These are also among the key intervention areas indicated in the national CID policy. The one sample T-test indicates appropriateness of training and education, availability of manpower (craft and operative), availability of physical infrastructure, rising wage levels and availability of information have comparatively less impact.

Table 5.4 Descriptive statistics of resource related variable

Resource related variables	**Clients**		**Contractors**		**Consultants**		**Total**		**One sample T-test**
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Sign**
Limited Management skills	3.81	3	3.88	2	3.89	3	3.90	2	.000
Limited technical knowledge	3.62	5	3.71	6	3.84	4	3.76	5	.000
Less access to working capital/ financial resource	3.90	2	4.12	1	3.80	5	3.89	3	.000
Availability of manpower: Skilled	3.19	8	3.22	11	3.16	8	3.24	8	.025
Availability of manpower: craft and operative	2.95	12	3.17	13	2.98	11	3.09	12	.336
Appropriateness of training and education	3.10	10	3.37	9	2.91	13	3.15	11	.190
Availability of materials	3.14	9	3.39	7	2.96	12	3.20	10	.060
Availability of equipment	3.24	7	3.39	8	3.04	9	3.23	9	.034
Adequacy of owner's/client's establishment to manage contracts and supervise construction	3.29	6	3.37	9	3.18	7	3.35	7	.003
Weak capacity of contractors	4.14	1	3.80	3	4.00	1	3.95	1	.000
Weak Capacity of consultants	3.67	4	3.80	3	3.89	2	3.83	4	.000
Rising of wage level	2.86	13	3.12	14	2.98	10	3.03	14	.739
Availability of information	2.67	15	3.12	15	2.87	14	2.94	15	.578
Availability of physical infrastructure e.g. Power and telecommunication	2.86	14	3.22	11	2.82	15	3.05	13	.660
Less application of information technology in the industry	3.10	11	3.80	5	3.60	6	3.60	6	.000

As indicated in Table 5.5, factor analysis of significant variables under this category has yielded two components with 62.40% cumulative variance explained, and the components are named as: component 1 (*weak capacity of contractors and*

consultants) and component 2 (*availability of 'skilled manpower and equipment' and adequacy of client's establishment*).

Table 5.5 Factor analysis of resource related variable

Resource related variables	**Component**	
	1	**2**
Limited management skills	.744	
Limited technical knowledge	.701	
Less access to working capital/ financial resource	.712	
Availability of manpower: Skilled		.826
Availability of equipment		.808
Adequacy of owner's/client's establishment to manage contracts and supervise construction		.792
Weak capacity of contractors	.822	
Weak Capacity of consultants	.840	
Less application of information technology in the industry	.564	
Variance explained %	37.08	25.32
Cumulative Variance explained %		62.40
Factor Score	3.82	3.27

Weak capacity of contractors and consultants

Capacity gap of domestic construction firms of sub-Saharan African countries has left the domestic market door open for international firms (Zawdie and Langford 2000). Ethiopian CI shares this situation in the region, the total amount of work awarded to foreign contractors in the road sector between 1998 to 2016 being 55%, as complex and big projects are awarded to foreign firms (ERA 2016). Many capacity building initiatives have been undertaken so far in building sector (MWUD 2010) and road sector (ERA 2016). However, these programs are fragmented and shortsighted. As there could be different shortfalls associated with planning and implementation of the programs (appropriateness of the support) and commitment of the organizations engaged in the program, effectiveness of these initiatives needs further investigation.

As shown in Table 5.5, weak capacity is attributed to poor management practices, limited management skills and technical knowledge, and lack of access to working capital. Poor IT application in the industry is also associated with capacity of the organizations.

Availability of 'skilled manpower and equipment' and adequacy of client establishment

Improvement of challenges associated with manpower development is discussed in detail in subtopic 8.1 (manpower development improvement framework). Improving equipment availability can be achieved through promoting suppliers and rental organizations.

There are also problems associated with adequacy of client's establishment to manage contracts and supervise construction, for example, unrealistic requirements and unrealistic contract duration are results of lack of technical knowledge of client organizations. ECPMI is working to mitigate the shortfalls associated with client establishments, specifically focusing on construction management capacity (ECPMI 2017). Training based capacity building needs initial gaps identification, feedback mechanism for its effectiveness and it has to be part of an integrated capacity development program.

5.3 Variables Emanating from Nature of the Industry

Results of the analysis are summarized in Table 5.6: mean values, rankings and one sample T-test results. Spearman's rank order correlation test indicates that there is significant correlation among the rankings: between clients and contractors (with $\rho = 0.594$ and $p<0.05$), contractors and consultants (with $\rho=0.923$ and $p< 0.01$) and clients and consultants (with $\rho= 0.691$ and $p<0.05$). The T-test indicates, except *competition from overseas contractors,* all other variables are significantly affecting development of the industry. The top challenges under this category are: *weak academic and industry linkage, lack of collaborative culture in the industry* and *poor information management in the industry*. Weak academic and industry linkage can be revealed in different forms: internship coordination and collaborative research practices. Weak academic and industry linkage is not only specific to CI but it is a national issue (Kahsay 2017; Salmi et al. 2017).

Table 5.6 Descriptive statistics of variables emanating from nature of the industry

Variables emanating from nature of the industry	Clients		Contractors		Consultants		Total		One sample T-test
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Sign
Poor Image of the industry	3.19	10	3.34	11	3.27	10	3.34	10	.001
Fragmentation of the industry	3.48	4	3.59	8	3.38	8	3.52	7	.000
Lack of collaborative culture in the industry i.e. poor relationship among key stakeholders	3.81	2	4.10	1	3.89	2	3.92	2	.000
Weak academics and industry linkage	3.81	1	4.05	2	3.87	3	3.98	1	.000
Demand stability/ fluctuation of workload	2.86	12	3.78	5	3.42	7	3.50	8	.000
Influence of culture, perception and attitude of stakeholders	3.29	8	3.41	9	3.31	9	3.41	9	.000
Professionalism of stakeholders	3.38	6	3.41	10	3.07	11	3.30	11	.005
Poor information management in the industry i.e. poor documentation and lack of organized data	3.52	3	3.85	3	3.89	1	3.86	3	.000
Lack of shared values amongst stakeholders for construction industry development	3.48	5	3.61	7	3.80	4	3.66	4	.000
Lack of industry-wide association of stakeholders	3.33	7	3.66	6	3.62	6	3.62	6	.000
Inconsistence of practice in the industry	3.24	9	3.80	4	3.69	5	3.64	5	.000
Competition from overseas contractors	3.14	11	3.27	12	3.00	12	**3.09**	12	.413

As indicated in Table 5.7, factor analysis yielded two components with 56.93% cumulative variance explained and the components are named as: component 1 (*collaboration and professionalism*) and component 2 (*image of the industry and demand stability*).

Lack of collaboration and professionalism

Improvements in construction industry can be achieved through concerted effort of the stakeholders. Hence, improving relationship among stakeholders and developing shared values through active engagement of different associations in the industry, professionals and business associations, would help to bring consistency in practices and can help to promote professionalism.

Improved professionalism will help for effective development of the construction industry. Raising standards of professionalism in the industry requires improving level of adoption of different practices like management practices, technology

development and IT application. Level of adoption of these dimensions of professionalism is poor in the industry, for example, management practice (Desta 2017) and technology transfer (Mengesha 2016).

Table 5.7 Factor analysis of variables emanating from nature of the industry

Variables emanating from nature of the industry	**Component**	
	1	**2**
Poor Image of the industry		.728
Fragmentation of the industry		.564
Lack of collaborative culture in the industry i.e. poor relationship among key stakeholders	.631	
Weak academics and industry linkage		.559
Demand stability/ fluctuation of workload		.729
Influence of culture, perception and attitude of stakeholders		.561
Professionalism of stakeholders	.642	
Poor information management in the industry i.e. poor documentation and lack of organized data	.796	
Lack of shared values amongst stakeholders for CID	.776	
Lack of industry-wide association of stakeholders	.672	
Inconsistence of practice in the industry	.700	
Variance explained %	30.40	26.53
Cumulative Variance explained %	56.93	
Factor Score	3.67	3.55

Image of the industry and demand stability

The negative image is associated with poor performance in different aspects. This shapes perceptions and attitudes of stakeholders towards the industry which ultimately affects its development. The overall practice in the industry is affected by perception and attitudes of the stakeholders towards changes in the industry, technology adoption, reputability etc. Improving image of the industry needs dedication and conscious effort of stakeholders to promote achievement of improved performance at all levels.

Demand situation in CI is associated with economic capacity of the country and the practice of long term planning for CID. Therefore, to reduce socio-economic pressure of other sectors and to reduce effect of demand fluctuation due to budget shortage, it is important to develop long term plan for CI.

5.4 Variables Emanating from Vision for Industry Development

Results of descriptive analysis and factor analysis are as summarized in Table 5.8. The top challenge in this category is lack of performance measurement of progress of the industry. Performance measurement is a base for continual development of CI. It is important to benchmark CID; hence the component is named *lack of benchmarking CID practice*. Establishing a shared vision and monitoring and evaluating change are practices to be adopted as a lesson from different reforms initiatives for developing countries (Wyk 2006). Even though Ethiopian government has a vision to build internationally competitive construction industry by 2025, benchmarking practice is poor leading to lack of information. Information about performance of the industry helps to channel resources into the right direction (Fox and Skitmore 1991).

Table 5.8 Descriptive statistics and Factor analysis of variables emanating from vision of the industry for development

Variables emanating from vision of the industry for development	**Mean**	**Std. Deviation**	**Rank**	**One sample T-test value**	Component
				sign	1
Weak research and development practice	3.91	1.031	2	.000	.845
Lack of long term thinking for construction industry development	3.89	.945	3	.000	.854
Lack of performance measurement of the industry improvement	4.01	.886	1	.000	.858
Less practice of Prefabrication and standardized production	3.75	.967	4	.000	.763
Variance explained %					69.04
Factor Score					3.89

5.5 Document Analysis and Discussion

Understanding existing CID practice requires reviewing the industry governance system. As discussed earlier in analysis of survey results, shortfalls in the regulatory system were identified as a challenge for the industry. Hence, with the aim of further investigation, powers and duties of MoC (regulatory body for construction industry in Ethiopia) and effectiveness of regulatory tools were reviewed and analyzed. As discussed in Section 2.3, governance structure of the CI is dynamic which by itself can be considered as a challenge to industry's development. While establishment of MoC in 2015 was appreciated by stakeholders of the industry, it merged back in 2018

with ministry of urban development and construction (MUDC) from where it was originally separated. Powers and duties of MoC are directly transferred to MUDC by proclamation no. 1097/2018 (FDRE 2018) and the regulatory tools are same. Hence, in the discussion the name 'MoC (MUDC)' is used. Framework for document analysis is indicated in Figure 5.2. The main focus here was to understand effectiveness of the regulatory system: powers and duties entrusted to the statutory institute to regulate and facilitate development of the industry, and adopted regulatory tools to achieve CID targets.

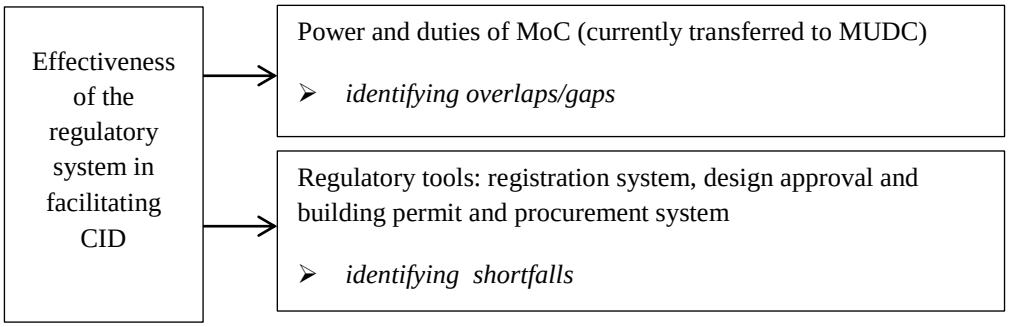

Figure 5.2 Framework for document analysis

5.5.1 Powers and Duties of Ministry of Construction

The objective was assessing the powers and duties and identifying overlaps/gaps considering core processes of the ministry. Core processes of the ministry were: (i) regulatory system and (ii) capacity building and technology transfer. **The regulatory system** has three categories: (a) preparation of applicable laws, codes and standards (LCS) and assurance of its implementation, (b) professionals, organizations and machinery registration and certification and (c) public projects follow-up and support. C**apacity building and technology transfer** had four categories: (a) capacity building of professionals and companies, (b) Research and Development and funding coordination, (c) Prefab technology and materials manufacturing development and (d) Database development and information management. The overlaps in powers and duties of MoC (MUDC) are summarized in Table 5.9 focusing on proclamation no. 916 /2015. Proclamation No. 916 /2015 was enacted to define powers and duties of the executive organs of the FDRE. The proclamation defines the common powers and

duties of ministries and particular powers and duties of respective ministries and is currently replaced by proclamation no. 1097/2018 (FDRE 2018).

As indicated in Table 5.9, the major shortfall in the duties of MoC were the overlaps with other organs of the government, e.g. with MoFEC (mainly Public Procurement Agency), Ministry of Transport (MoT) (mainly Ethiopian Roads Authority), Ministry of Industry (MoI), Ministry of Water, Irrigation and Electricity (MWIE) and Ministry of Science and Technology (MoST). In addition, mandate analysis report conducted by MoC to reengineer its core processes shows that there were activities which were not conferred to the ministry, but had been included in its strategic plan (MoC 2017). These activities were establishing a system of procurement: standard bid documents, methods of delivery system, sub-contracting and partnership which are mandates of Public Procurement Agency. Due to the nature of the industry, it is difficult to absolutely assign activities to a single office. However, this challenge can be overcome by effective coordination mechanism. In addition, the overlaps should be minimized to improve efficiency of regulation and coordination.

Apart from duplication of effort, overlaps create conflicting statutory requirements resulting in blame game in case of failure of coordination. Hence, the powers and duties which have gaps and those that lack clarity need to be redefined and refined, and the overlaps need to be allocated to the one that can better manage it, or there has to be a clear coordination mechanism facilitated by MUDC. However, it is important to note that, a separate autonomous regulatory body has more advantages than a department under the government to effectively regulate and facilitate development of the industry and that was the main reported reason for establishment of MoC in 2015.

Table 5.9 Summary of gaps and overlapping in power and duties of Ministry of Construction

Core process	Description of power and duties *(asterisk represents duties entrusted to other organs by proclamations/ regulations)*	Remarks
(i)(a)	• Set and follow up the compliance of standards for construction works Proc. No. 916./2015, 27(1)(a)-(FDRE 2015)	• Proc. No. 624./2009, 57-(FDRE 2009a) states, it prepares codes applicable at national level and supervises compliance. However, role of supervision is not indicated in Proc. No. 916./2015-27(1)(g)-(FDRE 2015). There is no clear coordination mechanism among states and MoC (MoC 2017).
	• **Procurement and contract administration issues* Proc. No. 916./2015, 18 & *Proc*. No. 649./2009(FDRE 2009b)	• This is the power and duty of Ministry of Finance and Economic cooperation. However, MoC has a plan to work on related works; preparing SBD, methods of deliver system, subcontracting. There is no coordination mechanism between the two ministries (MoC 2017).
	• **Set standards for transport infrastructures…and ensure their implementation. Though this does not clearly say about construction works*, ERA has standard for Road construction works. Proc. No. 916./2015-24(2)-(FDRE 2015)	• Practically there is overlap in the practice. ERA is mandated to Ministry of Transport (MoT); however it has construction 'specification and standards'.
(i)(b)	• register and issue certificates of professional competence to **engineers and architects** engaged in the construction sector • determine the grades of **contractors and consultants**, and issue certificates of competence to those operating in more than one Regional States Proc. No. 916./2015, 27(1)(d)	• Scope of the registration is not properly defined, professional other than the specified and semi-skilled labor are not included. • Ministry of Water, Irrigation and Electricity is registering professional engaged in water works construction without legal power (MoC 2017).
(i)(c)	• provide necessary support in the preparation of designs and contract documents and also supervision for **building constructions** financed by the Federal Government Proc. No. 916./2015, 27(1)(c)	• This is identified as one of the process under regulatory system. However, it is better to be categorized under capacity building for it is about capacity building of clients. It is not clear, why the focus is on building construction only.
(ii)(a)	• create conducive conditions for development of internationally competitive CI • design national construction enterprises, strengthening strategy to ensure competence and viability; follow up implementation of the same; Proc. No. 916./2015, 27(1)(b&c)-(FDRE 2015)	• 27 (1)(b) could be taken as summary of the entrusted powers and duties concerning capacity building.

Table 5.9 Summary of gaps and overlapping in power and duties of Ministry of Construction (continued)

Core process	Description of power and duties *(asterisk represents duties entrusted to other organs by proclamations/ regulations)*	Remarks
(ii)(b)	• undertake research for improving the types and qualities of local construction materials Proc. No. 916./2015, 27(1)(f)	• As indicated in the proclamation different institutes have the duty to collect information; e.g. (i) metals industry development institute, (ii) chemical and construction inputs industry development institute, (iii) MoLSA and (iv) Statistics authority which is essential to fulfill this duty. So, there has to be a clear coordination mechanism. • In summary: Technology development, R&D, information collection, Analysis and dissemination needs coordination as they are undertaken by different related organizations and institutes in their particular areas.
	• **in cooperation with the concerned bodies, establish a system for technology need assessment, identification, acquisition, packaging, utilization and disposal, and follow up implementation of the same;* Proc. No. 916./2015, 23(2), *MoST*	
(ii)(c)	• **Chemical and construction inputs industry development institute* o *Cement, ceramic…are the indicated construction inputs Regulation* 288/2005	
	• **Metals industry development institute* o *Rebar, CHS, RHS, Roofing Materials, etc Regulation* 183/2005	
	• **Establish system and provide support to domestic investors engaged in service, agriculture and* ***construction sectors to transfer and engage in manufacturing sector****.(MoI)* Proc. *No*. 916./2015, 21(3)	
(ii)(d)	• **Register technology transfers made in every sector, coordinate codification and technology capability accumulation efforts, and ensure successive use of same.* Proc. No. 916./*2015*, 23, MoST	
	• **Establish and put into operation a national labor market information system. …*Ministry of Labor and Social Affairs (MoLSA) Proc. No. 916./*2015*, 24(11),	

Note: The ministries are as per Proc. No. 916./2015, there are some differences as there is reorganization in the new Proc. No. 1097/2018, however it does not affect the discussion.

5.5.2 The Regulatory Tools

CID reform initiatives are dependent to a great extent on enforcement and compliance mechanisms, i.e. procurement instruments, registration and accreditation, legislations to seek compliances (Milford 2009). Here three tools: (i) registration system, (ii) design approval and building permit and (iii) procurement system (practice) are reviewed. There are other applicable codes and standards in the country: Building codes (adopted from Euro norms), Specifications and standards of ERA; however, they are not considered in this study due to their technicality.

5.5.2.1 Registration System

Registration is common in most countries and it may include registration of construction companies, professionals, suppliers, machineries, workers etc. Registration provides information to facilitate regulation /management of the industry, generate revenue for capacity development programs and it facilitates procurement as a general prequalification criteria. Registration also helps to set targets for firms and professionals to grow. Though registration has these benefits, some of its demerits are: restriction of trade, difficulties in administering the process (checking credentials and maintaining current and accurate data) and it may introduce bureaucratic delays as criteria for registration tends to change with time (Ofori 2004).

One of the duties of MoC (MUDC) is registering and issuing certificates of competence for professionals, and registering and determining grades of firms (contractors and consultants) (FDRE 2015). In addition, the ministry also undertakes registration of construction machinery (FDRE 1999). The ministry has two directives for registration, directive no. 19 and no.22 (MUDC 2013b; c). Directive no. 19 is for registration of construction professionals and contractors and directive no. 22 is for registration of design professionals and consultants.

Registration of Professionals

Registration of professionals should determine current competence of the professionals, regulate performance (e.g. suspension of certificate in case of violation) and ensure CPD. The existing registration practice for construction and design

professionals is summarized in Tables 5.10, 5.11 and 5.12. There are some differences between registration of construction and design professionals.

Table 5.10 Construction professional title identification (Directive No. 19)

Title	Service Year*	Qualification
Professional Engineer VII/ Professional Architect VII	16	For professional Engineer: BSc. In Civil Engineering or in other related field and for professional Architect: BSc. In Architecture or in other related field
PE VI/ PA VI	14	
PE V/ PA V	12	
PE IV/ PA IV	10	
PE III/ PA III	8	
PE II/ PA II	6	
PE I/ PA I	4	
Graduate Engineer/ Graduate Architect	0-4	
Associate Engineer VII	16	Diploma from University in Civil Engineering or other relate fields (or Level V *certificate from Technical school)*
Associate Engineer VI	14	
Associate Engineer V	12	
Associate Engineer IV	10	
Associate Engineer III	8	
Associate Engineer II	6	
Associate Engineer I	4	
Graduate Associate Engineer	0-4	
Junior Associate Technician VII	16	Diploma from Technical school or other similar institution (or Level IV *certificate) Drafting, surveying, electrical, building, road, construction, plumbing, carpentry, masonry and metal works*
Junior Associate Technician VI	14	
Junior Associate Technician V	12	
Junior Associate Technician IV	10	
Junior Associate Technician III	8	
Junior Associate Technician II	6	
Junior Associate Technician I	4	
Graduate Junior Associate Technician	0-4	
Engineer Aid VI	14	Diploma from Technical school or other similar institution (or Level II *certificate*) *Drafting, surveying, electrical, building, road, construction, plumbing, carpentry, masonry and metal works*
Engineer Aid V	12	
Engineer Aid IV	10	
Engineer Aid III	8	
Engineer Aid II	6	
Engineer Aid I	4	
Graduate engineer Aid	0-4	
Junior Engineer Aid VI	14	Certificate from Technical school or other similar institution (or Level I *certificate*)
Junior Engineer Aid V	12	
Junior Engineer Aid IV	10	
Junior Engineer Aid III	8	
Junior Engineer Aid II	6	
Junior Engineer Aid I	4	
Graduate Junior Engineer Aid	0-4	

**Service year signifies professional engagement: Applicant must have engaged in responsible position in building or civil construction works. In between 0-4 yrs. there are four level, e.g. for graduate engineer; GE, GEI, GEII, GEIII for fresh, 1, 2 and 3 yrs. of experience respectively. The same applies for other professionals (refer Table 5.11).*

Table 5.10 shows the qualification and service years (experience) required for different categories of construction professionals. As indicated in Table 5.11, there are 53 different titles leading to five careers (qualification): Professional Engineer, Associate Engineer, Junior Associate Technician, Engineering Aid and Junior

Engineering Aid. However, as it can be observed from Table 5.11, there are 33 overlaps which are considered in the directive as *'equivalence between construction professionals'*. The other observed shortfall is, even though there are different professional degrees related to construction offered in Ethiopian universities, the directives do not exhaustively list all the professions offered, but simply state 'Architecture, Civil Engineering and related' which is ambiguous. In addition, upgrading certification is based on only years of experience and there is no tracking mechanism to ensure the same.

Table 5.11 Equivalence between construction professionals

No.	Careers (qualification)				
	Professional Engineer (PE)	Associate Engineer (AE)	Junior Associate Technician (JAT)	Engineering Aid (EA)	Junior Engineering Aid (JEA)
1	PEVII				
2	PE VI				
3	PE V				
4	PE IV	AE VII			
5	PE III	AE VI			
6	PE II	AE V	JAT VII		
7	PE I	AE IV	JAT VI		
8	GE III	AE III	JAT V		
9	GE II	AE II	JAT IV	EA VI	
10	GE I	AE I	JAT III	EA V	
11	GE	GAE III	JAT II	EA IV	JEA VI
12		GAE II	JAT I	EA III	JEA V
13		GAE I	GJAT III	EA II	JEA IV
14		GAE	GJAT II	EA I	JEA III
15			GJAT I	GEA III	JEA II
16			GJAT	GEA II	JEA I
17				GEA I	GJEA III
18				GEA	GJEA II
19					GJEA I
20					GJEA

Table 5.12 shows the qualification, service years (experience) and professional engagement for different categories of design professionals. There are three categories: Building Works, Water Sector and Road and Transport Sector, and 27 different titles without including the highest title, 'practicing professionals'. Similar to Construction professionals upgrading certification for the 27 titles is based on experience. The difference is, for practicing professionals submitting design projects done by the professional/design projects involved in is a mandatory requirement. However, unlike directive No.19, here professional engagement is stated loosely (may

be engaged) which creates regulatory hurdle for enforcement of the requirement if taken seriously.

In both cases, construction and design professionals registration, identified problems are overlaps, it does not promote CPD and there is no clear follow up mechanism. The other problem is, professions listed in the directives are not exhaustive and explicit. While some professions are not offered in the country, there are others offered in the country but not included in the list. This mainly shows poor practice in manpower planning, poor linkage and coordination among the concerned parties.

Table 5.12 Design professional title identification (Directive No. 22)

Category	Title	Service Years	Qualification	Professional engagement
Building Works	Professional Architect and Engineer	4	BSc. In Architecture or Engineering (Civil, electrical, mechanical or related)	Applicant may be engaged in the preparation of design documents and supervision of construction works
	Graduate Architect and Engineer	0-4		
	Associate Engineer	6	Advanced Diploma in Building Engineering or equivalent	Applicant may be engaged in construction superintendence or supervision
	Graduate Associate Engineer	0-6	Diploma in Building Engineering or equivalent	Applicant may be engaged in construction or supervision
	Junior Associate Technician	6	Technical school diploma (10+3, 12+2) or certified for level IV in construction category	Applicant must engage in responsible position in civil construction works
	Graduate Junior Associate Technician	0-6		
	Engineer Aid	6	Technical school certificate	Applicant may be engaged in drafting, in surveying and other civil construction works
	Graduate engineer Aid	0-6		
Water Sector	Professional water supply Engineer	4	BSc.in Water supply engineering	Applicant may be engaged in the preparation of design documents and supervision of construction works
	Professional Irrigation and Hydraulics Engineer	4	BSc.in Irrigation and Hydraulics engineering	
	Professional water resource engineering & Hydrologist	4	BSc.in water resource engineering	
	Graduate Irrigation, hydraulics, Hydrology, Water Supply Engineer	0-4	BSc. In approved courses in irrigation and hydraulics engineering	
	Associate Engineer	6	Advanced Diploma in engineering or equivalent	Applicant may be engaged in construction superintendence
	Graduate Associate Engineer	0-6	Diploma in water technology/ engineering or equivalent	Applicant may be engaged in construction or project supervision
	Engineering Aid	6	Technical school certificate or equivalent	Applicant may be engaged in drafting, in surveying and other civil construction works
	Graduate engineering Aid	0-6		
Road and Transport Sector	Professional Materials Engineer	5	BSc. In Materials Engineering, Geology, Civil Engineering or Engineering Geology	Applicant may be engaged in the testing and preparation of reports on materials for projects and also in the supervision of construction material works
	Graduate Geologist	0-5	BSc. In Geology	Applicant may be engaged in the Geological and interpretation of aerial and satellite photos
	Professional Geologist	5		
	Professional Highway Engineer	5	BSc. In Highway Engineering or Civil Engineering	Applicant may be engaged in the preparation of Design and contract document and in supervision of highway construction works
	Professional Location Engineer	5	BSc. In Surveying, Civil Engineering or Highway Engineering	
	Professional Engineering Geologist	5	BSc. In Geology and engineering field	Applicant may be engaged in the Geological and interpretation of aerial and satellite photos and geo-technique projects
	Professional Bridge Engineer	5	BSc. In Civil Structural Engineering	Applicant may be engaged in the preparation of Bridge Designs and in the Supervision of Bridge, Tunnel, Viaduct Construction works
	Associate Engineers	6	Advanced Diploma in Building or Civil Engineering or equivalent	Applicant may be engaged in construction superintendence, design or supervision
	Graduate Associate Engineer	0-6	Diploma in Building or Civil Engineering or equivalent	
	Engineering Aid	6	Technical school certificate or equivalent	Applicant may be engaged in drafting, in surveying and design works
	Graduate Engineering Aid	0-6		
All	Practicing Professionals	8	At least BSc. Degree in Engineering or Architectural fields	Relevant and Progressive experience.

Specialty of practicing professionals are; Practicing Architect, Structural Engineer, Sanitary Engineer, Highway Engineer, Pavement Engineer, Location Engineer, Bridge Engineer, Material Engineer, Foundation Engineer, Irrigation Engineer, Hydraulics Engineer, Water Supply& Sewerage Engineer, Hydrologist, Construction Management, Mechanical

Remark: unlike directive No.19 professional engagement is expressed loosely, 'may be', which creates regulatory hurdle for enforcement of the requirement if taken seriously.

Registration of Firms

As the nature of establishment differs, registrations of contractors and consultants have different requirements. Registration of contractors requires employing staff and owning equipment (number, type and capacity) set for each specific category and grade. Categories of contractors are: General Contractors, Building Contractors and Road Contractors. As summarized in Table 5.13, for each category there are 10 grades resulting in 30 classifications excluding specialty contractors. The grades indicate capacity of the firm in its category which determines size of projects that the contractors can tender for.

Water works contractors are registered by Ministry of Water, Irrigation and Electricity which is not in its mandate (FDRE 2015; MoC 2017). This raises classification numbers to more than 40 which results in difficulties in monitoring and controlling.

Table 5.13 Grades for Contractors registration

Categories	Grade	Construction cost (Birr)		
		BC	RC	GC
GC,BC,RC	1	Above 210,000,000	Above 300,000,000	Above 350,000,000
GC,BC,RC	2	Up to 210,000,000	Up to 300,000,000	Up to 350,000,000
GC,BC,RC	3	Up to 160,000,000	Up to 225,000,000	Up to 270,000,000
GC,BC,RC	4	Up to 110,000,000	Up to 154,000,000	Up to 185,000,000
GC,BC,RC	5	Up to 54,000,000	Up to 76,000,000	Up to 100,000,000
GC,BC,RC	6	Up to 27,000,000	Up to 38,000,000	Up to 45,000,000
GC,BC,RC	7	Up to 11,000,000	Up to 15,000,000	Up to 18,000,000
GC,BC,RC	8	Up to 5,400,000	Up to 7,500,000	Up to 9,000,000
GC,BC,RC	9	Up to 3,000,000	Up to 4,200,000	Up to 5,000,000
GC,BC,RC	10	Up to 1,000,000	Up to 1,500,000	Up to 1,800,000

- "GC" General Contractors ... Contractors who are qualified to undertake a variety of construction works such as building, roads, railways, bridges, airports, and dams, waterworks, etc.
- "BC" Building contractors ... Contractors who are qualified to undertake building construction and supplementary works on buildings
- "RC" Road Contractors ... Contractors who are qualified to undertake construction of roads and other related civil engineering works.
- "SC" Specialized Contractors ... These are contractors who are qualified to undertake construction activities in specialized fields; Painting and decoration (SC-PD), Sanitary Installation (SC-SI), Wood and Metal Works (SC-MW) and Landscaping (SC-LS)
- Applicant shall submit satisfactory evidence showing the firm or organization has preferable number of registered staff and owning equipment (number, type and capacity) for category and grade of application.

Registration of consultants is carried under four sectors: *Building Sector*, *Water and Sewerage*, *Highway and Bridge* and *Construction Management*. The registration requires; employing staff, owning vehicles, office equipment (number, type and capacity), office area and capital indicated for the specific category and grade. As

summarized in Table 5.14, there are 6 grades with 10 categories which make up 60 possible classifications without including practicing professional (PP) and specialty consultants. The main shortfall observed is, in addition to the long list of classifications, description of the scope has ambiguity and overlaps.

Table 5.14 Grades for Consultants registration

Sector	Ser. No	Category	Class and project Size (Million Birr)							Description of the Scope
			I	II	III	IV	V	VI	PP	
Water and Sewerage	1	Water Resource consultancy (General)	350+	350	250	150	100	75	50	Preparation of all water engineering design works and supervision befitting their category
	2	Irrigation, Drainage and flood control consultancy	350+	350	250	150	100	75	50	Preparation of total design and supervision document for irrigation, drainage, flood control, sewerage and related projects befitting their category
	3	Sanitary Engineering consultancy	+120	120	100	80	60	40	20	Preparation of total design and supervision document for sanitary installation of building projects befitting their category
	4	Hydraulics engineering consultancy	350+	350	250	150	100	75	50	Preparation of total design and supervision document of hydraulic engineering projects befitting their category
Building	5	Architectural engineering and consultancy	+120	120	100	80	60	40	20	Preparation of total design document for building and civil projects befitting their category
	6	Consulting Engineers (general)	350+	350	250	150	100	75	50	Preparation of all engineering design works befitting their category
	7	Architectural consultancy	+120	120	100	80	60	40	20	Preparation design document for building projects
	8	Specialized consultancy	+120	120	100	80	60	40	20	Preparation design document befitting their category
General	9	Consultancy in Construction management	350+	350	250	150	100	75	50	Participate in works of supervision, contract document preparation, project management service, quantity surveying, construction planning, claim administration, engineering economics, construction engineering, engineering management, infrastructural development study document for building, highway, railway, harbor and civil projects befitting their category
Highway and Bridge	10	Highway and Bridge consultancy	350+	350	250	150	100	75	50	Preparation of design and supervision of projects befitting their category

Applicant shall submit satisfactory evidence showing the firm or organization has preferable number of registered staff and comparable financial standing, equipment, office area and office facilities of classification befitting their category

5.5.2.2 Design Approvals and Construction Permits

Building proclamation (FDRE 2009a) and the building regulation (FDRE 2011) were reviewed to identify the focus areas of design approvals and construction permits in Ethiopia. Functions covered are: design approval, issuing construction work permits,

inspection of construction activities and issuing occupancy permit. Construction work permit mainly focuses on controlling informality in the industry, i.e. the design and construction to be undertaken by registered professionals and registered firms. The regulation goes to the extent of limiting the amount of performance bond for design and construction. Similarly, in the inspection part, different stages are detailed where mandatory inspection by the department is required. Such details may lead to overlaps with procurement and contractual issues. In addition, as discussed earlier, the building regulation is not fully implemented.

As discussed in Section 8.3, in addition to regulating practices, design approval and construction permits can be used to promote/induce best practices to the industry. Hence, improving the provisions to meet targets of CID and eliminating implementation barriers will help achieve desired outcomes.

5.5.2.3 Procurement System

Similar to design approval and construction permits, procurement system can be used as CID tool. It is an important tool to permanently drive reforms to shape the industry practice. As government is the largest procurer of construction works in developing countries, it can effectively use procurement systems as a mechanism to enhance development of the industry. Some changes that could be achieved through procurement system are including pervious performance evaluation as selection criteria (this can promote competitiveness and reduce challenges of least cost practice), creative work packaging (for capacity development and technology transfer), promoting or introducing certain type of technology (i.e. introducing innovation or technique), etc.

In Ethiopia, some techniques have been tried and some are under use. Previous performance is considered as evaluation criteria: the bidder should submit goodwill letters from previous clients. However, this is not effective as the weight allocated to previous performance is small; and the letters cannot indicate performance as there is no accepted performance evaluation method/criteria. This can preferably be integrated with the registration system, i.e. auditing performance of the firms for upgrading (renewal of license) or quality assurance program.

Similarly, some capacity building initiatives have been tried: slicing projects to increase number of local contractors in road sector (ERA capacity building program), supporting new entrants to road sector (i.e. Universal Rural Road Access Program-URRAP) and engaging small and micro enterprises (SMEs) in building sector (apartment building). As discussed earlier, those initiatives are fragmented and lack sustainability. Such initiatives have to be integral part of long term CID program and coordinated centrally for continuous monitoring and control of the performance of the program.

In addition, as discussed earlier, enforcing information disclosure requirements in procurement system is necessary to deter corruption through transparency. The project delivery system in practice is mainly DBB which is fragmented in nature. It is recommended by studies in different countries to shift to integrated procurement systems for improving performance of the industry. Therefore, it is important to consider streamlining procurement system to achieve CI goals as a long term strategy.

5.6 Findings from Interviews and Discussion

As indicated in Section 4.3 (Figure 4.2), focus of the interviews was challenges of the industry and improvement of the determinant factors. Semi-structured interview questions (interview guide) were used to get opinion of the interviewees and attempt was made to map with subthemes of the research construct through a series of follow-up questions. Themes of analysis and discussion for challenges were the perceived sources of challenges: role of government, resource related challenges, and nature and vision of the industry for development. Characteristics of the pertaining business environment were also discussed along with challenges. Since interviews were held after arriving at preliminary findings from the questionnaire, an effort was made to link the interview discussion with findings of the questionnaire with an intention to validate and supplementing the questionnaire findings. Improvement mechanisms part of the interviews focused on manpower development, enhancing competitiveness and harmonizing industry practice and are covered in Chapter 7.

5.6.1 Role of Government

Challenges identified are associated with capacity of the regulatory authority and effectiveness of regulatory tools. The current concern for development of the industry, for example, establishment of MoC, ECPMI, CIC and provision of policy for CID was appreciated by the interviewees. As discussed earlier, the MoC had two core processes and seven categories to implement strategies set in the policy. However, as the interview with R5 indicates, it had problems: (i) most of the departments were understaffed and had competence related problems and (ii) there are gaps and overlaps in duties. As these are going to be the challenges of the new department under MUDC, it has to be the primary area of focus.

Concerning development of the policy and its exhaustiveness in addressing problems of the industry the interviewees agreed that the listed problems and strategies are enough if implemented properly. It was observed that development of the policy were participatory, R4 has explained the case as:

> *The policy has covered different relevant ideas which have been raised in different forums and workshops since 6/7 years before it was launched. If we are able to implement the listed strategies, it is a good progress. Establishment of construction industry council (CIC) and the MoC itself are among the achieved targets of the policy.*

According to R5, the point which is not addressed on the policy is fragmentation of the industry. He emphasized on the need for coordination mechanism between different organs which are not directly mandated to MoC, for example, Roads authority, PPA, Railway Corporation, MWIE, MoST, MoI etc.

Concerning the registration, interviewees agreed on the need to improve the existing registration system. R3 stated the case as:

> *Objective of registration is ensuring minimum capacity of firms. But the existing system does not do that. For example, we can see registration of consultants, the requirements are irrelevant: printer, plotter… these things do not measure capacity of firms. At least there has to be a mechanism to measure the deliverables. Similarly,*

the professionals' registration has to ensure competence. Generally, the registration has missed its objective.

R8 also added, the requirements for consulting firms are unreasonable, especially, office area requirement is exaggerated and some of the equipments required are outdated. The registration is prone to malpractices; among these providing false profile for registration is the common one. This has contribution to poor professionalism and poor performance in the industry. R12 has explained the case as:

Evaluating the appropriateness of the existing requirement for registration of firms is one thing, but at least the existing has to be implemented properly and there has to be a check and balance mechanism to control malpractice.

The interviewees proposed developing a database as a mechanism to control false profiles. According to R12, it is good to develop a database for registration to track equipment and manpower, but the main thing is companies' attitude/culture have to be changed. R14 suggested performance auditing and performance reward as an incentive:

Contractor's license renewal should consider the technical performance audit, not only financial audit, there has to be a check and balance mechanism in the industry and there has to be transparency and performance recognition mechanism.

The current registration of professionals does not promote CPD. To improve this, some interviewees suggested involvement of professional associations in certification. However, R2 stressed on the strength and legitimacy aspect of the associations:

For renewal of registration, certification can be a prerequisite as a mechanism of promoting CPD; but this needs strengthening the associations and creating legal platform to do so. We need to create strong and independent professional associations that engage in R&D and ensure the presence of competent professionals in the industry.

R12 has also emphasized on organization of the associations and coordination with the registering authority. Another challenge identified concerning professional registration is that there is no strong link between MoC (MUDC) and regional states'

construction bureau. This results in one being able to have two licenses at a time and sign for different companies. This can be a loophole which encourages malpractice.

As discussed earlier, the other role of government that affects the industry is as a client which is manifested in the adopted procurement system. The issues raised by the interviewees were, some of the prequalification criterions are difficult to prove, e.g. (i) goodwill letter from previous client as an indication for performance and good relationship and (ii) certificate of machinery owning. Crosschecking and authenticating forged documents is difficult. The interviewees suggested developing a central data system to overcome these changes. Also, contractors' and consultants' performance should be measured and recorded for future prequalification. As discussed in Section 8.4, improving these requires establishing some new systems, i.e. adopting quality assessment system suitable to the context (setting project performance evaluation system).

Absence of minimum consultancy fee and shortage of time given for design development are also identified as a problem. According to R8, absence of minimum consultancy fee is a main source of corruption and shortage of time given for design is the main reason for inadequate (incomplete) bid documents which lead to poor performance. Another problem indicated by R12 concerning provision of GCC was, the risk sharing is to some extent unfair, for example, price adjustment is not allowed for a project before 18 months, that means there is no price adjustment for a project having less than 18 months duration. The contractor is expected to consider the scenario and consider it in the bid. However, it is difficult to predict price movements during this duration in the existing market conditions.

5.6.2 Resource Related Challenges

Interviewees revealed that manpower, especially less experienced professionals and direct labor is not a problem. On the other hand it is indicated that there is shortage of experienced professionals. To improve the situation R13 recommended as:

> *The procurement prequalification criteria do not allow the contractor to recruit professionals with less years of experience; a sort of mechanism has to be devised to improve this practice so that the industry can absorb the new entrants.*

Dependency on import materials, especially, finishing materials in building projects is indicated as a problem for the industry. Some of the materials manufactured locally do not satisfy the minimum requirements. The other problem associated with import materials is financial accessibility, i.e., currency related issues.

Other problems indicated are management practice and technical capacity of the organizations. The indicators mentioned by the interviewees are: most of the ICB projects in the country are carried by international companies and most of the local contractors are majorly involved in only building projects, rather than strengthening their capacity and diversifying to other sectors. Details of suggested improvements concerning enhancing competitiveness are discussed in Chapter 7.

5.6.3 Nature of the Industry and its Vision for Development

Poor professionalism and poor image of the industry are identified as the main challenges associated with nature of the industry. These challenges are interrelated with those discussed under the role of government. There is no system that promotes professionalism in the industry. As indicated above, attitude and perception change is required in the industry.

In many of the discussions, poor information management in the industry is raised as a problem. The other challenge is weak academic and industry linkage. This is discussed in more detail in Chapter 7.

Planning and monitoring of the construction industry development is also poor. It is indicated that the demand potential is high and is increasing. However, there is absence of forecasting and planning demand. Forecasting and planning demand will help in forecasting the resources required and monitoring development of the industry. According to R1, the demand can be planned in different lot (levels) considering enhancing competitiveness:

> *Projects can be classified into four levels for integrated capacity building. Level 1: Economic value based projects; since these types of projects are associated with the fate of our economic development, completing these projects on time has to be the priority. Hence, those projects should be awarded to competent companies (local or international). Level 2 projects: to promote local companies to go global and to*

enhance them to win the local ICBs; this needs defining the requirement to this level and work to achieve it for all of the supply chain, Level 3: projects for middle level companies and Level 4: for micro and small companies to avoid entry barriers. This has two advantages; it is fair and sustainably ensures development of the industry.

5.7 Summary of the Chapter

Eight components from the four sources were identified as challenges through factor analysis (with different factor scores). Three components are from role of government, efficiency of regulatory system (3.29), CID policy implementation and corruption (4.02) and dependency on foreign aid (3.45). Two components are from resource related variables: weak capacity of contractors and consultants (3.82), availability of skilled manpower and equipment and client establishment (3.27). Two components are from nature of the industry: lack of collaboration and professionalism (3.67) and image of the industry and demand stability (3.55) and one component is from vision of the industry for development, lack of benchmarking CID practice (3.89). Document analysis and interviews also support these findings.

CHAPTER 6

FACTORS AND CHARACTERISTICS OF THE BUSINESS ENVIRONMENT

This chapter presents results for hypotheses set in Chapter 3 covering impact of factors on the business environment, characteristics of the business environment, the relationship between the factors and sources of the variables and interdependence between the factors and characteristics of the business environment. These discussions focus on the first objective of this research which is to understand the determinant factors (nature, interdependence and interrelationship with the business environment).

6.1 Impacts of the Factors on the Business Environment

Determining impact of the determinant factors needs identification of the dimensions of the factors through which it can affect progress of the industry. Manpower development has two dimensions: quantity and quality. There might be shortage of manpower in terms of number or quality (competence) in the industry or both. Competitiveness of the industry organizations also has different dimensions: technical capacity, financial capacity and management practice. Performance level of organizations in the industry is attributed to these dimensions. Similarly, impact of harmonized industry practices is measured through the state of adopted practices, technology development and IT application, and effectiveness of regulatory tools and participation level of associations.

Perceived impact of these dimensions of the determinant factors on progress of the industry is summarized in Table 6.1. The results indicate the respondents believed that all the dimensions have negative impact on the current performance of the industry. Quality of manpower, management practice and effectiveness of the applicable regulatory tools are the main dimensions from manpower development, enhancing competiveness and harmonized industry practice respectively.

Table 6.1 Impact of the factors on construction industry development

Factors	Dimensions of the factors	Mean	Std. Deviation	Rank
Manpower development	Quality of manpower	3.48	1.240	1
	Availability of manpower	3.21	1.206	2
Enhancing competitiveness	Technical capacity	3.34	1.142	3
	Financial capacity	3.41	1.281	2
	Management practice	3.53	1.350	1
Harmonizing industry practice	Effectiveness of the applicable regulation in harmonizing industry practice	3.23	1.100	1
	Participation of the industry (trade and professional associations) to improve the practice	3.04	1.151	5
	Effectiveness and efficiency of the regulatory institutes in improving the practice	3.20	1.175	2
	Application of IT for improvement of the practice	3.11	1.335	4
	Progress of Technological advancement	3.13	1.254	3

6.2 Characteristics of the Business Environment

The four dimensions of the business environment are measured by different variables. In this study demand potential and resource availability were the two variables adopted for measuring environmental munificence. Dynamism of the marketing environment, change orders, change in standards and regulations and demand fluctuations were considered as measurement variables for environmental dynamism. Management consistency in the industry, knowledge of the work, degree of market segmentation and effectiveness in supply chain management were adopted for measuring environmental complexity. Intensity of competition, reliability of the supply chain and effect of least cost practice in bidding were considered as measurement variables for competitive intensity. Most adopted measurement variables have been employed in main stream business management studies (Chi et al. 2009). Similarly, Oyewobi (2014) has employed these variables in the context of construction industry.

Characteristics of business environment of the CI as perceived by the respondents are summarized in Table 6.2. There is a potential for high demand growth in the industry which is an opportunity whereas the marketing environment is dynamic. Inconsistency of management practices is identified as a source of complexity in the industry. It is also found that the lowest bid award practice is majorly affecting the

competition intensity. This practice could be a cause for poor performance as there are possibilities where bidders with less capacity are awarded the contract. Such practice creates fierce competition which is going to affect development of the firms and overall competitiveness of the industry.

Table 6.2 Characteristics of the business environment of construction industry

Dimensions of the business environment	Variables of the Dimensions	Mean	Std. Deviation	Rank
Environmental Munificence	The current demand is strong	3.51	1.053	2
	There is a potential for high demand growth in the industry	3.56	1.096	1
	There is an abundance of resource (i.e. financial, supplies, human resource, etc.) in the industry for companies to support growth potential	3.09	1.151	3
	There is no shortage of necessary resources in the market	2.94	1.180	4
Environmental Dynamism	The marketing environment is rapidly changing	3.69	.982	1
	Rate of change in clients' need/requirement in the industry	3.42	.895	2
	Changes in standards and regulations	2.96	.971	4
	Demand fluctuation	3.39	1.000	3
Environmental Complexity	Inconsistency of management practices	3.67	.873	1
	The complexity of knowledge required to meet customer needs	3.28	.967	4
	The degree of market segmentation in the industry	3.28	.916	3
	The complexity of effectively managing the supply chain	3.45	1.021	2
Environmental Competitive intensity	Competition in the local market is intense i.e. number and diversity of rivals	3.37	1.037	3
	Selection is majorly on least cost bidder	4.05	1.097	1
	Unreliable supply chain	3.83	1.014	2

6.3 Relationships among the factors and sources of the variables

In this section Pearson's product moment correlation coefficient analysis was conducted to test the hypotheses. The analyses results are summarized in Table 6.3 that includes relationship between factors and sources of variables (H1), relationship among factors (H2) and relation among sources of variables (H4).

The test results for H1 indicate that there is significant relationship between the factors (MD, EC and HIP) and sources of the variables (VRG and RRV). The strongest relationship is found between HIP and VRG **(0.750)**. There is also

significant relationship between HIP and VNI. However, VVI has no significant relationship with other factors.

The test results for H2 indicate that there is significant relationship among the factors, the strongest being with HIP and EC **(0.830)**. Similarly, the test results for H4 indicate that there is significant relationship among sources of variables, with the exception of VVI which has no significant relation with VRG; rather it has strong significant relation with VNI (**0.725)**.

The observed insignificant correlation between VVI and the factors and VNI and VRG show poor perception about long term construction industry development. Variables of VVI, research and development, industry performance measurement practices and globalization are important to understand the local as well as the international dynamics and predict future of the industry.

Table 6.3 Correlation matrix of factors and sources of variables

	MD	EC	HIP	VRG	RRV	VNI	VVI
MD	1						
EC	.749**	1					
HIP	.670**	.830**	1				
VRG	.642**	.696**	.750**	1			
RRV	.625**	.660**	.650**	.751**	1		
VNI	.058	.124	.245**	.201*	.399**	1	
VVI	.020	.069	.155	.132	.362**	.725**	1

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

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

MD=Manpower Development	VRG=Variables emanating from role of government
EC=Enhancing competiveness	RRV=Resource related variables
HIP=Harmonized industry practice	VNI= Variables emanating from nature of the industry
	VVI=variables emanating from vision of the industry for development

6.4 Relationship of the factors and characteristics of the Business Environment

The test results of H3, characteristics of the business environment has significant relationship with the factors, are summarized in Table 6.4. The results indicate that there is significant correlation between all the factors and characteristics of the business environment, the strongest being between MD and Mu. However, MD being a resource by itself this correlation cannot explain the causal relationship. The

correlation between HIP and Mu and between HIP and competitive intensity explains the causal relationship which is discussed subsequently. In addition, the result shows that there is significant correlation among characteristics of the business environment, the strongest being between competitive intensity and complexity. The causal relationship is discussed subsequently, focusing on the determinant factors as how they affect and are affected by characteristics of the business environment.

Table 6.4 Correlation matrix among the factors and dimensions of the business environment

	MD	EC	HIP	Mu	Dy	Cp	Ci
MD	1						
EC	.749**	1					
HIP	.670**	.830**	1				
Mu	.463**	.382**	.462**	1			
Dy	.262**	.176*	.238**	.284**	1		
Cp	.259**	.269**	.302**	.185*	.339**	1	
Ci	.334**	.385**	.417**	.352**	.338**	.527**	1

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

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

Mu= Munificence Cp= Complexity

Dy=Dynamism Ci= competitive intensity

6.4.1 Manpower Development

While as an input of the industry, manpower availability affects environmental munificence, it is affected by the demand potential of the industry. High demand growth in the industry dictates the need for estimating the demand and projecting manpower requirement for effective supply of the required quantity and quality. Variables of environmental dynamism: demand fluctuation and change in regulations directly affect manpower development.

The complexity of knowledge required to meet customer needs and complexity of effectively managing the supply chain is directly associated with quality of manpower. Similarly, as discussed earlier, manpower development is affected by human resource management practices in the industry. Human resource management is affected by strategic management practice which in turn is affected by competitive intensity (Oyewobi 2014).

6.4.2 Enhancing Competitiveness

Enhancing Competitiveness is directly affected by demand condition, resource availability and dynamism of the marketing environment. Change orders during project implementation is a common problem in Ethiopian CI (Yadeta 2014) and it has consequences on performance in terms of time, cost and poor stakeholder relationships, which in turn have negative implications on enhancing competitiveness.

Complexity and competitive intensity also have direct impact on competitiveness of the firm. Hence, organizations need to understand the environment and adopt themselves to the changing conditions (Hughes, 1989; Walker, 2015).

6.4.3 Harmonized Industry Practice

The practice aspects of this factor, technology development and IT application, affects and are affected by the characteristics of the business environment. For example, IT benefits the industry by facilitating data sharing at project and industry level, whereas application of IT and new technology developments are challenged by lack of knowledge in the industry. This also indicates improving the complexity dimensions is associated with quality of manpower in the industry.

The other aspect of this factor, the institutional system, majorly the regulatory system affects characteristics of the business environment. According to Fox (2003), the influence of government at the broadest level is strong in creating conducive business environment by setting polices that promote private firms and combating corruption, than its role as a major client. Long term construction industry development policy can improve demand and resource conditions. This reduces the risk associated with competitive intensity. Similarly, complexity due to lack of knowledge which is associated with capacity of stakeholders can be improved through capacity development programs.

Active involvement of business associations (i.e. contractors, consultant etc.) and professional associations will help in promoting best practices: IT application and technology development and reduce inconsistency of practices. Further discussion on role of associations is given in Section 8.3.

6.5 Summary of the Chapter

After measuring the impact of the determinant factors on progress of the industry and characteristics of the business environment, correlation analysis was conducted to assess the interrelationship among the constructs. Empirical findings reaffirmed the hypothesized relationships: the factors and characteristics of the business environment are mutually interdependent. Harmonized industry practice has highly significant correlation with enhancing competitiveness and manpower development. The dimensions of harmonized industry practice, the regulatory system and the associations in the industry, are critical in creating conducive business environment through regulating and promoting the practices, technology development and IT application and similarly, help to regulate and promote manpower development and enhancing competitiveness. It is also indicated that there is significant relationship among sources of variables: role of government, resource related variables and nature of the industry. The overall relationship is summarized in Figure 6.1.

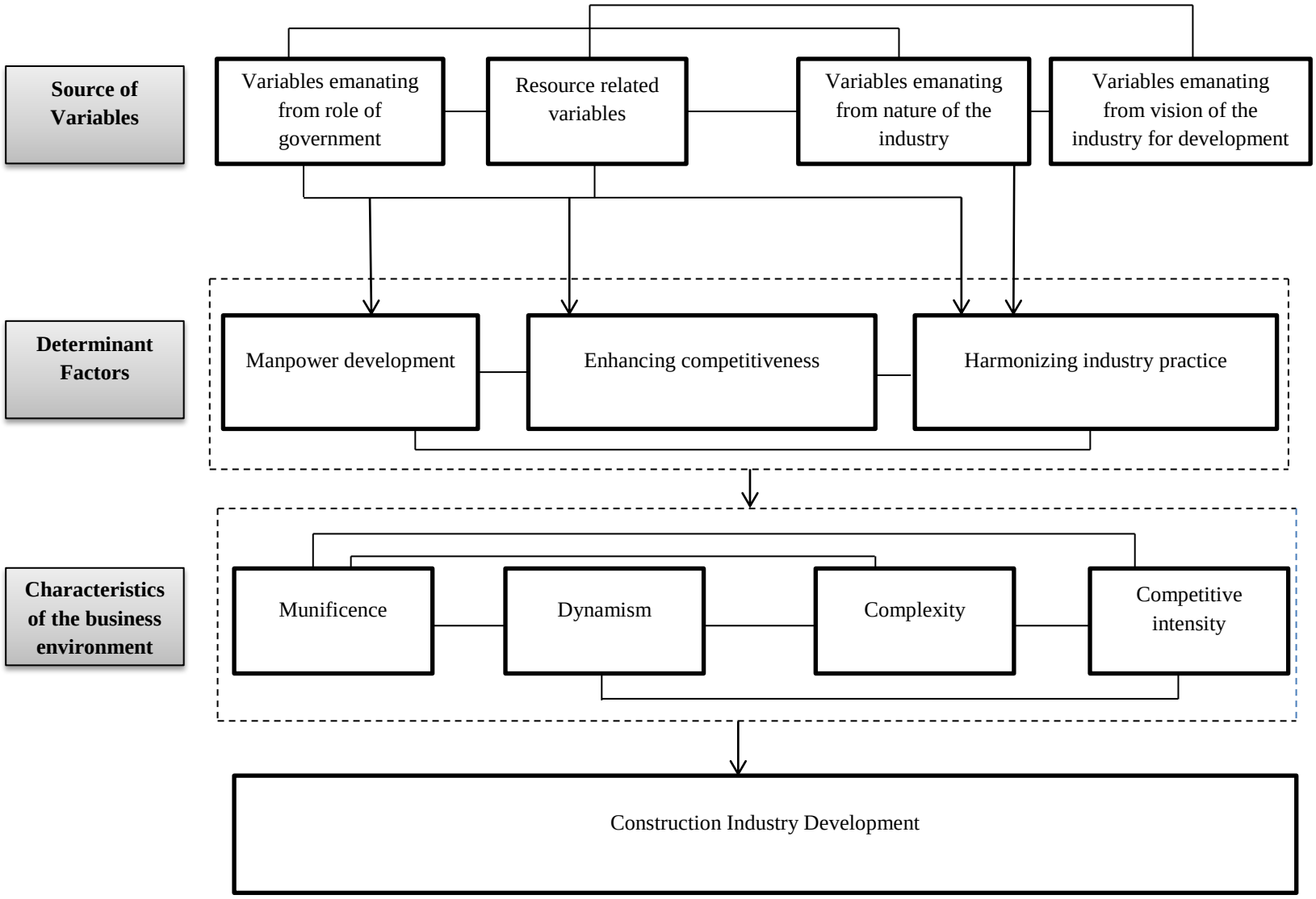

Figure 6.1 Relationship among the research constructs

CHAPTER 7

STATUS AND IMPROVEMENT OF THE DETERMINANT FACTORS

In this chapter, assessment of the required improvement level of the three determinant factors was conducted through analysis of survey responses and interviews. Dimensions of the determinant factors defined earlier were employed for the assessment. In addition, assessment was conducted on competitiveness improvement mechanisms and impact of psychosocial factors on development of the industry. Also, as mentioned in Chapter 5, analysis part of semi-structured interviews which focuses on improvement of the determinant factors is covered here.

Descriptive analysis and factor analysis were conducted on survey responses. One sample T-test was conducted to identify significance of the variables. Test results for appropriateness of data for factor analysis, KMO and Bartlett's Test of Sphericity, are summarized in Table 7.1. In factor analysis, except, financial capacity, management practice and better regulation, other dimensions have yielded a single component; hence, the discussion on those cases is limited to results of the descriptive analysis. However, factor loadings and cumulative percentage explained are indicated in the respective analysis tables.

In enhancing competiveness part, management practice has covered different practice areas. Hence, literature review to identify practice areas and the adopted analysis techniques are also covered in Section 7.2.3.

7.1 Manpower Development

Status of manpower development under the three dimensions: role of government, academic institutions and the industry organizations is discussed in the subsequent subsections.

Table 7.1 Test for appropriateness of the data for factor analysis

Determinant factors	Dimensions of the factors	KMO of Sampling Adequacy	Bartlett's Test of Sphericity
Manpower Development	Role of government	0.942	Significant
	Role of academic institutes	0.902	Significant
	HRM practice	0.950	Significant
Enhancing Competitiveness	Financial Capital	0.910	Significant
	Technical (Physical capacity)	0.927	Significant
	Management practice	0.970	Significant
	Competitiveness enhancement mechanism	0.823	Significant
Harmonized Industry Practice	Technology Development	0.927	Significant
	Wider Application of IT	0.942	Significant
	Institution building	0.862	Significant
	Better regulation	0.937	Significant
	Psychosocial factors	0.810	Significant

7.1.1 Role of Government

As per perception of the respondents, indicated in Table 7.2, all the variables require improvement and the top variables are: policy support, forecasting manpower demand and improving registration system. As discussed earlier, manpower development requires compiling the required manpower statistics and projecting the requirement. Setting polices that integrate the activities of the concerned parties is important to compile reliable and accurate data.

While continual professional development (CPD) can be promoted through the registration system, the registration system has to incorporate code of conduct to enhance ethical dimension of professionalism in the industry. It is important to promote larger public organizations to establish strong training centers to fill skill gaps and equip professionals in their respective sectors. ERA's Alemgena Training and Testing Centre can be taken as an example, it is the only large public training center providing courses in mechanized road construction (ERA 2012). Similar initiatives can be undertaken in other sectors. Also, accreditation and recognition of training centers needs attention. Apart from these, government as a large client can promote CPD by considering it in prequalification criteria for bidding.

Table 7.2 Survey results-Role of government in manpower development

Role of government in MD	**Mean**	**Std. Deviation**	**Rank**	**One sample T-test**	**Factor Analysis**
Promoting larger organizations to establish training center	3.33	1.322	8	.006	.827
National accreditation and recognition system of institutes/centers	3.37	1.201	6	.001	.872
Policy that enhances integrated and collaborative manpower development program	3.46	1.214	1	.000	.918
Setting up funding mechanism (from both government and the industry) for manpower development	3.33	1.228	7	.003	.876
Measuring competence of professionals for licensing, i.e. improving registration system	3.42	1.354	3	.001	.894
Promoting continual professional development	3.39	1.203	4	.000	.905
Forecasting and monitoring of manpower demand, i.e. long-term plan of manpower requirement of the industry	3.43	1.264	2	.000	.860
Considering training provision for employee as prequalification criteria for consulting and contracting organizations	3.25	1.291	9	.030	.884
Industry-wide code of conduct	3.39	1.260	5	.001	.885
				Variance	77.49%

7.1.2 Role of Academic Institutes

Equipping graduates with appropriate set of knowledge and skills is the primary role of academic institutes (Aniekwu and Ozochi 2010; Bhattacharjee et al. 2013; Naveed et al. 2017) and this requires surveying the expectations of the industry and ensuring inclusion of required knowledge and skills in the curriculum (Souder and Gier 2006). Skills and knowledge required for construction industry are identified by different studies (Briscoe et al. 2001; Love et al. 2001; Cieszyński et al. 2005; Souder and Gier 2006; Banik 2008; Mullin et al. 2010; Ahn et al. 2010; Bhattacharjee et al. 2013; Naveed et al. 2017). Major categories of the competences required are technical knowledge (core skills) and soft skills. The core skills are: construction materials and methods, construction contracts, estimation, scheduling, safety, sustainability. The required soft skills for CI includes: ethics, team working, leadership capability, negotiation skills, management skills, problem solving, critical thinking, adaptability to changing environment, communication (oral and written) and decision making skills.

As discussed in Section 4.2.1, objectives of questionnaire two were to evaluate knowledge and skills level of students in construction programs, assessing the perception towards internship and effectiveness of internship. The questionnaire was distributed to 300 students and 100 supervisors. Convenience sampling method was used to select universities offering undergraduate construction programs. The selected universities were: Hawassa University, Dilla University and Debre Berhan University and the students were selected randomly from the three programs: Civil Engineering (CE), Construction Technology and Management (CTM) and Water Resources and Irrigation Engineering (WRIE). The justification for considering these programs together is covered in Section 8.1. Similarly, company supervisors having experience in supervising internship students were randomly selected to participate in the questionnaire survey.

149 students and 48 company supervisors duly filled the questionnaire. Among students response CE was 48.32% (72), CTM was 34.90% (52) and WRIE was 16.78 % (25) and their internship placement was: at consultants 15.44% (23), at contractors 62.42% (93) and public organizations 22.15% (33). The supervisors were from: consultants 16.67% (8), contractors 66.67% (32) and public organizations 16.67% (8). The general information on intern students' placement and curriculum is summarized in Table 7.3.

Table 7.3 General information on intern students placement and curriculum

General information			Percentage (%) of respondents
Students	Assigned to the company by the institute		10
	Students searched on their own		90
	Do you think that generally the curriculum adequately prepared you for the internship?	Yes	31
		No	69
Supervisors	Students assigned to the company by the institutes		19
	Students searched on their own		81
	Do you file student profile including performance report for future recruitment?	Yes	42
		No	58

Both students' and supervisors' evaluations which are summarized in Appendix III indicate the students have not gained the required level of knowledge in 11 (44%) out of 25 core skills. The T-test indicates, from both evaluations, the students show better performance in 6 (24%) core skills. These skills are: (1) quantity takeoff, (2) ability to

interpret contract document, (3) properties, compositions and characteristics of construction materials, (4) construction techniques/ methods, (5) quality control and (6) identification of project activities and their relationship. Category wise: (1) and (2) are from estimation: (3), (4) and (5) are from construction materials and methods and (6) is scheduling. Since, 'identification of project activities and their relationship' is more related to construction methods it can be concluded that the students have satisfactory performance in 'construction materials and methods' and 'estimation' only. Concerning the soft skills both students' and supervisors' evaluation indicate except 'leadership capability' the students have better performance.

Similarly, as indicated in Table 7.3, 69% of students think that the curriculum did not adequately prepare them for the internship. This is associated with challenges indicated by the students in open ended questionnaire part: (1) in the course offering the practical aspect is underemphasized and (2) courses supposed to precede internship are offered after internship. As indicated by Basow and Byrne (1993), preparedness of the students affect their internship performance. Hence, courses necessary to understand site activities should precede internship, for example, construction materials, construction equipment, contracts, specifications and quantity surveying. Similarly, analysis results in Table 7.4 (from questionnaire one) shows that all activities need improvement, and relevant and practice based education is the area that requires most improvement.

Table 7.4 Survey results- Role of Academic Institutes

Role of academic institutes	**Mean**	**Std.**	**Rank**	**One sample T-test**	**Factor Analysis**
Involvement of academic institute for CID through R&D	3.36	1.277	2	.002	.866
Relevant and practice based education	3.45	1.326	1	.000	.920
Academic institutes and industry forum for quality of manpower development	3.33	1.322	5	.006	.919
Internship program coordination	3.28	1.152	6	.008	.853
Capacity of the institutes i.e. workshop, laboratory and staff	3.35	1.263	4	.002	.880
Provide short term training to fill skill gap in the industry	3.36	1.232	3	.001	.856
				Variance	77.88%

Internship plays an important role in equipping the graduate with practice based knowledge and skills through bridging academia and industry. Hence, building good relationship between academic institutes and industry organizations will maximize benefits of internship (Moore and Plugge 2008). Identification of potential companies and student placement are the primary activities in internship coordination by universities. However, response of students in Table 7.3 indicates, 90% of the students searched the company for their internship on their own and only 10% were placed by their university. Similar response was found from supervisors, i.e., 81% of the companies accepted the interns through request of students.

Respondents were asked to rate their agreement level on benefit of internship and effectiveness of the coordination. The perception towards internship benefit summarized in Table 7.5 shows that both students and industry have positive perception.

Table 7.5 Perceived benefit of internship

Students' View	Frequency % [Strongly Disagree - Strongly agree]					
	1	2	3	4	5	Total % agreement [4+5]
Internship programs provide an opportunity to gain real knowledge of my profession	0.7	2.7	12.1	31.5	53.0	84.5
My internship experience reinforced the knowledge I acquired in the classroom	0.0	4.0	12.1	32.9	51.0	83.9
My participation in an internship program enhanced my knowledge of the profession	0.7	2.0	14.8	29.5	53.0	82.5
My internship experience assisted me in determining career decisions as a graduate in the specializations of my profession. (i.e. it has helped me to choose my interest area)	2.7	1.3	14.1	47.7	34.2	81.9
My internship provided a linking relationship with industry (i.e. widened my network)	4.0	2.1	24.8	28.2	40.9	69.1
Internship experience will improve my chance of getting a job after graduation	4.0	6.0	22.2	43.6	24.2	67.8
During my internship, I feel I was able to contribute to my company's goals with knowledge acquired in my classes	4.0	4.0	18.2	44.3	29.5	73.8
My internship experience helped me perform better in my classes	0.7	0.7	16.7	38.9	43.0	81.9
This internship met my expectations and I felt that I gained professional experience	2.7	2.7	19.5	40.9	34.2	75.1
Supervisors' View						
Internship programs enhance communications between industry and academia	2.1	8.3	10.4	27.1	52.1	79.2
Hiring an individual upon graduation who was previously an intern within your company increases employee retention.	2.1	0.0	25.0	33.3	39.6	72.9
Internship programs can be used as a recruitment device for students upon graduation.	2.1	6.3	12.5	25.0	54.1	79.1
Internship students positively affect staff quality by providing fresh perspectives	18.7	12.5	25.0	16.7	27.1	43.8
Internship program gives opportunity to construction organizations to involve in education quality	2.1	2.1	18.8	20.7	56.3	77

However, as indicated in Table 7.6 and Table 7.7 the internship coordination by university and industry respectively was found unsatisfactory. There is a consensus on lower values, students view and supervisors view; the organizations did not provide opportunity to work in all relevant departments and they did not assign the students to work independently. This might be associated with two things, (1) as discussed before; the students were not equipped with the required knowledge and/or (2) perception of companies towards internship student. Students agree that 50.3 % of organizations are not willing to take intern students (they consider intern students as a burden) whereas similar perception was expressed by 33.3% of the supervisors. Concerning coordination by university, the major points highlighted by students were: institutes are not receiving feedback to improve their coordination and mentors are not regularly visiting interns.

Table 7.6 Internship coordination by university

Students' View	Frequency % [Strongly Disagree- Strongly agree]					
	1	2	3	4	5	Total % of agreement [4+5]
The institute gives opportunity to students to join organizations where they can get relevant experience	5.4	11.4	20.1	28.2	34.9	63.1
The assigned mentor visits the students regularly	4.7	23.5	24.2	31.5	16.1	47.6
Mentors encourage students to identify real life problems for final year project/ thesis	8.7	13.4	32.2	28.9	16.8	45.7
The institute receive feedback from students to improve internship program	22.1	18.8	21.5	24.2	13.4	37.6
Evaluation of reports are done responsibly i.e. it reflects actual performance of the students	6.7	15.4	27.5	28.9	21.5	50.4

In general, the findings indicate there is room for improvement in the curricula and coordination of internship program. Assuring competence of the student needs regular assessment to identify the skills and knowledge gaps of students to improve the curriculum and internship coordination mechanism. In addition, academic institutes should play their role for manpower development in the industry through identification of skill gaps in the industry through research and provision of short term training. This needs strengthening capacity of the academic institutes (workshop, laboratory and staff) and university industry linkage (UiL). Further discussion on the practice of internship coordination and UiL is provided in Section 8.1.

Table 7.7 Internship coordination by industry

Students' View	Frequency % [Strongly Disagree- Strongly agree]					
	1	2	3	4	5	Total % agreement [4+5]
The organizations give orientation about the entire workplace, procedures and policies of the company	11.4	16.8	18.8	30.2	22.8	53
The organizations assign supervisor for students	4.1	13.4	24.8	38.9	18.8	57.7
During my internship, the employees at my hosting company answered my questions thoroughly	1.3	6.1	28.9	40.9	22.8	63.7
The organization provided the opportunity to work in all relevant departments of the organization	3.4	11.4	34.8	33.6	16.8	50.4
I am assigned to work independently	6.7	10.1	28.9	34.2	20.1	54.3
Evaluations by supervisors from hosting company are conducted responsibly	6.7	10.7	24.8	36.3	21.5	57.8
Organizations are not willing to take intern students (they consider intern students as a burden)	8.8	20.8	20.1	20.1	30.2	50.3
Organizations understand as they are responsible to produce qualified manpower	6.1	11.4	24.8	35.6	22.1	57.7
The site was appropriate for my study/career goals	1.3	5.4	20.1	44.3	28.9	73.2
The site supervisor was well-prepared to cover specific areas of the workload	5.4	7.4	28.2	36.9	22.1	59
I would recommend this site supervisor for future internships	4.6	10.1	23.5	30.9	30.9	61.8
Supervisors' View						
For new internship students' organization provides orientation about the entire workplace, procedures and policies of the company	2.1	4.2	22.9	20.8	50.0	70.8
The organization assigns supervisor for students	4.1	14.6	20.8	16.7	43.8	60.5
Students are provided with the opportunity to work in different relevant departments of the organization	0.0	16.7	29.2	20.8	33.3	54.1
Students are assigned to work independently	0.0	25.1	33.3	33.3	8.3	41.6
Internship students are simply coming for learning	2.1	29.2	35.4	20.8	12.5	33.3
Organizations give feedback on the students' level of performance to the institute/university for future improvement	2.1	8.3	25.0	22.9	41.7	64.6

7.1.3 Human Resource Management Practice

HRM issues have potential implications for competitiveness and productivity of individual construction firms, as well as the performance and reputation of the industry as a whole (Wilkinson et al. 2012). According to Wasbeek (2004), a study conducted on general HRM practice, local companies in Ethiopia do not consider human resources as the company's most important asset and it is not given much attention. Effective HRM brings considerable benefit to organizations (Loosemore et al. 2003). This could be achieved through a distinctive set of integrated employment policies, programs and practices, embedded in an organizational and societal context (Bratton and Gold 2012). Generally improving HRM practices requires improvement in ways of attracting, retaining and motivating employees. It basically needs recognizing advantages of effective HRM and setting clear career development plan.

Ensuring CPD in a competitive market is an advantage, especially in CI where advances are continually being made (Lithebe et al. 2013).

As per perception of the respondents summarized in Table 7.8, priority areas of improvement should be: devising performance based pay system, improving leadership style and clear career development plan for all levels of employees. Except 'improving relationship with employee/trade union', all activities need significant improvement which shows poor HRM practice in the industry. Improving these activities will help to ensure CPD by encouraging employees to develop personal skills, and upgrade and maintain their competence. Akhter et al. (2013) have indicated that compensation and benefits, performance appraisal and leadership practices have a positive impact on employee performance. Similarly, Nukić and Šuvak (2013) and Zhai et al. (2014) have indicated that these have positive impact on business performance of the organization. It is also indicated that performance evaluations is an important tool which can sustain employee performance (Cheng and Li 2006) and therefore it is essential to adopt performance based pay system for CID.

Table 7.8 Survey results-Role of industry organizations (HRM practice)

HRM practice	**Mean**	**Std. Deviation**	**Rank**	**One sample T-test**	**Factor Analysis**
Recruitment and selection of employees e.g. reasonable skill and experience based selection	3.32	1.221	4	.003	.880
Clear career development plan for all levels of employees	3.38	1.221	3	.001	.915
Training and development	3.30	1.236	6	.007	.930
Performance appraisal system	3.31	1.276	5	.008	.918
Create enabling working environment	3.26	1.135	7	.011	.897
Improve relationship with employee/trade union	**3.21**	**1.213**	**9**	**.050**	.864
Improving welfare and safety of personnel	3.25	1.297	8	.030	.901
Improving leadership style	3.39	1.241	2	.001	.930
Devising performance based pay system	3.43	1.324	1	.000	.919
				Variance %	82.15

7.2 Enhancing Competitiveness

Discussion on enhancing competitiveness is provided under the three dimensions: financial capacity, technical capacity and management practice.

7.2.1 Financial Capacity

As the descriptive analysis summarized in Table 7.9 shows, improving payment process to avoid delays, availability of lease and rent options for equipment and availability of credit for the industry are identified as the variables that need significant improvement to enhance financial capacity of firms. Retention amount and mode of payment, advance payment arrangement, availability of suitable insurance facilities, improving payment arrangements and price adjustment mechanism need relatively less improvement.

Factor analysis has yielded two components with 72.21% cumulative variance explained. Improving advance arrangements is excluded from interpretation due to its significant cross loading. Variables under Component 1 are more associated with prequalification criteria and payment mechanisms related to contractual matters, hence, the component is named *prequalification and payment system*. Variables under Component 2 are external to firms and named *access to working capital*.

In developing countries access to working capital (ease of financial arrangement) is constrained by the general economy. Hence, improving contractual arrangements related to payment to smoothen the cash flow and avoiding payment delay are the easiest options. This improvement will result in avoiding locking up of organizations' capital. Improving prequalification requirements to improve opportunities of getting projects will also help in enhancing capacity, e.g. the amount of liquid assets required and equipment ownership requirement.

Table 7.9 Survey results-Financial capital

Financial capital	Mean	Std. deviation	Rank	One sample T-test	Factor Analysis	
					C1	C2
Ease of arranging bond, guarantee and insurance requirements	3.21	1.074	5	.027		.838
Availability of credit for the industry	3.33	1.182	3	.002		.772
Availability of lease and rent options for equipment	3.41	1.072	2	.000		.778
Availability of suitable insurance facilities e.g. CAR and other forms of insurance required in contracting	3.15	1.092	8	.125		.715
Improving advance arrangement	3.04	1.065	9	.678	.694	.538
Improving payment arrangement e.g. considering material on site in interim payments	3.17	1.089	7	.090	.706	
Improving prequalification requirement to enhance capacity building	3.24	1.139	4	.017	.764	
Improving payment process to avoid delay	3.42	1.275	1	.000	.790	
Price adjustment mechanism	3.21	1.270	6	.062	.801	
Retention amount and mode of payment	2.98	1.175	10	.880	.781	
				Variance %	39.97	32.24
				Total variance %		72.21

7.2.2 Technical Capacity

As per perception of the respondents indicated in Table 7.10, all variables need significant improvement. Acquiring technical competencies and capabilities helps organizations to build reputation in the industry (Oyeyipo et al. 2016). Resources and capabilities are the measures of organization's internal element of competitiveness (Oyewobi 2014), hence, capacity in terms of equipment and plant owned and technical staff (quantity and quality) are resource aspect of technical capacity. The capability aspect includes creating encouraging working environment for innovation and adoption of technology and standardization of activities and processes that helps to improve efficiency and productivity and build competitive advantage. Further discussion on this is covered in Section 8.2.

Table 7.10 Survey results-Technical capacity

Technical capacity	Mean	Std.	Rank	One sample T-test	Factor Analysis
Creation of work environment that encourages creativity and innovation	3.36	1.277	7	.002	.901
Efficiency of companies in integrating new technology into business system and process	3.36	1.219	6	.001	.922
Capacity in construction Equipment and Plant	3.39	1.209	3	.000	.881
Efficient utilization of Equipment and Plant	3.46	1.200	1	.000	.921
Maintenance practice of Equipment and Plant	3.37	1.284	5	.001	.900
Adequacy of Technical Staff	3.41	1.150	2	.000	.892
Experience/knowledge of technical skill	3.39	1.155	4	.000	.889
Research and Development practice by companies in technological activities	3.31	1.446	9	.015	.876
Standardization of activities and process to increase efficiency and productivity	3.35	1.318	8	.004	.891
				Variance%	80.49

7.2.3 Management Practice

Management practice in construction is application of broad range of skills and knowledge for efficient and effective delivery of construction process by the stakeholders. There is relationship between management practices and performance in construction industry (Castillo et al. 2018). In addition, the practice areas are correlated (Ramirez et al. 2004), example, cost management practice is related with planning and scheduling. Similarly, it is related to quality management and all these are affected by organization culture. Construction management practice areas suggested in different literature to improve poor performance in the industry are as summarized in Table 7.11.

Relationship between management practice and performance can be observed from studies done on causes of poor performance and recommendations towards eliminating these causes. Causes of delay identified by Sambasivan and Soon (2007) are: contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and delay in payments for

completed work, problems with subcontractors, shortage of material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. As a mitigation measure for delays in construction, Kikwasi (2012) suggested that the focus of the parties in project procurement process should be towards allocating appropriate budget, timely issuing of information, design completion and project management capability. To reduce cost overrun, Shibani and Arumugam (2015) have suggested proper management of site and supervision of the project, efficient planning, proper methods for construction, suitable planning and arrangement of project, regular meetings on project performance and hiring capable suppliers and subcontractors. Similarly, Okoye et al. (2015) have emphasized on the importance of appropriate management strategies to efficiently handle challenges facing construction practice.

Challenges in the industry may arise from role of different stakeholders depending on their contribution (Ssegawa-Kaggwa et al. 2013; Mohammad et al. 2016; Ogunde et al. 2017). Incomplete design, variations due to erroneous estimation and poor contract administration are the most common issues that affect project performance (Al-Momani 2000; Lo et al. 2006; Le-hoai et al. 2008; Memon et al. 2012) which are majorly associated with the role of consultants. Similarly, unrealistic requirement and unrealistic contract duration imposed by client are factors that affect project performance (Lo et al. 2006), which are results of lack of technical knowledge of client. There are also different causes for poor performance that arise from contractors like poor project management and control, low efficiency and poor planning. Therefore, the problems can be reduced through joint efforts of stakeholders in the industry (Venkatesh et al. 2012; Kumar 2016; Venkateswaran and Murugasan 2017).

Different classifications have been given for construction management practices. Castillo et al. (2018) built on the work of Ramirez et al. (2004) and listed 15 management dimensions to study construction companies' management practices: quality, communication and information, costs and schedule, leadership, corporate goals, organizational change, planning and programming, production, human resources, relations with owner, health and safety, technology, supply, risk and innovation. As indicated above, the causes for poor performance may arise from role

of the different stakeholders depending on their contribution. Hence, improvement of the overall construction management practices in the industry needs improvement across the main stakeholders. Therefore, construction management practice areas considered in the questionnaire were without any prior classification.

Analysis results of survey responses with respect to management practice areas are summarized in Table 7.12 (descriptive analysis) and Table 7.13 (factor analysis). In Table 7.12, one sample T-test indicates that except 'promoting ISO/ similar certification' all areas need significant improvement despite their different ranks. Poor perception towards ISO certification in the local industry was also reported by Kidanu (2014). However, an industry aspiring to be internationally competent in near future needs promoting standardization; hence this area should not be overlooked. The perception towards promoting ISO/ similar certification may need further investigation to unravel the causes and remedy them.

Table 7.11 Summary of construction management practices areas

Management practices areas	**References**
Project management commitment by top management	(Chin and Choi 2003); (Pheng and Teo 2004); (Tan and Hamzah 2008);
Adequacy of project management team building practice	(Spatz 2000); (Chin and Choi 2003); (Kwofie et al. 2015)
Maturity of site management and supervision practice	(Kumaraswamy and Chan 1998); (Sambasivan and Soon 2007); (Shibani and Arumugam 2015); (Gluszak and Lensniak 2015)
Practice of project planning, scheduling and performance tracking	(Ramirez et al. 2004); (Sambasivan and Soon 2007); (Shibani and Arumugam 2015); (Gluszak and Lensniak 2015); (Castillo et al. 2018)
Adoption of decision support system	(Kumaraswamy and Dissanayaka 2001); (Kumaraswamy 2006); (Abdul-Rahman et al. 2006)
Project performance evaluation practice	(Ramirez et al. 2004); (Kikwasi 2012); (Castillo et al. 2018)
Due diligence in pre-tender planning phase	(Akoa 2011); (Alinaitwe et al. 2014); (Ssegawa-Kaggwa et al. 2013); (Mohammad et al. 2016)
Improving Risk management practices	(Tadayon et al. 2012); (Goh and Abdul-Rahman 2013); (Chileshe et al. 2016); (Castillo et al. 2018)
Accepted industry model for Risk analysis	(Cho et al. 2002); (Karimiazari et al. 2011); (Castillo et al. 2018)
Improving communication management practice	(Sambasivan and Soon 2007); (Castillo et al. 2018)
Adequacy of contract documents	(Abdul-Rahman et al. 2006); (Sambasivan and Soon 2007); (Mohammed 2007); (Kikwasi 2012); (Mohammad et al. 2016); (Dosumu 2018)
Improving contract management practice	(Okpala and Aniekwu 1988); (Mansfield et al. 1994); (Le-hoai et al. 2008); (Sambasivan and Soon 2007)
Provision of adequate time for tendering	(Abdul-Rahman et al. 2006); (Le-hoai et al. 2008); (Akoa 2011); (Idoro 2012); (Venkateswaran and Murugasan 2017)
Health and safety management practice	(Ramirez et al. 2004); (Durdyev et al. 2017); (Castillo et al. 2018)
Adoption and application of quality management system	(Ramirez et al. 2004); (Castillo et al. 2018)
Practice of constructability review to resolve major project problems	(Alinaitwe et al. 2014); (Chai et al. 2015)
Documentation and information management	(Kikwasi 2012); (Qady and Kandil 2013); (Senaratne and Mayuran 2015); (Castillo et al. 2018);
Cost management practice	(Ramirez et al. 2004); (Kikwasi 2012); (Okoye et al. 2015); (Mohammad et al. 2016); (Castillo et al. 2018)
Dispute resolution practices	(Okpala and Aniekwu 1988); (Ren et al. 2002); (Cheung et al. 2006); (Yiu et al. 2012)
Improving financial management practice	(Le-hoai et al. 2008); (Kikwasi 2012); (Okoye et al. 2015); (Mohammad et al. 2016)
Quality management practice	(Ramirez et al. 2004); (Okoye et al. 2015); (Castillo et al. 2018)
Efficiency of Resource management	(Lo et al. 2006);(Ssegawa-Kaggwa et al. 2013)
Logistic and supply chain management	(Egan 1998); (Ramirez et al. 2004); (Kumaraswamy 2006); (Behera et al. 2015); (Castillo et al. 2018)
Strategic management	(Dikmen and Birgönül 2003); (Kazaz and Ulubeyli 2009); (Castillo et al. 2018)
Improving organization culture	(Ramirez et al. 2004); (Gajendran et al. 2009);(Fong and Kwok 2009); (Teräväinen et al. 2018)
Promoting ISO/ similar certification	(Ciribini and Rigamonti 1998); (Ofori et al. 2000)
Strengthening supportive departments	(Dikmen and Birgönül 2003); (Tiller 2012)
Empowerment of professional employees	(Ramirez et al. 2004); (Castillo et al. 2018)

‘Health and safety management practice’ had the highest standard deviation value, meaning that the perception for this practice area varied among the respondents. The stakeholders may have given different rating level to each practice areas. For example, contractors may be more concerned about ‘improving organization culture’, whereas demand side (client and consultant) may be more concerned about ‘adequacy of contract documents’. Hence, the results may differ depending on the respondent’s affiliation.

To test significance of the mean difference, data was categorized into two groups and independent sample T-test, t-test for equality of means between groups, was conducted. The test was conducted between the demand side (clients and consultants) and supply side (contractors) as the three parties account for 84.4 % of the responses and they are the key stakeholders involved in practice. Contractors mean values for all practice areas are higher than that for the clients and the consultants. However, as the T-test for equality of mean scores indicates, only ‘adequacy of project management team building practice’ and ‘strengthening supportive departments’ had significance value lower than, α, of 0.05. Significant difference in the mean of these two practice areas shows that the concerns of the parties in these two areas are different. Contractors are more concerned in these areas as the contractor’s mean value for these two areas are higher than the demand side. Significance values for other twenty six areas were higher than, α, of 0.05, i.e. differences in the mean values for the two groups were not statistically significant.

Aggregate ranking indicates the top five areas are: (i) Practice of project planning, scheduling and performance tracking, (ii) Project management commitment by top management, (iii) Project performance evaluation practice, i.e., utilization of past project lessons learned, (iv) Quality management practice and (v) Cost management practice. These are among the areas whose difference of mean values’ for the two groups were not significant. Therefore, it can be concluded that these are the priority areas for improvement in the context of Ethiopian CI.

Table 7.12 Survey result-Descriptive analysis (Management practice)

Construction management practices areas	Overall result of the perceived improvement requirement				Group results of the perceived improvement requirement				
					Mean		Independent sample T-test 'Client and consultant' and contractor		
							t-test for equality of means		
	Mean	Std. Deviation	One sample T-test	Rank	'Client and consultant'	Contractor	Sig. (2-tailed)	Mean difference	Std. Error difference
Project management commitment by top management i.e. company level project management policies and procedures	3.55	1.160	0.000	2	3.38	3.73	.140	-.353	.237
Adequacy of project management team building practice	3.38	1.215	0.001	15	3.12	3.66	.030	-.537	.244
Maturity of site management and supervision practice	3.45	1.132	0.000	8	3.29	3.59	.194	-.297	.228
Practice of project planning, scheduling and performance tracking	3.57	1.251	0.000	1	3.38	3.68	.219	-.304	.246
Adoption of decision support system i.e. voiding intuition and personal judgment for decision making	3.37	1.118	0.000	16	3.30	3.46	.483	-.160	.228
Project performance evaluation practice i.e. utilization of past project lessons learned	3.54	1.167	0.000	3	3.36	3.68	.194	-.319	.244
Due diligence in pre-tender planning phase	3.36	1.125	0.000	18	3.27	3.46	.410	-.191	.231
Improving Risk management practices	3.35	1.300	0.003	21	3.17	3.51	.199	-.346	.267
Accepted industry model for Risk analysis	3.41	1.317	0.001	11	3.32	3.39	.788	-.072	.268
Improving communication management practice	3.31	1.193	0.004	24	3.12	3.39	.249	-.269	.232
Adequacy of contract documents	3.36	1.193	0.001	19	3.29	3.41	.606	-.127	.245
Improving contract management practice	3.41	1.204	0.000	10	3.21	3.56	.149	-.349	.240
Provision of adequate time for tendering	3.25	1.182	0.018	27	3.03	3.49	.055	-.458	.236
Health and safety management practice	3.40	1.329	0.001	13	3.27	3.44	.539	-.166	.270
Adoption and application of quality management system	3.46	1.240	0.000	7	3.33	3.51	.477	-.179	.251
Practice of constructability review to resolve major project problems	3.38	1.161	0.000	14	3.29	3.32	.902	-.029	.236
Documentation and information management	3.37	1.181	0.001	17	3.17	3.54	.134	-.370	.245
Cost management practice	3.48	1.246	0.000	5	3.27	3.61	.189	-.337	.255
Dispute resolution practices	3.36	1.200	0.001	20	3.24	3.41	.482	-.172	.244
Improving financial management practice	3.32	1.253	0.004	23	3.15	3.41	.299	-.263	.252
Quality management practice	3.53	1.278	0.000	4	3.44	3.54	.708	-.097	.259
Efficiency of Resource management	3.48	1.296	0.000	6	3.24	3.59	.196	-.343	.263
Logistic and supply chain management	3.40	1.230	0.000	12	3.23	3.49	.308	-.261	.254
Strategic management	3.33	1.202	0.002	22	3.21	3.37	.533	-.154	.246
Improving organization culture	3.28	1.221	0.010	26	3.08	3.44	.153	-.363	.252
Promoting ISO/ similar certification	3.14	1.258	0.207	28	3.02	3.20	.485	-.180	.257
Strengthening supportive departments	3.31	1.185	0.004	25	3.02	3.49	.046	-.473	.234
Empowerment of professional employees	3.43	1.257	0.000	9	3.26	3.61	.167	-.352	.253

The factor analysis has resulted in four underlying components with a cumulative variance of 81.89%. As discussed earlier, there is correlation between the different practice areas. Two areas 'health and safety management practice' and 'logistics and supply chain management' were significantly cross loaded under component 2 and component 3. This is logically acceptable as these areas are explicitly or implicitly related with the components. Similarly, adoption and application of quality management system, improving financial management practice, efficiency of resource management, strengthening supportive departments and empowerment of professional employees (decentralization of decision making authority) were cross loaded under component 1 and 2. These in general indicate the interdependence between the components. On the other hand, there are two items, namely improving communication management practice and documentation and information management that did not significantly load in any of the dimensions. The results are summarized in Table 7.13, however, the cross loaded and the under loaded items were not included in factor interpretation. Though these items were excluded due to statistical reasons they need improvement as indicated in Table 7.12, for example, health and safety management needs significant improvement. Also, safety has to be one of the major concerns in practice due to nature of the industry.

Project Management (C1)

Component one from factor analysis is named Project Management and includes: (i) Project management commitment by top management, (ii) Adequacy of project management team building practice, (iii) Maturity of site management and supervision practice, (iv) Practice of project planning, scheduling and performance tracking, (v) Cost management practice and (vi) Quality management practice. Among these six areas, (i), (iv), (v) and (vi) are under the top five areas indicated by descriptive statistics. This implies improving project management practice in Ethiopian CI has to be a priority area. This confirms studies (Yimam 2011; Solomon 2017) that reported low level project management maturity in Ethiopian CI.

Table 7.13 Survey result- Factor Analysis (Management practice)

Management practices areas	Factor Analysis			
	C1	C2	C3	C4
Project management commitment by top management i.e. company level project management policies and procedures	.656			
Adequacy of project management team building practice	.634			
Maturity of site management and supervision practice	.695			
Practice of project planning, scheduling and performance tracking	.531			
Adoption of decision support system i.e. voiding intuition and personal judgment for decision making			.723	
Project performance evaluation practice i.e. utilizing lessons learned from previous projects			.633	
Due diligence in pre-tender planning phase			.696	
Improving Risk management practices			.604	
Accepted industry model for Risk analysis			.648	
Improve communication management practice				
Adequacy of contract documents				.772
Improving contract management practice				.579
Provision of adequate time for tendering				.782
Health and safety management practice		.532	.600	
Adoption and application of quality management system	.541	.527		
Practice of constructability review to resolve major project problems			.537	
Documentation and information management				
Cost management practice	.616			
Dispute resolution practices		.556		
Improving financial management practice	.588	.539		
Quality management practice	.531			
Efficiency of Resource management	.514	.545		
Logistic and supply chain management		.575	.505	
Strategic management		.595		
Improving organization culture		.664		
Promoting ISO/ similar certification		.807		
Strengthening supportive departments	.536	.617		
Empowerment of professional employees	.567	.561		
Variance %	22.50	22.40	21.97	15.02
Commutative variance %				81.89
Factor Score	3.49	3.28	3.40	3.34

Since construction organizations are project based organizations, they have to improve their project management practice for success of the project and their

sustainability with the ultimate aim of enhancing their competitiveness. The items under this category are interrelated, top management commitment is key to improve planning and performance tracking which will lead to organize the required team and improve site management maturity and supervision practice, which in turn will help meeting budget and quality requirements of the contract.

Organization Management (C2)

Component two from factor analysis is named Organization Management and includes: (i) Dispute resolution practices (though this area seems external to organizations it is affected by organizations attitude towards claims), (ii) Strategic management, (iii) Improving organization culture and (iv) Promoting ISO/ similar certification. Project Management (C1) is also highly influenced by organization culture and improving strategic management will help to generate competitive advantage and better performance and ensure sustainability. Currently, in the local industry, big projects are executed by foreign companies and those executed by local companies exhibit poor performance (Kifle 2013). Apart from the technical capacity, it is important to improve organization management practice for effectiveness in big projects and to compete in the global marketplace. As indicated by Kidanu (2014), ISO certified companies in the local industry are not benefiting from the certification because they do not give much emphasis to internal benefits of standardization such as process efficiency and effectiveness, their weakness being inadequate training and inadequate motivation. Therefore, avoiding those shortfalls and practicing quality management by contracting and consulting organizations will help to improve project and organizational performance. In addition, improvement of organization management practice has to involve improvement of supply chain management that will help to improve dispute resolution practices and reputability.

Knowledge and Risk Management (C3)

Component three is named Knowledge and Risk Management and includes: (i) Adoption of decision support systems, (ii) Project performance evaluation practices i.e. utilizing lessons learned from previous projects, (iii) Due diligence in pre-tender planning phase, (iv) Improving Risk management practices, (v) Accepted industry

model for Risk analysis and (vi) Practice of constructability reviews to resolve major project problems.

To improve future performance it is important to evaluate and use lessons learned from past performance (Enshassi et al. 2014; Chai and Habil 2015) as it helps in avoiding ad-hoc decision making based on intuitions. Utilizing effective risk management to improve the common construction industry problems is important (Tadayon et al. 2012; Goh and Abdul-Rahman 2013; Chileshe et al. 2016). Similarly, due diligence in pre-tender planning phase and constructability reviews will help to reduce major problems that will arise on later phases (Alinaitwe et al. 2014).

Project Development and Contract Management (C4)

Component four is named Project Development and Contract Management which includes: (i) Adequacy of contract documents, (ii) Improving contract management practices and (iii) Provision of adequate time for tendering. Items (i) and (iii) are associated with Knowledge and Risk Management (C3), incomplete technical documents with deficiencies such as errors and omissions in design which will contribute to poor performance and other inconveniences in later stages. Therefore, clients should provide adequate time for consultants to prepare contract documents.

Relative importance of the Components

Factor loadings under each component indicate only correlation of the areas to the individual components but not importance of the components. Hence, factor score formula indicated in Chapter 4 was used to identify their relative importance. Results indicate that component 1 is ranked the highest with a score of 3.49, second is component 3 with a score of 3.40, third is component 4 with a score of 3.34 and the last is component 2 with a score of 3.28. This implies improving project management practice is the priority area. This reaffirms studies of Yimam (2011) and Desta (2017) that have reported low level project management maturity in Ethiopian CI.

7.2.4 Competitiveness Improvement Mechanism

Improving competitiveness can be achieved through different mechanisms. Respondents were asked to indicate their level of agreement on proposed mechanisms

to enhance competitiveness of construction organizations using a 5 point Likert scale where, [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree. As indicated in Table 7.14, one sample T-test shows that respondents have agreed on all the mechanisms except for 'facilitating supply of materials/ equipment by the client'. This indicates that there is no single best mechanism. Hence, CID body needs to identify possible options and select a combination of mechanisms that can suit the context. Further discussion on this topic is given in Section 8.2.

Ethiopia is showing rapid growth in the region; hence, apart from competing in local market, competitive firms will have the opportunity to participate in the regional market which will help the country to become middle income country as envisaged in the near future. The experience of other countries shows competitiveness of their firms built through integrating competeiveness of the industry with the broader economic development of the country. Therefore, as discussed in Section 5.6.3, it is important to plan the demand considering enhancing competitiveness of the firms.

Table 7.14 Survey result-Competiveness enhancement mechanism

Improvement mechanism	**Mean**	**Std.**	**Rank**	**One sample T-test**
Promoting best practice	3.92	1.138	1	.000
Performance based preferential tendering	3.72	1.089	4	.000
Facilitating supply of materials/ equipment by the client	3.08	1.117	7	.428
Facilitating arrangement of financial requirement	3.77	1.100	3	.000
Integrated work packaging	3.79	1.021	2	.000
Promoting joint venture (JV)	3.44	1.089	6	.000
Slicing project to fit capacity of local companies	3.59	1.122	5	.000

7.3 Harmonized Industry Practice

Under this subtopic two practices: technology development and wider application of IT and two facilitating institutional systems: institution building (trade and professional associations) and better regulation are discussed.

7.3.1 Technology Development

The dimensions of technology development considered in this study involve improving construction methods and improving materials and equipment availability/accessibility. Research questions focused on four points: prefabrication (including promoting ready mixed concrete-RMC), technology transfer vehicles (R&D, mega projects and policy intervention), materials development (promoting local manufacturers) and creating opportunities to get information about equipment and create network with manufactures.

Table 7.15 Survey results- Technology development

Technology development	Mean	Std.	Rank	One sample T-test	Factor Analysis
Prefabrication and industrialized building	3.26	1.229	8	.019	.887
Promoting materials development through Research and development	3.37	1.296	5	.002	.901
Facilitating adoption of new technology e.g., improving take-up rate of research result & necessary changes in codes and standards	3.31	1.312	6	.009	.909
Capacity building of material manufacturers	3.27	1.256	7	.018	.922
Promoting exhibitions/establishment of showrooms/ point of sales of equipment and machineries for international manufacturers	3.09	1.057	9	.316	.798
Technology transfer from international companies involving in megaprojects	3.46	1.246	2	.000	.882
Promoting technology development through appropriate policy	3.43	1.186	4	.000	.914
Availability of Material Testing and Laboratories Centers	3.46	1.265	3	.000	.838
Availability of RMC-suppliers	3.50	1.234	1	.000	.857
				Variance %	77.3

As indicated in Table 7.15, except ‘promoting exhibitions for machineries and equipment’, all other activities need significant improvement which indicates that practice in these aspects is poor. Construction methods could be improved through technology transfer mechanisms/vehicles and also changing production systems by promoting prefab manufacturers and RMC suppliers. Materials shortage is one of the problems in the industry and this can be improved through capacity building of local manufacturers. This has benefit in terms of saving procurement time and saving hard currency. Facilitating adoption/transfer of new technology may need necessary changes in codes and standards. Similarly, R&D is challenged by limitation of material testing and laboratory centers. Academic institutes and research centers should be strengthened to address this shortfall. Promoting exhibitions for

machineries and tools will help to create awareness among stakeholders and build relationships with foreign companies.

7.3.2 Wider Application of Information Technology

Focus of the questions was on awareness development, skills development and linking services with IT. The results summarized in Table 7.16 indicate that there is need for improvement of IT application in the industry. A study conducted by Zewdu (2016) also shows that there is low penetration of software package application in the industry. This practice could be improved by improving IT skills of professionals and promoting use of relevant software packages. Other mechanism of promoting wider application of IT is by delivering associated services with IT like: developing database at industry level for open access, IT based data collection systems at industry level, providing online registration and approval services and web portals for project information disclosure.

Table 7.16 Survey results- Wider application of Information Technology

Wider application of IT	Mean	Std.	Rank	One sample T-test	Factor Analysis
Awareness development on importance of IT	3.30	1.150	7	.004	.892
Improve Information sharing and reporting practice among parties	3.34	1.135	4	.001	.902
Promoting use of relevant software packages	3.41	1.178	2	.000	.903
Improving professional's IT skills/ Training	3.33	1.176	5	.002	.924
Developing database at industry level for open access e.g. standard practices, codes and standards, and relevant information	3.42	1.263	1	.000	.925
Project information disclosure i.e. for transparency	3.39	1.176	3	.000	.861
IT based data collection system at industry level	3.31	1.257	6	.007	.922
Providing online registration and approval service	3.20	1.388	8	.099	.902
				Variance (%)	81.76

7.3.3 Institution Building

As indicated in Table 7.17, developing shared vision and involvement of professional associations are priority areas of improvement. Active involvement of different industry associations, professional and trade associations, have importance in improving and harmonizing the industry practice as they act as bridge to their members and the industry (further discussion on this is given in Section 8.3). There

are many professional and trade associations in the industry: Ethiopian Association of Civil Engineers (EACE), Association of Ethiopian Architects (AEA), Ethiopian Construction Technology and Management Professionals' Association (ECoTMPA), Construction Contractors Association of Ethiopia (CCAE), Ethiopian Consulting Engineers and Architects Association (ECEAA), etc.. The associations organize different workshops (almost the mentioned professional associations), exhibitions (e.g. CCAE is organizing construction exhibitions). They also participate in different workshops if invited by the concerned statutory authority. However, their contribution level is unknown as there is no clear mechanism to convey the effort as input to development of the industry. This can better be achieved through establishing industry-wide associations to provide a common voice for the industry. As discussed earlier, the newly established CIC may play such role unless it is constrained by different factors.

Table 7.17 Survey results- Institution building

Institution building	Mean	Std.	Rank	One sample T-test	Factor Analysis
Improving involvement of professional associations	3.27	1.231	2	.016	.939
Improving involvement of Trade association (e.g. Contractors association and Supplier association)	3.17	1.183	4	.101	.940
Establishing industry-wide association to provide a common voice for the construction industry	3.25	1.208	3	.020	.945
Developing shared vision for construction industry development	3.39	1.203	1	.000	.908
				Variance	87.10%

7.3.4 Better Regulation

As discussed earlier, regulatory system is the main institutional system to induce and sustain good practices in the industry. The results summarized in Table 7.18 reaffirm the earlier discussion indicating that the existing regulatory system needs improvement. Factor analysis has yielded two components that explain 68.01 % of the cumulative variance. Detail discussion on this is provided in Chapter 5 (Section 5.1 and 5.5). Additional discussion on new grouping of variables is provided below.

Capacity of regulatory authorities and regulatory tools

This component mainly consists: organization of the regulatory authorities, consistency of requirements, registration system, CID policy and procurement system.

Efficiency of implementation of CID strategy is dependent on capacity of the regulatory authority and effectiveness of the regulatory tools. Hence, it is important to strengthen the authorities and align the regulatory tools to meet strategies of the CID policy.

Table 7.18 Survey results- Better regulation

Better regulation	Mean	Std. Deviation	Rank	One sample T-test	Factor Analysis	
					C1	C2
Strengthening capacity of regulatory authorities	3.39	1.196	8	.000	.832	
Consistency of statutory requirement	3.22	1.105	17	.026	.793	
Clear accountability and transparency	3.48	1.320	3	.000	.764	
Registration system of construction organizations (contractors and consultants)	3.39	1.142	7	.000	.756	
Registration system of workers (professionals and semiskilled workforce)	3.30	1.115	12	.003	.761	
Lack of safety regulation	3.46	1.153	5	.000		.828
Ease of getting construction permit	3.24	1.096	15	.013		.662
Building permit i.e. delay in appropriate implementation of Building regulation	3.48	1.060	2	.000		.837
Right of way and compensation i.e. facilitating early clearing of right of way problems	3.47	1.220	4	.000	.578	.529
Suitability of prequalification criteria in supporting construction development vision	3.31	1.111	11	.002	.780	
Promoting alternative Procurement system i.e. integrated procurement system	3.33	1.134	9	.001	.791	
Equitable distribution of risks in the applicable conditions of contract	3.24	1.109	16	.018	.805	
Provision of effective means of dispute resolution in the applicable conditions of contract	3.31	1.058	10	.001	.794	
Consistency of codes, standards, specification and guidelines to improve industry practice	3.28	1.105	14	.005	.790	
Long term construction industry development policy	3.53	1.194	1	.000	.819	
Suitability of legal framework on arbitration and dispute resolution	3.28	1.052	13	.004	.806	
Lack of comprehensive industry wide applicable law	3.44	1.066	6	.000		.650
Suitability of environmental regulation	3.07	1.114	18	.475	.727	
				Variance %	47.94	20.07
				Cumulative Variance %		68.01

Building regulation and safety

This component consists of building permit i.e. delay in appropriate implementation of building regulations, ease of getting construction permits, lack of safety regulation and lack of comprehensive law with industry wide application. Delay in implementation of promulgated proclamations, directives and policy is one of the shortfalls of the regulatory system in the industry.

Poor performance of safety practice in the industry is indicated by previous studies also (Sermolo 2014; Gebreamlak 2016; Fekele et al. 2016). Efficiency of the related regulations is indicated as one of the cause for poor performance.

7.3.5 Effect of Psychosocial Factors on Construction Industry Development

Perceptions and attitudes of stakeholders towards the industry affects its development and these are shaped by image of the industry (Fox 2003). The perception and attitude of the stakeholders towards changes in the industry, technology adoption, and track record of the industry affects the working culture. As indicated in the Table 7.19, all these factors need improvement in the industry. As discussed earlier, it is important to integrate CID plan with other sectors to reduce socio economic pressure of other sectors.

Table 7.19 Survey results- Psychosocial Factors

Psychosocial factors	Mean	Std.	Rank	One sample T-test
Attitude and Perception of stakeholders	3.40	1.049	2	.000
Culture in the industry	3.32	1.076	4	.001
Image of the industry	3.45	1.187	1	.000
Socio economic pressure of other sectors	3.39	1.032	3	.000

7.4 Findings from Interviews

Survey results discussed earlier indicate that the determinant factors need improvement in all aspects. Here the discussion covers the related problems and the suggested improvement of the determinant factors as determined from analysis of interview responses.

7.4.1 Manpower Development

Problems raised by the interviewees reaffirm results of the survey results that includes poor UiL, the education being not practice based, poor HRM practices and lack of planning and monitoring of manpower development at industry level.

Concerning planning and monitoring of manpower development, identification of categories of manpower and problems in each category were suggested by R1 and R3. R1 suggested: identification of the demand clearly, aligning education to meet the

demand and increasing practical component of the education. R3 explained the case as:

> *It is better to see manpower in two categories: professional and occupational level. The problems for the professionals so far are two, lack of competence and lack of experience. Competence for me is commitment, academic caliber (the basic knowledge) and professional discipline. For example if you take our seniors, they are too disciplined. The other is occupational; these are required in large number. For these two classifications the measurement is different. At professional level the problems are commitment and core science. For occupational, the problems are lack of decision making skills and internalizing the process and consequence, technical problem might be there but the main is lack of understanding the process and the consequences. The other is, as a country we have to develop the practice of rewarding performance, these need policy direction.*

Improving the practical aspect of the education is emphasized by the interviewees. It is indicated by R11 & R12 that the curriculum has no problem; it has reasonably covered the knowledge and skills required for CI. The problem is capacity to deliver requirements of the curriculum. The challenge identified for this was the rapid expansion of universities without facilities and qualified academic staff. The other problem highlighted is poor UiL specifically internship coordination.

Follow up and evaluation mechanism of internship by the academic institutes, commitment of the students and the hosting company are the major problems identified by the interviewees. R14 explained the case as:

> *The first problem is students' lack of commitment to get detailed information about the work, to improve this, the hosting companies should give exams rather than simply evaluating the intern based on attendance. The second problem is coordination by the institute which is weak, even while the mentors are coming to visit students they meet students only, they do not communicate with hosting companies, it seems as if they are coming to check for the sake of attendance.*

Setting joint exams by hosting company and academic institutes at the end of internship to improve students' commitment and devising incentives and recognition

by government for companies involved in internship was proposed by most of the interviewees as an improvement mechanism for internship effectiveness.

Concerning HRM practices, the problem was perceived to be associated with shortsightedness of firms' strategies. The interviewees indicated that, rather than investing on manpower development organizations prefer hiring experienced professionals from other companies with higher salary. R3 explained that they have the fear of losing trained and developed manpower and focus on building physical assets. R12 and R21 emphasized that, change in mindset is required from the side of professionals to recognize that firms invest on them and they should consider the company as their own. This problem of trust is evident on both sides.

According to R1's argument, continuous professional and occupational development has to be duties of organizations and they should be incentivized, e.g. it has to be considered in prequalification. R2 has also added that it is important to link certification of professionals and registration of companies, and then companies having certified/ chartered professionals should be incentivized, and this will encourage the companies to promote their employees to get certified.

7.4.2 Enhancing Competitiveness

The major problem indicated in enhancing competitiveness was management practice and the second was support (capacity building) mechanisms. Concerning management practice, the interviewees expressed most local firms as 'one-man show', i.e., the owner is everything. The perception towards company growth is also identified as a problem; companies were said to be grown based on the number of projects and not based on their management capacity. This attitude has made most of them to chase projects without considering their actual implementation capacity. R3 explained the problem associated with such cases as: after some time the firm will start accumulating negative finance that leads it to abnormal growth and finally failure. He added that the trend of firms' growth in the industry is inverted parabola, they go up and finally collapse, i.e., local firms lack sustainable growth. Similar perception was highlighted by R10 who believed that the owners are ambitious without any organized management structure.

Contractors should handle manageable number of projects and build their experience, reputability, financial, materials etc., on strong base. R1 explained the case as:

> *Commitment and strategy are the basic things for reputability. In our industry, the companies are one-man show. The second is registration requirements and prequalification focus on number of equipment, number of manpower…. it does not measure the implementation capacity of the organizations. The third is the organization does not value their human resource. The other is their documentation is also poor, even the information is only with that one-man. The fourth is the work is not system based.*

This notion is supported by R18:

> *The main problem with contractors is their management practice, their number of projects and their capacity are different (not matching), and there is mobility of professionals due to their poor HRM practices.*

Poor performance due to many changes during project implementation caused by inadequacy of the contract documents was also seen as a problem. Similarly, it is indicated that although contractors are required to prepare detail general work methodology and specific methodology during tendering, they submit it for name sake only and the evaluation is not strict.

Major management problems indicated by the interviewees were: planning, inadequate contract documents, lack of due diligence during tendering and cash flow management. R1 argued that improving project management and contract management should be emphasized. R12 added that contract administration practice should be strict, so that at least for the sake of contractual requirements, practices will be improved.

Concerning government support, R1 opined that there are incentives like duty free construction equipment, but whether they are sufficient or not is questionable. Also, easy registration criteria for contractors were seen to encourage new entrants. However, as discussed earlier capacity development programs are fragmented.

7.4.3 Harmonized Industry Practice

Major points raised concerning harmonized industry practice were: involvement of associations (professionals and business), technology development/transfer and regulatory system.

The problem identified concerning associations (professional) was weak capacity of associations. Absence of difference between being a member and not a member has resulted in members being not active. R2, president of one of the associations, explained, professional societies are voluntary based, hence, commitment is the main problem. R15 explained that the first problem with the associations was emanating from the associations themselves in that they were not strong.

The other point raised was technology transfer. Technology transfer can be enforced through inclusion in design and specifications. This is determined by the client and consultants commitment. While the clients being cost conscious was a problem, from consultants side, the problem was absence of minimum consultancy fee which made competition abnormal. Therefore, new technology in design and specifications was found to be rare.

Even though most mega projects are handled by international companies, the practice of technology transfer was considered weak. In this regard, it was felt that a mechanism to transfer technology through policy support was required. Also, it was perceived that flexibility in terms of applicable codes, standards and specifications was required to improve the practice in the industry.

7.5 Summary of the Chapter

Assessment of the improvement requirement level indicates that there is room for improvement in all aspects in all the factors. Priority areas of improvement indicated in manpower development aspect are: UiL, practical aspects of education, HRM practices and planning and monitoring of manpower development. The major challenge to enhance competitiveness was management practice and the support (capacity building) mechanism. Major issues raised concerning harmonizing industry practices are: involvement of associations (professionals and business), technology

development/transfer and regulatory system. Required improvement dimensions are as summarized in Figure 7.1.

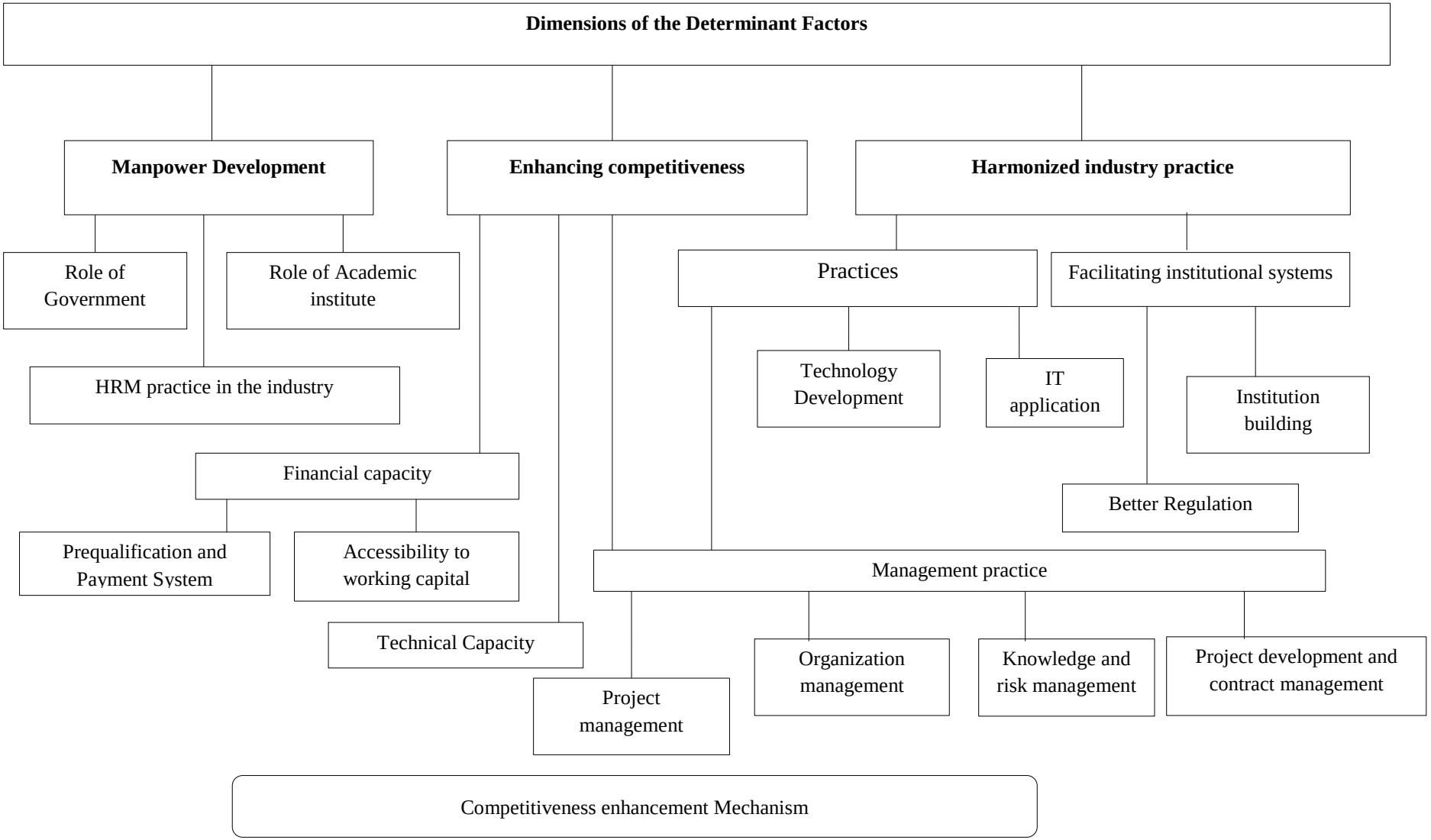

Figure 7.1 Summary of improvement dimensions

CHAPTER 8

IMPROVEMENT FRAMEWORKS AND KEY PERFORMANCE INDICATORS

This chapter covers improvement frameworks of the determinant factors of CID namely: manpower development, enhancing competitiveness and harmonizing industry practice and identification of KPIs for monitoring and tracking improvements of the factors.

8.1Manpower Development Improvement Framework

Objectives of manpower development are producing competent entry level professionals (new graduates) and maintaining competence of the experienced professionals to meet the demands of the industry. This helps to build adequate and competent manpower pool in the industry so that problems related to quality and quantity of manpower will be controlled. Findings indicate that there is a need to improve manpower development practice for CID in Ethiopia. Findings from the survey provided the major activities which need improvement under the role of the three stakeholders: academic institutes, government and industry organizations. Also, being a long term activity, improving manpower development needs concerted effort of concerned parties and continual monitoring and controlling. Considering these, a framework is proposed and discussed in the subsequent section. Figure 8.1 shows the proposed framework for manpower development.

8.1.1 Competence of Entry Level Professionals

Education quality is affected by different factors including qualification and competence of academic staff, teaching, learning and assessment, quality of facilities and support services. However, relevance of the curriculum and university industry linkage practice are directly associated with the technical aspect of construction education, hence *'relevant and practice based education'* has been brought out as a

priority area of improvement. The main measurement of the relevance is assuring inclusion of skills and knowledge required for the industry in the curriculum.

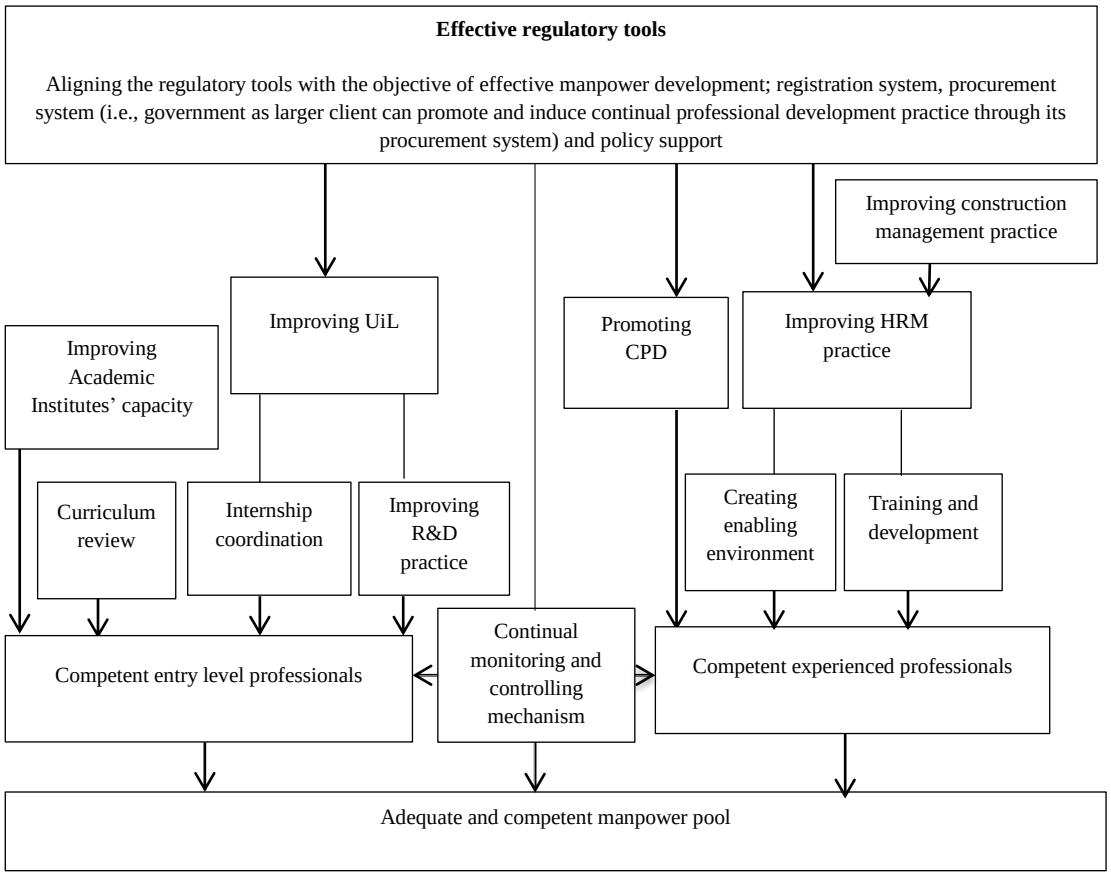

Figure 8.1 Manpower development improvement framework

Multidisciplinary nature of the construction industry makes different professionals to engage in and graduates of the different programs to share responsibilities. There are different undergraduate construction programs offered in Ethiopian universities: Civil Engineering (CE), Construction Technology and Management (CTM), Water Resources and Irrigation Engineering (WRIE) and related. Review of the three curricula (CE, CTM and WRIE) and of professional registration directives confirms this nature of the industry. Therefore, apart from their major specialty, graduates of these programs are required to possess common skills that the industry expects from entry level professionals.

Curricula of the programs were reviewed to identify inclusion of the required knowledge and skills. The core skills are found either as a separate course or part of related courses in the curricula. The courses found commonly in all the three curricula are: construction materials, 'contracts, specifications and quantity surveying', engineering economics and construction equipment. Planning and scheduling is a separate course in CTM and WRIE programs. Other core skills found in different related courses are: construction methods, design and analysis, environment related (sustainability) and safety. Though the courses are given in different depth depending on major specialization of the program, the required core skills indicated in Section 7.1.2 are found in the curricula. Similarly, the soft skills are also found across different courses in the curricula. This shows relevance of the programs. However, improving UiL is expected to make it more practice based education.

Assurance of inclusion of the required knowledge and skills in the curriculum could be done through active involvement of the professional institutes/associations. Even though there are many professional associations in the country, they have no involvement in professional registration/ certification and accreditation of programs. Higher Education Relevance and Quality Agency (HERQA) is the only agency that accredits and audits higher education institutes (HEIs) in Ethiopia (Adamu and Addamu 2012). It was established in 2003 (FDRE 2003) and it is accountable to the Ministry of Education. Even though the objective of its establishment is to supervise the relevance and quality of higher education offered by any institution, the accreditation procedures are not yet applied to public HEIs. In addition, its establishment is a generic one. A separate unit focusing on engineering and technology like Accreditation Board for Engineering and Technology (ABET) of US and Engineering Council (EC) of UK is absent and is advisable. Several countries have adopted this practice with contextual modifications (Natarajan 2000) to both guidelines, ABET and EC which are generally similar (Anwar and Richards 2018). Professional associations should strengthen their capacity and engage in supporting the accrediting agency similar to the practice of their counterpart in developed countries, e.g. ASCE (Ressler and Lenox 2015). Further discussion on the benefit of active involvement of professional and trade associations is provided in Section 8.3.

UiL can be expressed in terms of internship coordination or research and development. Internship plays an important role in bridging academia and industry to equip the graduate with practice based knowledge and skills. Analysis of questionnaire two responses indicates that the coordination of the internship program from both academia and industry side is not satisfactory. In delivering the required knowledge and skills, participation of industry organizations is important. Hence academic institutes should build a relationship with the industry for effectiveness of internship program (Moore and Plugge 2008). However, as the findings of the survey questionnaires indicate, problems of internship coordination starts from student placement itself, the students search the internship company by their own and the follow up by mentors is also poor. The UiL office should set criteria for the students who are searching companies by their own. However, this trend leads to bias on students' evaluation and loose supervision and therefore, students search for companies should be limited to preapproved companies. Other problems that are associated with the role of the organizations are lack of proper orientation of students, not assigning work independently and lack of creating exposure to different relevant departments of the organizations. Highlighting these problems will improve effectiveness of internship (Rothman 2007). In addition, poor commitment of students is also indicated as a problem. This can be improved by providing pre-placement training by academic institutes (by UiL and the respective departments) to boost students commitment and develop realistic and positive expectations for effectiveness of the internship. Periodical review of the internship effectiveness is important and the mentors have to be a link to take feedback on students' performance and curriculum from company supervisors (Bhattacharya and Neelam 2018).

One of the duties of higher education institutions is promoting and enhancing research focusing on knowledge and technology transfer consistent with the country's priority needs (FDRE 2009c). Effective UiL will assist in aligning research output to industry needs which can help to improve take-up rate of findings. However, the practice is poor, output and impact of the research produced by academic institutes in the country is very low (Salmi et al. 2017). The cause for weak partnership between university and industry in terms of R&D and less contributions of academic research in

enhancing economic development in Ethiopia are: lack of overarching framework that brings all actors (university, industry and government), lack of readiness and willingness on part of both the universities and industries, limited attention and inadequate funds for research and innovation at national level, absence of well-established research infrastructure and facilities dedicated for research and innovation activities in both the industries and universities, inadequate institutional commitment and support at all levels and shortage of capable staff to undertake advanced research (Kahsay 2017). Improving the performance of Ethiopian universities in science and technology needs strengthening the quality of academic staff and building up the capacity of academic institutes (Salmi et al. 2017).

8.1.2 Competence of Experienced Professionals

CPD helps to ensure updated experienced professionals in the industry, as indicated in Figure 8.1, it is majorly the role of government and industry organizations. Government can assure this through the registration system and as a larger procurer in the industry, it can promote the same by considering training and development during bidder selection and can promote and coordinate through policy provisions.

As discussed in chapter 5, the registration system has shortfalls. Identified problems are: numerous classifications resulting in overlaps, it does not promote CPD, and list of the professions is not exhaustive. All these indicate poor practice in manpower planning and there is no clear follow up mechanism. As discussed in Section 8.3, the regulatory system needs revamping to mitigate these problems.

The other improvement mechanism for CPD is through policy provisions to support industry organizations to improve their HRM practice and incentivizing in prequalification. Even though overall management in the industry is poor, the case is worse especially in HRM. It does not promote the professionals to update their skills and knowledge. Therefore, industry organizations should contribute to CPD by creating enabling environment, integrate performance appraisal system and develop effective training.

As best practices of other countries indicate, monitoring and controlling manpower development in CI needs collaboration of different parties: multi-departmental

approach. It is difficult to absolutely assign activities to a certain body due to the nature of the industry. However, through efficient coordination mechanism improvement can be achieved. Hence, in the case of Ethiopia, MoC (MUDC) has to coordinate all concerned parties such as ministry of education, ministry of science and technology, professional and business associations, central statistics agency, national plan commission for effective manpower development.

8.2 Improvement Framework for Enhancing Competiveness

Competitiveness of firms has significant contribution in improving the performance of the industry. Competitive firms will have the opportunity to achieve business and project requirements and help to ensure professionalism in the industry: state of the practices is determined by firms' competiveness. Enhancing competitiveness needs commitment of firms (internal elements) and external elements. The measures of organization's internal element of competitiveness are resources and capabilities (Oyewobi 2014), resources are not competitive advantages unless organized into capabilities (Chew et al. 2008). Hence, achieving superior performance by firms is a function of acquiring, exploiting, managing and deploying resources and capabilities. these activities are with varying extent under-pinned by broader industry circumstances (the external elements) (Phua 2006). The broader industry circumstances includes: manpower development in the industry, technology development, interventions and the regulatory systems. Hence, enhancing competitiveness of firms in the industry needs improvement of the internal and external determinants.

Findings from the survey, as discussed in 7.2, indicate competiveness of the firms in the local industry needs improvement in all aspects: financial capacity, technical capacity and management practices. That needs both government support and commitment of the firms. Governments of different countries have implemented initiatives to improve competitiveness of their local firms, e.g. Malaysia and Singapore (Ofori 2006). Different lessons can be drawn from these initiatives to accelerate the improvement. As discussed in Chapter 5, different capacity building initiatives have been taken so far in Ethiopia; however, they are fragmented and

shortsighted. The major lesson to be taken from other countries initiatives is, setting clear objective indicators, setting targets and a roadmap to achieve them and monitoring implementation is important. Also, help by government should not create much dependency and it should be monitored and adjusted as the context changes (Ofori et al. 1999).

The firms have to strengthen their strategic management practice to be competitive and reputable in the industry. Assessing the internal and external factors and exploiting advantageous factors properly helps to build competitive advantage: strategic alignment is important for success (Hastheetham and Hadikusumo 2011; Setiawan et al. 2015). Considering the findings and discussions a framework of improvement is developed as indicated in Figure 8.2.

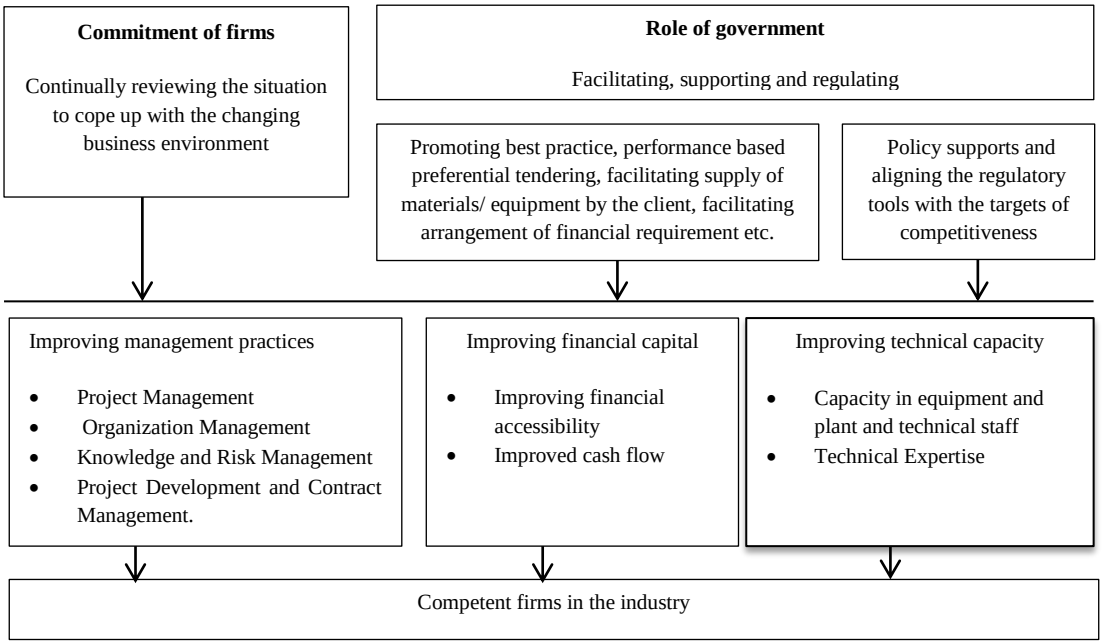

Figure 8.2 Framework for enhancing competitiveness

Different mechanisms can be employed to improve competitiveness of firms in the industry. These could be implemented by aligning the regulatory tools with the objectives of enhancing competiveness, for example, government as the largest procurer of construction works can use procurement system as a tool to enhance competiveness by mechanisms such as performance based preferential tendering, promoting best practice, slicing projects to fit capacity of local companies, integrated

work packaging and promoting JVs. Government can also facilitate arrangement of financial requirements e.g. performance bond, and getting loans to finance projects by improving access to financing bodies. Improving management can be done through government aided trainings on selected knowledge areas. This can be better handled in Ethiopia by ECPMI, as the purpose of its establishment is facilitating development of the industry through building project management capacity of the key stakeholders (FDRE 2013).

8.3 Improvement Framework for Harmonized Industry Practice

Findings from the survey as discussed in Section 7.3 indicate that improvement is required in both the practice areas (technology development and wider application of IT) and the facilitating institutional systems (regulation and institution building). In terms of improving technology development in the industry as a practice area, promoting RMC suppliers, establishment of testing and lab centers and technology transfer from international companies are indicated as priority areas for improvement while for wider application of IT, industry level database development, promoting use of relevant software packages and project information disclosure are considered priorities. In institution building, developing shared vision for CID and improving involvement of professional associations are required to be given priority. Similarly, the survey findings and document analysis indicate that the regulatory tools need improvement. Achieving these will create conducive business environment by creating effective and efficient industry practices.

Hence, the regulatory tools have to be aligned with the objective of CID and the associations need to be active participant for improvement of the practice areas in the industry. As indicated in Figure 8.3, government has the role of shaping the industry through different regulatory tools: determine extent of IT application in the industry, technology transfer and involvement of associations. Similarly, involvement of associations has a role in improving IT application and technology transfer in the industry.

Some of the services can be associated with IT to promote its wider application, for example design approval and construction permit, registration process and disclosure

of information of public projects (as currently implemented by FPPA). Awareness development is one of the mechanisms for improving the application. Training for certain selected IT tools, e.g. BIM can be done by professional associations and government aided training can help to diffuse the required IT tools. Effective policy support for R&D practice, financial support and strengthening research centers helps in selecting and transferring technologies. Similarly, promoting prefab manufacturers, RMC suppliers and material manufacturers can enhance the general technology development in the industry.

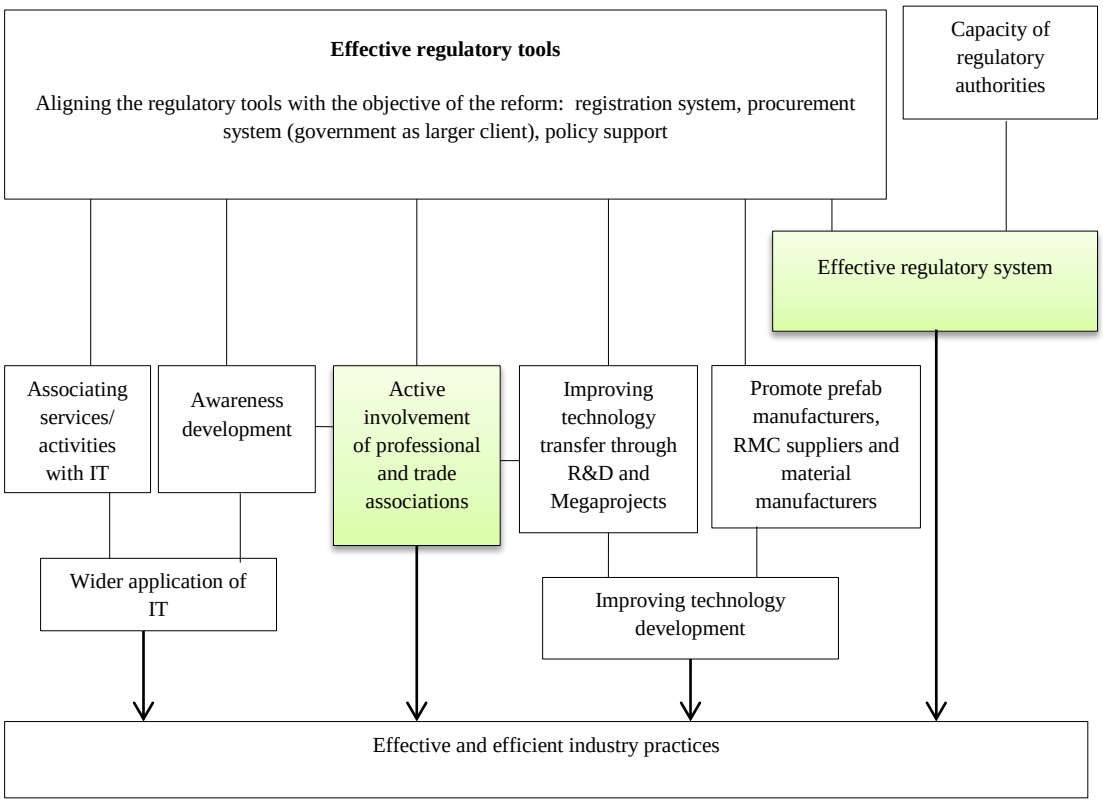

Figure 8.3 Framework for improving harmonized industry practice

Materials manufactured locally are criticized for their low quality. Hence, it is important to promote material manufacturers to produce materials meeting the prevailing specifications and standards. In developing countries shortage of materials is one of the factors that affects project performance (Okpala and Aniekwu 1988; Mansfield et al. 1994; Assaf et al. 1995). Hence, enhancing capacity of construction materials manufacturers is important for improvement of CI performance (Ofori 1980). Heightening enforcement of compliance to mandatory material standards also helps to drive poor quality materials out of the market (CIDB-Malaysia 2015).

8.3.1 Regulatory System

Functions, power and duties, of the authorities and relationship with the industry have to be clear and any overlapping duties which will lead to conflicting requirements have to be avoided. Some power and duties of MoC (MUDC) which needs clarity should be redefined and refined and others which overlap need to be given to the organization that can better manage it. It is difficult to absolutely assign duties to one party due to the nature of the industry, but through efficient coordination mechanism the barriers can be reduced. The indicated delay in implementation of promulgated proclamations and regulations should be avoided. In general, it is important to recognize importance of the regulatory tools in shaping the industry practice and devising integrated improvement mechanism through regulatory tools.

Hence, it is important to reevaluate the regulatory tools to meet strategies of the industry development policy: registration system, design approval and construction permit and procurement system/ practice, and set coordination mechanisms for short-term and envisage at comprehensive industry wide applicable law for the future. Registration system should act as a focal point for development of the industry and enhance its performance by improving competitiveness of firms and promoting CPD of professionals. To achieve these, there has to be feedback mechanism (involvement of the stakeholders in improving the system) and the registration system needs to be reviewed periodically to make it continuously relevant to the needs of the industry (Ofori 2004).

Design approval and construction permits could be used to regulate the industry and promote/induce best practices to the industry. Compliance of different codes and standards help to ensure safety, and quality, and it can also be used to diffuse required change of practice in the industry, i.e. alternative methods and materials and wider application of IT, Buildable Design Appraisal System (BDAS) of Singapore can be taken as an example (PSIB 2004). Similarly, government as a major client can mainly diffuse improved practices to the industry through its procurement system by aligning prequalification and other contractual requirements with industry specific strategies. In general, the applicable codes, specifications and standards have to be flexible to

adopt new technologies and kept up to date to diffuse best practices and improvements to the industry.

8.3.2 Role of Trade and Professional Associations

Institution building and active participation of professional and trade associations is affected by both internal and external factors. The regulatory system is the external factor that affects their participation and in this regard, the new CIC is expected to improve the existing poor participation of the associations in the industry and build strong institutions supporting development of the industry. However, it is important to ensure the council from being constrained by the bureaucracy.

Professional associations bring different benefits for the industry: improve productivity, social mobility, governance and ethical standards, and policy formation (Green 2015). They improve productivity through increasing the capability of the workforce, promoting best practice and sharing the latest advancements, coordinate advances in innovation and promote the uptake of new technologies. They can advise on the likely impact of policy both on the industry and on the public at large, they also have a role in communicating and explaining the implications of pertinent policy decisions to their members.

Trade associations also bring many similar benefits: they have importance in indicating matters affecting the industry's business environment, awareness development and dissemination of information associated with technology development and related policy issues to their members. Hence, it is important to maximize their contribution by creating conducive environment for their participation.

8.4 Key Performance Indicators for Monitoring and Tracking Improvement

Performance management system is a tool to maintain continual improvement. Many studies have indicated importance of performance measurement and suggested measurement framework in construction industry at project, organization and industry level (Kagioglou et al. 2001; Bassioni et al. 2004; Costa et al. 2006; Chan and Sundaraj 2009; Kumaraswamy et al. 2017). Performance improvement action needs

measurement mechanism. As the review of performance measurement and benchmarking initiatives of different countries by Chan and Theong (2013) indicates, performance measures for the CI necessarily include a combination of metrics: project level metrics (time, cost, quality), company level (profitability, turnover, return on capital) and the industry level (safety, growth, labor productivity, innovation, training, construction demand).

Maintaining continual improvement needs identifying the measures and their suitability. According to Parmenter (2015), there are two major types of performance measures: result indicators and performance indicators. Result indicators reflect combined teamwork measures but these do not help management to fix a problem as it is difficult to pinpoint which teams were responsible for the performance or nonperformance. Performance indicators, on the other hand, are measures that can be tied to a team or a cluster of teams working closely together for a common purpose. Hence, it gives clarity and ownership for good or bad performance. To show importance of the measures the extra word "key" is used: key result indicators (KRIs), result indicators (RIs), performance indicators (PIs) and key performance indicators (KPIs). EFQM Excellence Model also identifies three types of measures: key performance indicators (KPIs), key performance outcomes (KPOs) and perception measures (Beatham et al. 2004). KPIs are measures that are indicative of performance of associated processes, KPOs are results of a completed action or process and perception measures are usually carried out by direct question or survey and can be used at any stage. In CI KPIs is the collective terms for performance measures (Beatham et al. 2004). Therefore, it is necessary to identify nature of the measures, adopt and use in the way that ensures continual improvement. Majorly, to maintain continual improvement key performance indicators is appropriate.

8.4.1 Key Performance Indicators for Construction Industry Development

The main objective of CID is attaining continual improvement and maximizing socioeconomic contribution of the industry. Improving construction industry performance is a long-term activity (Wolstenholme 2009; Kumaraswamy et al. 2010; Ofori et al. 2011). Improvement requirements of the industry varies along different

periods (Ofori 1980; Fox 2003). Hence, setting KPIs and amending them over time to suit the changing context is important (Ofori 2001; Kumaraswamy et al. 2017). KPIs need to be part of performance management system to be used successfully (Beatham et al. 2004). Therefore, continual monitoring and controlling the performance of different dimensions of the determinant factors should be integral part of CID initiative.

According to Furneaux et al. (2010), the difficulties with measuring and reporting KPIs are lack of coordinating agencies, subjective assessment, crude (questionable measures), large number of schemes (fragmentation), data overloaded and large (cash and in-kind) investment required. Overcoming the difficulties needs understanding the contextual nature of the industry and ensuring the adopted KPIs have the expected attributes. The expected attributes of KPIs are identified by different studies (OECD 1993; Beatham et al. 2004; Furneaux et al. 2010; Parmenter 2015; CIC 2015); it has to be quantifiable, easy to interpret (easily understood), readily available at low cost, adequately documented, meaningful to the industry (relevance and importance to the industry), significant impact, show a trend over time, aligned (must link to the national goals for the industry), have a threshold reference value to be compared against, it must be able to be implemented, it should reflect future development and should be able to improve external accountability and verification.

The KPIs adopted for CID in Ethiopia in GTP I for the period 2011-2015 (MoFED 2010b) and in GTP II for the period 2016-2020 (NPC 2016b) lack the required attributes: some lack relevance, lack of significant impact and lack of forecasting and information systems, lack of threshold reference value to be compared against and some have ambiguity. The other shortfall is there is no consistency among the KPIs in the consecutive national plans which show lack of actual implementation.

Monitoring and follow up of the overall improvement of the CI is the role of the central statutory organization. Hence, the KPIs of CID can be considered as KPIs of this organization. Chan and Sundaraj (2009) in their study on performance measures of Malaysian CIDB, have indicated that the KPIs for this organization are significantly different from those of the industry organizations. They have indicated

that financial measures will not be directly relevant and its KPIs mainly focus on improving procurement methods, contractor performance, planning and approvals process, defining and assessing product quality, providing training, funding R&D and increase ICT usage, enhancing occupational safety and health practices, and creating opportunities for export of construction services. These show that the KPIs have to be aligned with the particular strategic thrusts set for CID. In this study, the main strategic thrusts are manpower development, competitiveness of firms and efficiency and effectiveness of the industry practice.

Different performance indicators can be suggested for these strategies depending on the context. As it is difficult to measure everything, it is important to identify a core set of KPIs for each scenario (Ci3 2017b). For example, concerning manpower development different KPIs are indicated; with the objective of improving the way the industry treats people, Egan (2002) has suggested, respect for people KPIs: employee satisfaction, staff turnover rate, sickness, absence, pay, safety and working hours. These indicators help companies to improve the way they handle people and thereby improve their contribution to manpower development in the industry. Similarly, three KPIs are indicated in CIC (2015) for manpower development; workers' wage index, workers' aging index and retention rate of graduates. In this study the targets are producing competent entry level professionals and maintaining competence of the experienced professionals in the industry.

In general, the KPIs have to serve the main purpose that is providing critical information needed to drive meaningful improvements that help to know the past and present status and to target future and track the progress (Kumaraswamy et al. 2017). Hence, considering the relevance, some of the KPIs are adopted from different literature on manpower development (Ofori 2001; Chan and Sundaraj 2009; Zhai et al. 2014; CE 2015), enhancing competitiveness (Ofori 2001;Chan 2009; Adediran 2018), technology development, IT application and the regulatory tools in effectively diffusing the required practices to the industry (Hamid and Kamarn 2010; MPC 2016). As summarized in Table 8.1, 19 KPIs are proposed for the determinant factors, and the business environment. The implementation needs concerted effort of

stakeholders with varying extent as the context requires. Hence, the expected coordinating body is indicated along with the proposed KPIs.

Manpower development has 6 KPIs: (i) number of accredited universities offering the relevant UG programs (CE, CTM, WIRE, etc.) and (ii) Satisfaction/perception of student and industry organization on internship coordination/ measuring knowledge and skills level/ which helps to know status of the entry level professionals in the industry while (iii) number of professionals registered/ certified/ and (iv) percentage of demand (employable) fulfillment by categories which helps to know competence and quantity of professionals in the industry and (v) staff attrition (%) and (vi) annual training expenditure to profit ratio which shows commitment to human resource management practice of the industry organizations.

Enhancing competitiveness has 5 KPIs: (i) Rate of companies' upgrading shows the general status while (ii) number of companies with quality assurance programs shows the level of competitiveness. (iii) Number of companies involved in capacity development program (% achieved in targeted capacity development program) helps to measure effectiveness of capacity development programs which will lead to the second level of the KPI and (iv) percentage of project value awarded to local firms and (v) Overseas work volume/ local work volume which shows competiveness of firms in ICB projects in particular and the industry competitiveness in general.

Harmonized industry practice has 6 KPIs focusing on practices and facilitating institutional systems: (i) types of relevant technology adopted/promoted, (ii) level of relevant software package application in the industry and (iii) number of services associated with IT show general status of the practice areas in short term, while (iv) annual R&D expenditure to profit ratio, (v) participation level of associations and (vi) effectiveness of the regulatory tools in achieving CID targets help to measure disseminations of the adopted practices. However, in the long term assessing effectiveness of the adopted practice areas is required.

Demand stability and demand sustainability are the two KPIs proposed to measure the general business environment as these are the key to check the general health of the industry.

Table 8.1 Proposed Key Performance Indicators

Targets	Responsibility	KPIs	Remarks	
			Short term (3-5 years)	**Long term (>5years)**
• Build adequate and competent manpower pool	• Academic institutes offering the relevant programs o To be coordinated by ministry of higher education and technology	• Number of accredited universities offering the relevant UG programs	• Establish system of accrediting construction related programs o Target 50%	• Periodical accreditation o Target 100% • Promote international accreditation of programs
		• Satisfaction/perception of student and industry organization on internship coordination/ measuring knowledge and skills level	• Establishing a system of evaluation and feedback mechanism • Perception survey o Target 80%	• Periodical measurement with benchmarking
	• MUDC o Demand planning needs participation statistics agency and national plan commission	• Number of professionals registered/ certified	• Revaluing the existing registration system to incorporate CPD and improve the shortfalls • Number of registered professionals o Target 50% • Promote certification o Promoting CPD	• Number of registered professionals o Target 100%
		• Percentage of demand (employable) fulfillment by categories	• Establishing forecasting model • Percentage of shortfalls in supply to demand ratio in each category	• Regular assessment and devising mechanism to fill the shortfalls in supply
	• Industry organization (improving HRM practice)	• Staff retention rate (%)	• Attrition rate o Creating enabling environment will reduce attrition	• Job satisfaction survey
		• Annual training expenditure to profit ratio (percentage)	• Promoting employee training	• Number of certified professionals • Training evaluation
• Competent firms in the industry	• MUDC, ECPMI and Industry Organizations	• Rate of companies' upgrading	• Revaluing the existing registration system • Percentage of upgrading in each grade	• Assessing performances of each grade category for benchmarking
		• Number of companies with quality assurance programs	• Adopting quality assessment system suitable to the context (e.g. PASS- HK) o Set project performance evaluation system	• Shift to detail performance evaluation (Productivity, health and safety etc.)
		• Number of companies involved in capacity development program/ % achieved in targeted capacity development program	• Setting integrated capacity development program	• Measuring performance of the companies participated in the program (shift to quality assurance program)
		• Percentage of project value awarded to local firms	• Project volume	• Project performance
		• Overseas work volume/ local work volume	• Ratio of overseas work volume/ local work volume	• Overseas work performance of the companies

Table 8.1 Proposed Key performance indicators (continued)

Targets	Responsibility	KPIs	Remarks	
			Short term (3-5 years)	Long term (>5years)
• Effective and efficient industry practice	• MUDC, ECPMI	• Type of relevant technology adopted/promoted o Level of prefab/ number of RMC suppliers/ number local manufactures certified	• Mechanism of transfer can be designed in the integrated capacity development program	• Effectiveness of the adopted technology
		• Level of relevant software package application in the industry, e.g., planning software, BIM etc.	• Selecting and promoting certain IT applications • Measuring level of the application	• Assessing effectiveness of the adopted IT applications
		• Number of services associated with IT o E.g. Registration system, design approval , Transparency (project information disclosure) etc.	• Establishing the system/ strengthening/ supporting the existing (e.g. the initiative of CoST)	• Effectiveness of the services and benefit to the industry
		• Annual R&D ex**p**enditure to profit ratio (percentage)	• Setting reasonable annual budget for R&D	• Effectiveness of the R&D
		• Participation level of associations (perception) o Representation of associations in CIC/ Workshops, seminars by associations on relevant CID targets	• Promoting participation of associations • Satisfactory/ unsatisfactory	• Measuring detail participation
		• Effectiveness of the regulatory tools in promoting and regulating the practices and the other factors (perception)	• Satisfactory/ unsatisfactory o Effectiveness of the regulatory tools in promoting and regulating technology transfer and IT application	• Measuring detail effectiveness of the regulatory tools
• Business Environment	• MUDC	• Demand Variability	• Percentage demand variability	• Effect of the demand variability on the performance of the industry
		• Demand sustainability	• Sector wised demand forecast; building, road, waterworks, etc.	• Associate the demand with the required resources

8.4.2 Implementation Strategy

As discussed earlier, performance indicators are measures that can be tied to a team or a cluster of teams working closely together for a common purpose. Hence, it needs developing common vision and identifying the clear responsibilities and ensuring the KPIs have the expected attributes. In addition, as CID is time taking the KPIs should not be aggressive; it has to be attainable in a reasonable timeframe. As indicated in improvement framework part improvements of the factors have different dimensions which need concerted effort of different concerned parties. Being central statutory institute, MoC (MUDC) has to coordinate the concerned parties and devise cascading mechanism to achieve the targets. Establishing industry performance measurement practice (practice of monitoring and tracking of improvement) needs contextualization of three activities: establishment phase, implementation /cascading and data collection mechanism.

Concerning establishment phase; the local context needs improving/revaluing certain things and establishing some new systems. As discussed earlier in chapter 5 and 7, improvement is needed in the regulatory system (capacity and the regulatory tools). In addition, as discussed earlier, KPIs need regular update to include modification and additional measures. This needs reasonable duration in achieving targets. From experience of different CID initiatives, 3-5 years is considered as short term and 5-10 as long term and targets have to be designed in the context of this duration.

As indicated in Table 8.1, most of the proposed KPIs need establishing a system. Hence, in short term (3-5 years) the objective has to be revaluing the existing systems, establishing required new systems and achieving short term targets. In the long term (beyond 5 years), the objective has to be setting benchmarks, refining and streamlining systems, achieving targets and amending the KPIs based on changing needs. For example, in manpower development counting number of accredited universities offering the relevant UG programs needs establishing a system to accredit construction related programs. As suggested earlier, the existing HERQA's establishment is a generic one and it is important to have a separate institute focusing on engineering and technology. Similarly, revaluing the existing registration system and promoting a system of certification is required. Enhancing competitiveness also

needs adopting quality assessment system (setting project performance evaluation system) and setting integrated capacity development program.

The implementation/ cascading mechanism includes two ways: the mandatory one through regulatory compliance and the others through promoting voluntary acceptance. Examples for voluntary are benchmarking clubs (self-improvement initiatives), e.g. Client charter of Ci3 (Kumaraswamy et al. 2017). The implementation can start by voluntary basis and shift to being mandatory as the practice gets mature. Voluntary acceptance needs awareness development about importance of performance measurement and benchmarking. Mapping performance indicators with company´s targets is important (Bassioni et al. 2005; Iveta 2012) as organization and industry success factors are related to one another (Johnston et al. 2002). However, CID's KPIs may not serve to measure internal performance of organizations. Hence, organizations also need to develop their own performance indicators for their internal performance assessment (DETR 2000; Mahmoud and Scott 2002; CAENZ 2006; Kumaraswamy et al. 2017). This is expected to help them maximize their competitive advantage.

Similarly, data collection can be done in two ways: (i) independent collection and verification and (ii) self-reporting data (PSIB 2005). Independent collection and verification is the situation when data is collected under statutory powers, or where there is an independent survey of client satisfaction or independent scrutiny of data supplied for different purpose e.g. for pre-qualification scheme. Self-reporting data, e.g., benchmarking clubs utilize self-reported information, sometimes without independent validation. Data collection has association with the cascading mechanisms: mandatory and voluntary. However, there are problems associated with data in CI like authenticity, reliability and accuracy (Windapo and Qongqo 2011). Hence, it is important to establish a central data collection, processing, storage and dissemination system to reduce the associated problems (Ofori 1988). Extensive consultation with stakeholders is required in order to secure commitment to meet targets of the industry development and its data collection and analysis procedures (PSIB 2005). Therefore, as discussed earlier, MoC (MUDC) has to create coordination mechanisms among the relevant government departments.

8.5 Summary of the Chapter

In this chapter, based on findings of the pervious chapters and specific targets of the determinant factors, improvement frameworks were developed. Based on the improvement frameworks and considering the relevance, 19 KPIs are proposed to measure improvement of the factors and the business environment. In addition, the nature and contextual scenario to establish and implement industry performance measurement practice were discussed.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

The study began by reviewing literature in the area of CID with the aim of identifying factors affecting the development. Further, literature review was conducted on characteristics of business environment affecting CID with the aim of understanding the relationship between the factors and the pertinent business environment. After identification of the factors, three were found as the recurring factors affecting CID in Ethiopia. Therefore, further research was focused on developing improvement frameworks for the recurring factors affecting Ethiopian CI so as to facilitate development of the industry. To achieve this, three research questions were posed and five specific objectives were set as shown in Section 1.2.

Mixed methods approach consisting of questionnaire survey, semi-structured interview and document analysis was adopted for the empirical data collection. Conclusions drawn from above data are summarized below.

9.1 Conclusions

The first two objectives focus on understanding the factors affecting CID and developing conceptual framework. The initial review on CID helped to identify determinant factors of the industry, and thorough literature review helped in understanding the factors: identifying variables affecting the factors and improvement suggestions and understanding the relationship among the factors and between the factors and the business environment. After understanding the factors, two frameworks were developed analytically: framework to improve the business environment for CID and conceptual framework of the study. In the conceptual framework of the study, hypotheses were set to further understand the relationship. Results of the hypotheses testing were covered in chapter 6. Major findings of the two objectives are:

The differences in different jurisdictions and/or perceptions of researchers in terms of the classification of the factors are mainly the contextual definition given to the factors. The identified factors are: manpower development, enhancing competitiveness, harmonized industry practice, sustainable investment in the industry, capturing alternative market and industry performance measurement practice. The recurring factors affecting CID in Ethiopia are: manpower development, enhancing competitiveness and harmonizing industry practice. Detailed assessment of improvement requirement level of the factors was conducted under different dimensions; manpower development was assessed under the role of government, academic institution and the industry organizations. Dimensions of enhancing competitiveness are: technical capacity, financial capacity and management practice of the industry organizations. Concerning harmonized industry practices, the practices assessed were technology development and IT application (where management practice considered under enhancing competitiveness) and the facilitating institutional systems are regulatory system and involvement of industry associations.

With the aim of identifying challenges of the industry and also understanding the relationship with the other research constructs the variables affecting the determinant factors were grouped to four categories based on their presumed sources. This ties the second and the third objectives. The identified major challenges from their respective sources are: CID policy implementation and corruption from role of government, weak capacity of contractors and consultants from resource related variables, lack of collaboration and professionalism from nature of the industry and lack of benchmarking CID practice from industry's vision for development.

The empirical findings reaffirmed the hypothesized relationships, the factors and characteristics of the business environment are mutually interdependent. Harmonized industry practice has significant correlation with environmental munificence and competitive intensity. Similarly, harmonized industry practice has high correlation with enhancing competitiveness and manpower development. These correlations indicate dimensions of harmonized industry practice: efficiency of the regulatory system and active involvement of associations are critical in creating conducive business environment by regulating and promoting the practices (technology

development and IT application) and the other factors (manpower development and enhancing competitiveness). In addition, it was revealed that, though competitive intensity is significantly correlated with all dimensions of the business environment, it is mainly affected by environmental complexity. It is also indicated that there is significant relationship among sources of variables: role of government, resource related variables and nature of the industry.

The fourth and fifth objectives were developing improvement frameworks and developing KPIs for monitoring and tracking improvement of the factors. Assessment of the improvement requirement level indicates that there is room for improvement in all aspects in all the factors. Considering the targets set, producing competent entry level professionals and maintaining competent manpower in the industry, enhancing competiveness of firms and developing effective and efficient industry practices, three frameworks were developed for the respective targets (implications indicated in 9.3) and 19 KPIs are proposed to measure improvement of the factors, and the business environment. Benchmarking the performance is important for sustainable development of the industry. Performance measurement of the industry development needs establishing some systems and improving some of the practices (which is part of the improvement framework). It needs strengthening the existing institutions for effective coordination and aligning the applicable regulatory tools and emphasis should be given to implementation of the policy and regulation already set in place. Hence, in short term the objective has to be establishing the system (and improving some) and achieving certain short term targets and in the long term it is important to assess the short term KPIs and amend as required towards meeting the long term targets.

9.2 Contribution to Theoretical Knowledge

Due to specificity, each country's CI needs a tailor-made solution to its problems; hence the recommendations are specific to the context of Ethiopian CI. In addition to its contextual contribution, this study adds value to the area of CID, specifically construction in developing countries, by being an additional case study.

Understanding the relationships among the factors affecting CID and between the factors and the business environment is important for formulation of solution oriented policies and appropriate interventions to help the industry to achieve its purpose in better way. In this regard, this study has established the nature of these relationships. For example, as indicated earlier, the dimensions of harmonized industry practice, the regulatory system and the associations in the industry, are critical in improving the business environment through regulating and promoting the practices, technology development and IT application and similarly, help to regulate and promote manpower development and enhancing competitiveness. This reaffirms the need for integrated plan for CID.

There is a dearth of industry level studies in the country; hence it may invite other researchers in the country to focus on CID. Studying the different industry level strategic thrusts helps to understand nature of the problems and their extent. This will help to frame organization and project level research agendas aligned with the strategic thrusts that can help to optimize research contributions and facilitate development of the industry.

9.3 Practical Implications

The study shows the practice in manpower development, enhancing competitiveness and the effectiveness of facilitating institutional systems in Ethiopian CI. Building adequate and competent manpower pool in the industry needs concerted effort of the concerned parties. Findings of this study and the proposed framework will give information for the concerned parties to improve the practice. Government as a major client, regulator and promoter of the industry, should integrate activities of the concerned parties for effective manpower development. Improving the relevant regulatory tools will help to achieve these, e.g. the registration system and prequalification for tendering can be integrated to promote continual professional development. The findings will also help academic institutes to review their curricula and improve their internship coordination mechanism. It gives information for industry organizations in indicating knowledge and skills gap of entry level professionals which could be filled through training.

Improving competiveness needs government support and also commitment of the firms. Support by government should not be fragmented and shortsighted and also it should not create much dependency. Industry organizations also have to improve their competitiveness by adopting best management practices which will help them to build and maintain reputability in the industry.

The proposed framework for improvement of the practices indicates the relationships among the practice areas and institutional systems which will help in prioritizing activities for improvement. It can be used as an input to the concerned stakeholder in their particular area of intervention.

Even though the study focuses on Ethiopian CI, considering the similarity of nature of CI problems in developing countries, the findings and recommendations can be extended to developing countries with similar CI problems with contextualization.

9.4 Limitations of the Study

The frameworks are suggested based on empirical investigation. However, KPIs based on the frameworks are derived analytically. Hence, it requires empirical validation.

As with any research in CI, getting responses to survey questionnaire from senior experienced professionals and getting time for interviews from company owners and higher officials was a major challenge. The adopted research approach, mixed methods, has helped in mitigating the effect of these challenges by triangulating the results and supporting the discussion. Detailed case studies on dimensions of each factor can consolidate the findings further; however, the problem of getting information (the perception towards research and the poor documentation) will remain a challenge. Hence it is important to support the cases with other sources of data.

9.5 Scope for Further Studies

In addition to the points indicated in the limitations, there are some aspects that need to be further investigated to facilitate development of the industry. This study has focused on competence of manpower; however adequacy of manpower at all levels in

the industry needs to be considered as it is going to be an area of concern in the future. This is associated with efficient mechanism for data collection and compiling manpower statistics which can be considered under general concept of industry practice benchmarking and demand modeling in terms of construction volume.

Effect of dynamism of governance structure of the industry is also potential area of concern, e.g. establishing strong statutory organization and effective system needs time; however, MoC was established in 2015 and remerged back with ministry of urban development and housing in 2018 even without proper establishment. This can be associated with the failure in implementing strategies set in the policy and regulations. Similarly, investigation can be done on assessing efficiency and challenges for capacity development initiatives taken so far and the way of adopting best practices of other developing countries.

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APPENDIX I: QUESTIONNAIRE ONE

Survey questionnaire on construction industry development in Ethiopia

This questionnaire is part of a Ph.D. research project that is underway to investigate the challenges in facilitating construction industry development (CID) in the case of Ethiopian Construction Industry (CI). We kindly request you to participate in this survey and share your experience and knowledge. The questionnaire has three sections with their respective objectives.

If you would like to get a summary of the findings and/ or want to continue your participation in the next phase of this research project, provide your contact address in the space provided below. The information provided by you will be treated confidentially and will be used for academic purpose only. For any suggestions and questions please do not hesitate to contact us at: m.g.desalegn@gmail.com

Thank you in advance for participating in this survey and providing us your valuable opinion.

1. **Part 1: General Information**
   - 1.1 Name of Organization in which you are currently working (optional) _____
   - 1.2 Type of organization
     - Client/Employer
     - Consultant
     - Contractor
     - Academic
     - Regulatory authority
     - Others (Please specify)_____
   - 1.3 Organization's area of establishment
     - Building
     - Road
     - Water works
     - General (all infrastructure)
     - Others (Please specify)_____
   - 1.4 Your experience in the industry (in years)
     - Less than 3
     - 3-5
     - 6-10
     - 11-15
     - 16-20
     - 21-25
     - Greater than 25
   - 1.5 Address (optional)
     (Put your address if you would like to get report of this survey and/ or want to continue your participation in the next phase of this research.)
     - Name
     - Email
     - Phone
2. **Part 2: Variables affecting CID and Characteristics of the Business Environment**

This part has three subsections with different objectives. The first objective, section 2.1, is to identify the level of impact of variables affecting CID in Ethiopian CI. The other objective, section 2.2, is to assess the level of impact of the determinant factors on CID. The third objective, section 2.3, is to assess the characteristics of business environment pertaining CID.

2.1 Variables affecting CID

No	From your experience in the industry, rate ***the level of impact*** of variables emanating from different sources as defined below on the current progress of construction industry development. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low --Very High				
		1	**2**	**3**	**4**	**5**
I	**Variables emanating from role of government**					
	Delay in formulation and appropriate implementation of construction industry development policy					
	Adequacy of Ministry of Construction as regulatory body					
	Effective coordination between the concerned government departments					
	Capacity of regulatory bodies, i.e. relevant government departments					
	Taxation system applicable to construction industry					
	Efficiency of registration system (firms and professionals)					
	Efficiency of the applicable regulations, codes and standards					
	Suitability of contract forms and contracting practice					
	Suitability of the applicable Procurement system to improve construction industry development					
	Conflicting statutory requirement					
	Corruption and lack of transparency					
	Economic cooperation i.e. dependency on foreign aid					
	Economic Condition					
	Government promoting labor-intensive methods to create employment					
	Government policy in supporting capacity building of organizations					
II	**Resource related variables**					
	Limited Management skills					
	Limited technical knowledge					
	Less access to working capital/ financial resource					
	Availability of manpower : Skilled					
	Availability of manpower : craft and operative					
	Appropriateness of training and education					
	Availability of materials					
	Availability of equipment					
	Adequacy of owner's/client's establishment to manage contracts and supervise construction					
	Weak capacity of contractors					
	Weak Capacity of consultants					
	Rising of wage level					
	Availability of information					
	Availability of physical infrastructure e.g. Power and telecommunication					
	Less application of information technology in the industry					
III	**Variables emanating from nature of the industry**					
	Poor Image of the industry					
	Fragmentation of the industry					
	Lack of collaborative culture in the industry i.e. poor relationship among key stakeholders					
	Weak academics and industry linkage					
	Demand stability/ fluctuation of workload					
	Influence of culture, perception and attitude of stakeholders					
	Professionalism of stakeholders					
	Poor information management in the industry i.e. poor documentation and lack of organized data					
	Lack of shared values amongst stakeholders for construction industry development					
	Lack of industry-wide association of stakeholders					

	Inconsistence of practice in the industry, e.g. management practices					
	Competition from overseas contractors					
IV	**Variables emanating from vision of the industry for development**					
	Weak Research and Development practice					
	Lack of Long term thinking for construction industry development					
	Lack of performance measurement of the industry improvement					
	Less practice of Prefabrication and standardized production					

2.2 Determinant factors of CID

No	From your experience in the industry, rate **the level of impact** of the following factors as defined below on the current progress of construction industry development. [1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High	**Scale** Very Low ----Very High				
		1	**2**	**3**	**4**	**5**
	Manpower development					
	Quality of manpower					
	Availability of manpower					
	Enhancing competitiveness (capacity of local organizations i.e. consulting and contracting organization)					
	Technical capacity					
	Financial capacity					
	Management practice					
	Developing Harmonized Industry practice					
	Effectiveness of the applicable regulation in harmonizing industry practice					
	Participation of the industry (trade and professional associations) to improve the practice					
	Effectiveness and efficiency of the regulatory institutes in improving the practice					
	Application of IT for improvement of the practice					
	Progress of Technological advancement					

2.3 Dimensions of business environment

No	From your experience in the industry, rate characteristics of the business environment pertaining to CID as defined below *[1] = Very Low, [2] =Low, [3] =Moderate, [4] =High, [5] = Very High*	**Scale** Very Low ----Very High				
		1	**2**	**3**	**4**	**5**
	Environmental Munificence (The degree to which an environment offers myriad resources and opportunity to organizations. i.e. the degree to which an environment supports the growth of organizations within it)					
	The current demand is strong					
	There is a potential for high demand growth in the industry					
	There is an abundance of resource (i.e. financial, supplies, human resource, etc.) in the industry to companies to support growth potential					
	There is no shortage of necessary resources in the market					
	Environmental Dynamism (Uncertainties in the business environment)					
	The marketing environment is rapidly changing					
	Rate of change in clients' need/requirement in the industry					
	Changes in standards and regulations					
	Demand fluctuation					
	Environmental Complexity (Difficulty of implementing a plan to achieve a number of quantifiable objectives)					
	Inconsistency of management practices					
	The complexity of knowledge required to meet customer needs					
	The degree of market segmentation in the industry					
	The complexity of effectively managing the supply chain					
	Environmental Competitive intensity (The degree to which an organization functions in markets that limit their potential growth opportunities due to number of competitors)					
	Competition in the local market is intense i.e. number and diversity of rivals					
	Selection is majorly on least cost bidder					
	Unreliable supply chain					

3. Part 3: Improvement requirement of the determinant factors

The objective of this part is to assess the required improvement level of the determinant factors to facilitate development of the industry.

3.1 Manpower development: Role of government

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improve manpower development. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low------Very High				
		1	**2**	**3**	**4**	**5**
	Promoting larger organizations to establish training center					
	National accreditation and recognition system of institutes/centers					
	Policy that enhances integrated and collaborative manpower development program					
	Setting up funding mechanism (from both government and the industry) for manpower development					
	Measuring competence of professionals for licensing					
	Promoting continual professional development					
	Forecasting and monitoring of manpower demand i.e. long-term plan of manpower requirement of the industry					
	Considering training provision for employee as prequalification criteria for consulting and contracting organizations					
	Industry-wide code of conduct					

3.2 Manpower development: Role of Academic institute

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improve manpower development. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low-----Very High				
		1	**2**	**3**	**4**	**5**
	Involvement of academic institute for CID through research and development					
	Relevant and practice based education					
	Academic institutes and industry forum for quality of manpower development					
	Internship program coordination					
	Capacity of the institutes i.e. workshop, laboratory and staff					
	Apart from regular programs provide short term training to fill skill gap in the industry					

3.3 Manpower development: Human Resource Management Practice

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improve manpower development through improving HRM practice. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High				
		1	**2**	**3**	**4**	**5**
	Recruitment and selection of employees e.g. reasonable skill and experience based selection					
	Clear career development plan for all levels of employees					
	Training and development					
	Performance appraisal system					
	Create enabling working environment					
	Improve relationship with employee/trade union					
	Improving welfare and safety of personnel					
	Improving leadership style					
	Devising performance based pay system					

3.4 Enhancing competitiveness: Financial Capacity

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improving financial capacity of organizations. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High **1**	**2**	**3**	**4**	**5**
	Ease of arranging bond, guarantee and insurance requirements					
	Availability of credit for the industry					
	Availability of lease and rent options					
	Availability of suitable insurance facilities e.g. CAR and other forms of insurance required in contracting					
	Improving advance arrangement					
	Improving payment arrangement e.g. considering material on site in interim payments					
	Improving prequalification requirement to enhance capacity building					
	Improving payment process to avoid delay					
	Price adjustment mechanism					
	Retention amount and mode of payment					

3.5 Enhancing competitiveness: Technical capacity

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improving technical capacity of organizations. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High **1**	**2**	**3**	**4**	**5**
	Creation of work environment that encourages creativity and innovation					
	Efficiency of companies in integrating new technology into business system and process					
	Capacity in construction Equipment and Plant					
	Efficient utilization of Equipment and Plant					
	Maintenance practice of Equipment and Plant					
	Adequacy of Technical Staff					
	Experience/knowledge of technical skill					
	Research and Development practice by companies in technological activities					
	Standardization of activities and process to increase efficiency and productivity					

3.6 Enhancing competitiveness: Management practice

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to improving management practice in the industry. *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High **1**	**2**	**3**	**4**	**5**
	Project management commitment by top management i.e. company level project management policies and procedures					
	Adequacy of project management team building practice					
	Maturity of site management and supervision practice					
	Practice of project planning, scheduling and performance tracking					
	Adoption of decision support system i.e. voiding intuition and personal judgment for decision making					
	Project performance evaluation practice i.e. utilization of past project lessons learned					
	Due diligence in pre-tender planning phase					
	Improving Risk management practices					
	Accepted industry model for Risk analysis					
	Improve communication management practice					
	Adequacy of contract documents					
	Improving contract management practice					
	Provision of adequate time for tendering					
	Health and safety management practice					
	Adoption and application of quality management system					
	Practice of constructability review to resolve major project problems					

	Documentation and information management					
	Cost management practice					
	Dispute resolution practices					
	Improving financial management practice					
	Quality management practice					
	Efficiency of Resource management					
	Logistic and supply chain management					
	Strategic management					
	Improving organization culture					
	Promoting ISO/ similar certification					
	Strengthening supportive departments					
	Empowerment of professional employees					

3.7 Harmonized industry practice: Technology development

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to facilitate ***technology development to harmonize industry practice.***	**Scale** Very Low----------Very High				
	[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High	**1**	**2**	**3**	**4**	**5**
	Prefabrication and industrialized building					
	Promoting materials development through Research and development					
	Facilitating adoption of new technology e.g., improving take-up rate of research result & necessary changes in codes and standards					
	Capacity building of material manufacturers					
	Promoting exhibitions/establishment of showrooms/ point of sales of equipment and machineries for international manufacturers					
	Technology transfer from international companies involving in megaprojects					
	Promoting technology development through appropriate policy					
	Availability of Material Testing and Laboratories Centers					
	Availability of RMC-Suppliers					

3.8 Harmonized industry practice: Wider application of IT

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to facilitate ***wider application of IT to harmonize industry practice.***	**Scale** Very Low---Very High				
	[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High	**1**	**2**	**3**	**4**	**5**
	Awareness development on importance of IT					
	Improve Information sharing and reporting practice among parties					
	Promoting use of relevant software packages					
	Improving professional's IT skills/ Training					
	Developing database at industry level for open access e.g. standard practices, codes and standards, and relevant information					
	Project information disclosure i.e. for transparency					
	IT based data collection system at industry level					
	Providing online registration and approval service					

3.9 Harmonized industry practice: Institution building

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to facilitate ***institution building to harmonize industry practice.***	**Scale** Very Low---Very High				
	[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High	**1**	**2**	**3**	**4**	**5**
	Improving involvement of professional associations					
	Improving involvement of Trade association (e.g. Contractors association and Supplier association)					
	Establishing industry-wide association to provide a common voice for the construction industry					
	Developing shared vision for construction industry development					

3.10 Harmonized industry practice: Better regulation

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to facilitate ***better regulation to harmonize and improve industry practice.*** *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High				
		1	**2**	**3**	**4**	**5**
	Strengthening capacity of regulatory authorities					
	Consistency of statutory requirement					
	Clear accountability and transparency					
	Registration (licensing) system of construction organizations (contractors and consultants)					
	Registration (licensing) system of workers (professionals and semiskilled workforce)					
	Lack of safety regulation					
	Ease of getting construction permit					
	Building permit i.e. delay in appropriate implementation of Building regulation					
	Right of way and compensation i.e. facilitating early clearing of right of way problems					
	Suitability of prequalification criteria in supporting construction development vision					
	Promoting alternative Procurement system i.e. integrated procurement system					
	Equitable distribution of risks in the applicable conditions of contract					
	Provision of effective means of dispute resolution in the applicable conditions of contract					
	Consistency of codes, standards, specification and guidelines to improve industry practice					
	Long term construction industry development policy					
	Suitability of legal framework on arbitration and dispute resolution					
	Lack of comprehensive industry-wide applicable law					
	Suitability of environmental regulation					

3.11 Improving psychosocial factors

No	From your experience in the industry, rate the ***required level of improvement*** of the following parameters to *improve impact of psychosocial factors on CID.* *[1] = Very Low, [2]=Low, [3]=Moderate, [4]=High, [5]= Very High*	**Scale** Very Low---Very High				
		1	**2**	**3**	**4**	**5**
	Attitude and Perception of stakeholders					
	Culture in the industry					
	Image of the industry					
	Socio economic pressure of other sectors					

3.12 Mechanism for enhancing construction organization competitiveness

No	Indicate the level of your agreement on the proposed mechanism to enhance competitiveness of construction organization *[1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree*	**Scale** Strongly Disagree----Strongly Agree				
		1	**2**	**3**	**4**	**5**
	Promoting best practice					
	Performance based preferential tendering					
	Facilitating supply of materials/ equipment by the client					
	Facilitating arrangement of financial requirement					
	Integrated work packaging					
	Promoting JV					
	Slicing project to fit capacity of local companies					

APPENDIX II: INTERVIEW GUIDE

I. Individual Professionals

1. Brief information about your organization profile (yourself)?
2. What are the general problems and challenges in the local construction industry? In terms of sources;
    - Role of government as; regulator, major client and promoter of the industry
    - Resource related challenges
    - Related to nature of the industry, e.g.
        - *How do you describe problems related to professionalism in the industry?*
        - *How do you describe consistency of practice in the industry and its impact?*
    - Variables emanating from vision of the industry for development
        - *The industry is changing all over the world both in technology and management practice. How do you describe Ethiopian CI and what is your suggestion for its sustainable development to cope up with the ever-changing situations?*
3. How do you describe, generally, characteristics of the business environment pertaining to the industry?
4. How do you describe status of the determinant factors and their improve mechanisms?

4.1 Manpower development, in terms;

- Role academic institute,
- Role of government
- HRM practice in the industry

4.2 Enhancing competitiveness, how do you describe competence of the stakeholders? In terms of;

- Financial capital
- Physical capital
- Management practice
    - At every phases of the project and at project and organization level!
- What has to be the role of the stakeholders in these respects?

4.3 Harmonizing industry practices?

- Technology Development
- Wider application of IT
- Institution Building
    - E.g. how do you explain the involvement of professionals and trade association in the industry?
- What has to be the role of the stakeholders in these respects?

5. Are there any unutilized opportunities in the industry? Your recommendations.

II. Ministry of Construction

The interview held with R5 was mainly focus on the role and overall duties of MoC.

1. What are the main responsibilities of the ministry? Organization structure of the ministry?
2. Is there enough coordination among the various bodies? Have there been any occasions of duplication of effort or insufficient definition of duties?
    - *Do you think the existing governance structure is adequate?*
3. What are the major problems facing the industry?
4. What plans does the ministry have to alleviate the problems?

5. Discussion on;

5.1 The current **construction industry Policy**

- *Do you think all the problems facing CI has identified thoroughly?*
- *What difficulties were met, or are being met, in implementing these policy decisions?*
- *What are the overall results of the implementation of the measures?*
- *What causes can you see as lying behind the failure of any of these measures?*

5.2 The current **registration system**

- *What are the criterions for qualification for registration professionals and organizations?*
    - *Have you ever received any complain on the qualification criterion?*
- *Do you have any means of ensuring that the contractor's claim to possess any equipment and employ certain people is really genuine or that the equipment, say a truck, is really used by his construction firm and no other subsidiaries?*

5.3 The current **SBD**

- *Have you had any complaints from contractors/consultant as the tendering practices affecting performance of the industry? E.g. unfair prequalification requirements….*
- *Do you have mechanism of identifying problems related to these?*
    - *How do you communicate those issues with "public procurement and property administration agency"?*
    - *Ideally who should be mandated to control the document? MoC or PPA?*
- *How do you explain the suitability of applicable GCC? In terms of….*
    - *equitable distribution of risks*
    - *providing effective means of dispute resolution mechanism*

5.4 Do you have the practice of performance measurement practice to ensure continual development of CI? If yes, how? If not, why? (I.e. is there long-term plan for CID?)

6. What are the problems facing the ministry? Capacity? System?

- *What is your future plan concerning these issues?*

APPENDIX III: QUESTIONNAIRE TWO

I. Student focus

Perception of Students on Education Quality in Imparting the Required Knowledge and Skills

Objectives of the Survey

- To assess perception of the students on quality of education in imparting knowledge and skills which are required for construction industry career success
- To identify problems and challenges in internship program

- Students participating in this survey should be those who are returned from internship.

1. General information

1. Name/ID (optional)_____
2. Name of your institute/university _____
3. Department (your major)
   a) Civil Engineering
   b) Construction Technology and Management
   c) Water Resource and Irrigation Engineering
   d) Other _____
4. Type of the company where you have been for internship
   a) Contractor
   b) Consultant
   c) Government organization
   d) Other (for this option give full information) _____
5. How did you join the company for internship?
   a) Assigned by the institute (university)
   b) I have searched by my own
6. What was the nature of the work you involved in during internship period?
   a) Project site
   b) Head office
   c) Both
7. How many weeks have you stayed in internship? _____

2. Perception of the students after internship towards their level of knowledge required for construction industry

Category of knowledge	From your internship experience and your industry perception. How do you rate the level of the following construction knowledge you have gained from the curriculum? Rate 1-5 scale under each category where; [1] =Very Poor, [2] = Poor, [3] =Average, [4] = Good and [5] =Excellent.	Very Poor --- Excellent				
		1	2	3	4	5
Construction materials and methods	Properties, compositions and characteristics of construction materials					
	construction techniques (construction methods)					
	Quality control					
Construction contract	Familiarity with construction contracts					
	Familiarity with applicable standards. E.g. standard bidding document (SBD); FPPA, FIDIC, NEC etc.					
Estimation	Ability to interpret contract document					
	Quantity takeoff					
	Components of bid document					
	Software package for estimation					
Scheduling	Identification of project activities and their relationship					
	Schedule development and updating					

	Software package for schedule development					
Safety	Safety regulations about construction related safety hazard					
	Site safety record keeping					
	Health and safety regulation and design application					
Sustainability	Basic knowledge about sustainability					
	Sustainability principles and design application					
	Sustainable construction materials and methods					
Analysis and Design	Design techniques, tools and principles					
	Familiarity with applicable codes and standards. E.g. building code standards, building regulation…					
	Software packages for design					
Feasibility Study	Project appraisal techniques (engineering economics)					
	Environmental Impact assessment tools and techniques					
Risk management	Risk management process (risk identification, quantification and risk response mechanism)					
	Risk management tools and techniques					

3. Perception of the students towards their level skills and competencies required for construction industry

Category	How do you rate the level of the following attributes/skills you have developed during the period of your study program? Rate 1-5 scale under each category where; [1] =Very Poor, [2] = Poor, [3] =Average, [4] = Good and [5] =Excellent.	Very Poor --- Excellent				
		1	2	3	4	5
Attributes/skills required	Trust					
	Ethics					
	Team working					
	Leadership capability					
	Negotiation skills					
	Management skills					
Generic competencies	Problem solving					
	Critical thinking					
	Adaptable to changing environment					
	Written communication					
	Oral communication					
	Decision making skill					

- Do you think that generally the curriculum adequately prepared you for the internship?
  a. Yes_____
  b. No _____

4. Student perception on benefit of internship program

Show the level of your agreement on benefit of internship program for your career. Rate 1-5 scale where; [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree	Strongly Disagree ---- Strongly Agree				
	1	2	3	4	5
Internship programs provide an opportunity to gain real knowledge of my profession					
My internship experience reinforced the knowledge I acquired in the classroom.					
My participation in an internship program enhanced my knowledge of the profession					
My internship experience assisted me in determining career decisions as a graduate in the specializations of my profession. (i.e. it has helped me to choose my interest area)					
My internship provided a linking relationship with industry (i.e. widened my network)					
Internship experience will improve my chance of getting job after graduation					
During my internship, I feel I was able to contribute to my company's goals with knowledge acquired in my classes.					
My internship experience helped me perform better in my classes.					
This internship met my expectations and I felt that I gained professional experience					

5. Internship program coordination (University)

Rate the level of your agreement on the following statements. Rate 1-5 scale where; [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree	Strongly Disagree ---- Strongly Agree				
	1	2	3	4	5
The institute gives opportunity to students to join organizations where they can get relevant experience					
The assigned mentor visits the students regularly					
Mentors encourage students to identify real life problems for final year project/ thesis					
The institute receive feedback from students to improve internship program					
Evaluation of reports are done responsibly i.e. it reflects actual performance of the students					

6. Internship program coordination (industry)

Rate the level of your agreement on the following statements. Rate 1-5 scale where; [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree	Strongly Disagree ---- Strongly Agree				
	1	2	3	4	5
The organizations give orientation about the entire workplace, procedures and policies of the company					
The organizations assign supervisor for students					
During my internship, the employees at my hosting company answered my questions thoroughly					
The organization provided the opportunity to work in all relevant departments of the organization					
I am assigned to work independently					
Evaluations by supervisors from hosting company are conducted responsibly					
Organizations are not willing to take intern students (they consider intern students as a burden)					
Organizations understand as they are responsible to produce qualified manpower					
The site was appropriate for my study/career goals					
The site supervisor was well-prepared to cover specific areas of workload for you					
I would recommend this site supervisor for future internships					

7. What are the challenges you have faced during internship?

_____

_____

II. Supervisors focus

Perception of the Industry on Education Quality in Imparting the Required Knowledge and Skills

- **<u>Objective of the Survey</u>**
  - To assess perception of the industry on the current education quality in imparting knowledge and skill required in construction industry.

- This questionnaire is prepared for company supervisors (professionals who have experience in supervising internship students).
  - ✓ The respondents should consider students whose major is, Civil Engineering, Construction Technology and Management, Water Resource and Irrigation Engineering, Hydraulics Engineering and related discipline which are directly involving in construction industry.

1. General information

1. Name of the company /organization (optional)_____
2. Type of the company
   a) Contractor
   b) Consultant
   c) Government organization

d) Other (for this option give full information) _____

3. Do you think organizations are responsible for manpower development in the industry?
   a) Yes
   b) No
4. Do you regularly accept internship students?
   a) Yes
   b) No
5. Are there universities which have special relationship with your organization?
   a) Yes
   b) No
6. How do you accept internship placement?
   a) Through communication with the institute
   b) Through request of students
7. Do you file student profile including performance for future recruitment?
   a) yes
   b) No
8. Averagely how many weeks they are spending? _____
9. Does your organization have clear policy to build relationship with academia in terms of internship and research and development?
   a) Yes
   b) No

2. Perception of the industry towards the performance of internship students with respect to fundamental knowledge required for construction industry

Category of knowledge	From your experience how do you rate the performance of internship students with respect to the following knowledge required for construction industry? Rate 1-5 scale under each category where; [1] =Very Poor, [2] = Poor, [3] =Average, [4] = Good and [5] =Excellent.	Very Poor --- Excellent				
		1	2	3	4	5
Construction materials and methods	Properties, compositions and characteristics of construction materials					
	construction techniques (construction methods)					
	Quality control					
Construction contract	Familiarity with construction contracts					
	Familiarity with applicable standards. E.g. standard bidding document (SBD); FPPA, FIDIC, NEC etc.					
Estimation	Ability to interpret contract document					
	Quantity takeoff					
	Components of bid document					
	Software package for estimation					
Scheduling	Identification of project activities and their relationship					
	Schedule development and updating					
	Software package for schedule development					
Safety	Safety regulations about construction related safety hazard					
	Site safety record keeping					
	Health and safety regulation and design application					
Sustainability	Basic knowledge about sustainability					
	Sustainability principles and design application					
	Sustainable construction materials and methods					
Analysis and Design	Design techniques, tools and principles					
	Familiarity with applicable codes and standards. E.g. building code standards, building regulation…					
	Software packages for design					
Feasibility Study	Project appraisal techniques (engineering economics)					
	Environmental Impact assessment tools and techniques					
Risk management	Risk management process (risk identification, quantification and risk response mechanism)					
	Risk management tools and techniques					

3. Perception of the industry towards the performance of internship students with respect to skills required for construction industry

Category	From your experience how do you rate the performance of internship students with respect to the following skills required for construction industry? Rate 1-5 scale under each category where; [1] =Very Poor, [2] = Poor, [3] =Average, [4] = Good and [5] =Excellent.	Very Poor --- Excellent				
		1	2	3	4	5
Attributes/skills required	Trust					
	Ethics					
	Team working					
	Leadership capability					
	Negotiation skills					
	Management skills					
Generic competencies	Problem solving					
	Critical thinking					
	Adaptable to changing environment					
	Written communication					
	Oral communication					
	Decision making skill					

8. Do you think that generally the curriculum adequately prepared the student for the internship?
   c. Yes___
   d. No___

4. Industry perception on benefit of internship program

From your experience show the level of your agreement on benefit of internship program for your organization. Rate 1-5 scale where; [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree	Strongly Disagree ---- Strongly Agree				
	1	2	3	4	5
Internship programs enhance communications between industry and academia					
Hiring an individual upon graduation who was previously an intern within your company increases employee retention.					
Internship programs can be used as a recruitment device for students upon graduation.					
Internship students positively affect staff quality by providing fresh perspectives					
Internship program gives opportunity to construction organizations to involve in education quality					

5. Internship program coordination (industry)

From your experience show the level of your agreement on the following statements. Rate 1-5 scale where; [1] = Strongly Disagree, [2] = Disagree, [3] =Neutral [4] = Agree and [5] =Strongly Agree	Strongly Disagree ---- Strongly Agree				
	1	2	3	4	5
For new internship students' organization give orientation about the entire workplace, procedures and policies of the company					
The organization assign supervisor for students					
Students are provided with the opportunity to work in different relevant departments of the organization					
Students are assigned to work independently					
Internship students are simply coming for learning					
Organizations give feedback on the students' level of performance to the institute/university for future improvement					

III. Summary of analysis on Knowledge and skills level of students

The discussion is covered in Section 7.1.2 (role of Academic institutes in Manpower Development).

Knowledge and skills level: self-evaluation of students and evaluation by company supervisors

Knowledge and skills		Self-evaluation of students				Evaluation by supervisors			
Knowledge		Mean	Std	Rank	T-test	Mean	Std	Rank	T-test
Construction materials and methods	Properties, compositions and characteristics of construction materials	3.65	.907	2	0.000	3.42	.919	3	0.003
	construction techniques (construction methods)	3.55	.976	3	0.000	3.33	.996	5	0.025
	Quality control	3.44	1.176	5	0.000	3.31	.971	6	0.031
Construction contract	Familiarity with construction contracts	3.34	1.166	10	0.001	2.98	1.194	17	0.904
	Familiarity with applicable standards. E.g. standard bidding document (SBD); FPPA, FIDIC, NEC etc.	3.12	1.185	16	0.215	3.00	1.130	16	1.000
Estimation	Ability to interpret contract document	3.26	1.116	12	0.006	3.44	1.109	2	0.009
	Quantity takeoff	3.68	1.232	1	0.000	3.75	.978	1	0.000
	Components of bid document	3.37	1.117	8	0.000	3.13	1.214	9	0.479
	Software package for estimation	2.71	1.158	25	0.003	2.90	1.171	23	0.541
Scheduling	Identification of project activities and their relationship	3.36	1.110	9	0.000	3.38	.959	4	0.009
	Schedule development and updating	3.09	1.115	18	0.341	3.19	1.065	7	0.229
	Software package for schedule development	2.93	1.134	21	0.428	2.67	1.209	25	0.062
Safety	Safety regulations about construction related safety hazard	2.87	1.287	23	0.205	3.10	1.134	10	0.528
	Site safety record keeping	2.89	1.285	22	0.309	3.02	1.158	15	0.901
	Design application of safety regulations	2.84	1.214	24	0.107	2.94	1.119	20	0.700
Sustainability	Basic knowledge about sustainability	3.27	1.004	11	0.001	3.10	1.036	11	0.490
	Sustainability principles and design application	3.23	1.079	13	0.011	3.06	1.019	14	0.673
	Sustainable construction materials and methods	3.43	1.073	6	0.000	3.10	1.036	12	0.490
Analysis and Design	Design techniques, tools and principles	3.39	1.089	7	0.000	3.08	.871	13	0.511
	Familiarity with applicable codes and standards.	3.48	1.057	4	0.000	3.15	1.031	8	0.332
	Software packages for design	3.10	1.190	17	0.303	2.92	1.007	22	0.569
Feasibility Study	Project appraisal techniques (engineering economics)	3.17	1.143	14	0.064	2.98	1.021	18	0.888
	Environmental Impact assessment tools and techniques	2.97	1.165	20	0.726	2.94	1.040	21	0.679
Risk management	Risk management process (risk identification, quantification and risk response mechanism)	3.16	1.157	15	0.091	2.96	1.110	19	0.796
	Risk management tools and techniques	3.07	1.095	19	0.455	2.88	1.123	24	0.444

Knowledge and skills level: self-evaluation of students and evaluation by company supervisors

Knowledge and skills			Self-evaluation of students				Evaluation by supervisors			
Soft Skills			Mean	Std	Rank	T-test	Mean	Std	Rank	T-test
Attributes/ Generic competencies						0.000				0.000
	Ethics		4.07	.942	1	0.000	3.63	.914	1	0.000
	Team working		4.05	1.035	2	0.000	3.50	.945	3	0.001
	Leadership capability		3.79	1.022	8	0.000	3.15	1.031	12	0.332
	Negotiation skills		3.75	.937	10	0.000	3.38	.937	7	0.008
	Management skills		3.83	.971	6	0.000	3.4	.962	6	0.006
	Problem solving		3.74	.953	11	0.000	3.35	.956	8	0.014
	Critical thinking		3.80	.986	7	0.000	3.27	.844	11	0.031
	Adaptable to changing environment		3.58	1.021	12	0.000	3.50	.899	4	0.000
	Communication	written	3.79	1.063	9	0.000	3.35	.934	9	0.012
		Oral	4.01	.900	3	0.000	3.48	.899	5	0.001
	Decision making skill		3.91	.918	4	0.000	3.33	.907	10	0.014

APPENDIX IV: PROFILE OF INTERVIEWEES

No	Code	Profile
1	**R1**	Asst.Prof. (AAU), Ex. President of one of the professional associations and having more than 25 years academic and industry experience.
2	**R2**	Asst.Prof. (AAU), current President of one of the professional associations and having more than 25 years academic and industry experience.
3	**R3**	Asst.Prof. (AAU) and having more than 20 years academic and industry experience.
4	**R4**	Engineering Contract Lawyer and having more than 30 years industry experience.
5	**R5**	Main advisor to the minster, Ministry of Construction
6	**R6**	Contract Administration Directorate Director, Public Client
7	**R7**	Deputy General Manager of Private Construction Company
8	**R8**	Senior Architect, Private Consulting Company
9	**R9**	Resident Engineer, Private Consulting Company
10	**R10**	Resident Engineer, State Owned Consulting Company
11	**R11**	Project Coordinator, Private Construction Company
12	**R12**	Regional Site Engineer, International Consulting Company
13	**R13**	Resident Engineer, Consulting Company
14	**R14**	Head of Construction Bureau, Zonal (District) Office
15	**R15**	Construction Engineer, Private Construction Company
16	**R16**	Contract Administrator, Public Client
17	**R17**	Contract Engineering Head, Private Construction Company
18	**R18**	Head of Construction Project Office, Pubic University
19	**R19**	Project Coordinator, State Owned Consulting Company
20	**R20**	Worked in Different Organizations
21	**R21**	General Manager, State Owned Consulting Company

LIST OF PUBLICATIONS

International Journals

1. Mengistu D.G and Mahesh G. (2019). "Manpower Development Framework for Ethiopian Construction Industry." *International Journal of Construction Management,* https: //doi.org/10.1080/15623599.2019.1613208.

2. Mengistu D.G and Mahesh G. (2019). "Construction Education in Ethiopia: Knowledge and Skills Level Attained and Effectiveness of Internship Program." *Higher Education, Skills and Work-Based Learning, Vol. 9 No. 3, pp. 510-524,* https://doi.org/10.1108/HESWBL-06-2018-0062

3. Mengistu D.G and Mahesh G. (2019). "Dimensions for improvement of construction management practice in Ethiopian construction industry." *Journal of Engineering, Design and Technology,* https://doi.org/10.1108/JEDT-10-2018-0175

4. Mengistu D.G and Mahesh G. (2019) "Challenges in developing Ethiopian construction industry." *African Journal of Science, Technology, Innovation and Development* , https://doi.org/10.1080/20421338.2019.1654252

5. Mengistu D.G and Mahesh G. (2018). "Factors Affecting Construction Industry Development: Relationship with Characteristics of the Business Environment." *International Journal of Advances in Mechanical and Civil Engineering (IJAMCE), Vol. 5, No. 5, pp. 49-53.*

International Conferences

1. Mengistu D.G and Mahesh G. (2019). "Manpower Development in Construction Industry: The Case of Ethiopia." *International Conference on Construction, Real Estate, Infrastructure and Project Management, M. G. Korgaonker (Ed.), Construction Materials and Management (pp. 260–269).* NICMR, Pune.

National Workshop

1. Mengistu D.G and Mahesh G. (2017). "Factors Affecting Construction Industry Development." *National workshop, 1st Construction Profession Week, 'Building a City for Generations' by the City Government of Addis Ababa Construction Bureau*, August 28th -September 3rd 2017, Addis Ababa, Ethiopia.

BIO-DATA

Desalegn Girma Mengistu

Email: m.g.desalegn@gmail.com

+251-972-691-337/ +251-923-294-519

Hawassa, Ethiopia

Educational Background

Degree	Year	Field of study / Department	University/Institute
M.Tech.	2010	Construction Engineering and Management (Department of Civil Engineering)	Addis Ababa University (AAU-IITD Program)
B.Sc.	2007	Construction Technology and Management (Department of Construction Technology and Management)	Addis Ababa University

Employment Condition	Lecturer at Hawassa University, Institute of Technology, Department of Construction Technology and Management