Development of an Anti-Corruption Toolkit with Components from Lean Construction

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Finally, I want to thank all my family members, my father, mother, wife and brothers & sisters for their full support and their prayers.

I want to thank and dedicate this research to my wife Aya and our little daughter Sarah as I spent a long time away from them to complete this research.

I would not forget my people in Syria with the current situation of the country and the blood that is being shed everywhere. I am sure that one of the most important reasons for what is happening in Syria these days is the same as the subject of this research: Corruption.

Karlsruhe, January 2017 Ahmed Haj Stifi

Kurzfassung

Korruption ist ein gefährliches und grenzenloses Phänomen. Es ist weltweit ausnahmslos, in allen Ländern, Bereichen und Branchen, von der Ernährungs- bis zur Raumfahrtindustrie, vertreten. Sogar die Welt des Fußballs, die sich immenser Beliebtheit erfreut, blieb von Korruption nicht verschont, wie durch die in jüngster Zeit aufgetretenen großen Korruptionsfälle bei der FIFA (Fédération Internationale de Association Football - Weltfußballverband), bekannt wurde.

Die Bauindustrie ist leider die Industrie, wo Korruption am stärksten vertreten ist, während gleichzeitig hier die Bemühungen zur Korruptionsbekämpfung am schwächsten ausfallen. Auch die Forschung auf diesem Gebiet kann dem Ausmaß und der Gefahr dieses Problems nicht gerecht werden. Es scheint, als ob dieses Phänomen bewusst unter den Tisch gekehrt würde.

Diese Arbeit basiert auf der Überzeugung, dass ein Paradigmenwechsel im Umgang mit der Korruption in der Bauindustrie unumgänglich ist, und dass dieser Wandel von der Industrie selbst getragen werden muss. In der jüngeren Vergangenheit gab es einen einflussreichen Umbruch in der Bauindustrie: „Lean Construction“ wurde vor etwa einem Vierteljahrhundert eingeführt, wodurch neue Konzepte für das Baumanagement, basierend auf der Arbeit von Koskela mit seiner TFV Theorie und praktischen Werkzeugen, wie dem LPS (Last Planner System), das von Ballard entwickelt und angewandt wurde, verfügbar wurden. Im Rahmen des Lean Construction wird jedoch das Problem der Korruption ignoriert. Diese Lücke soll durch diese Forschungsarbeit geschlossen werden.

Intensive Forschung zu den Themen „Korruption im Bauwesen“ und „Lean Construction“ haben gezeigt, dass Korruption einen schädlichen Einfluss auf Lean hat und die erfolgreiche Implementierung von Lean Construction verhindert. Es müssen deshalb Maßnahmen eingesetzt werden, um diese Auswirkungen der Korruption auf Lean zu verhindern. Diese Forschungsarbeit zeigt auf, dass dies durch die Ergänzung des zentralen Prinzips der „Integrität“ möglich ist.

Darüber hinaus wird ermittelt, dass die Hauptursachen der Korruption (1) Transparenz-, (2) Verantwortungs - und (3) Integritätsmangel sind. Während Transparenz und Verantwortung Teil der Lean Construction Philosophie sind, wird Integrität nicht vollständig wahrgenommen. Diese Forschungsarbeit argumentiert, dass Integrität der Schlüssel ist, um Lean Contruction gegen Korruption zu wappnen. Es wird gezeigt, wie Ideen und Werkzeuge, vor allem das LPS, durch die Einführung dieses neuen Prinzips vor Korruption geschützt werden können. Dann können im Rahmen des Leans Werkzeuge und Richtlinien entwickelt werden, mit deren Hilfe die Korruption dezimiert werden kann.

Durch diese Forschungsarbeit wird Lean Construction um zwei korrelierende Aspekte erweitert. Erstens wird eine neue Art der Verschwendung, nämlich „Korruption“, eingeführt. Es hat sich gezeigt, dass Korruption eine signifikante Art der Verschwendung darstellt, die weitere Verschwendungsarten verursacht. Zweitens wird, zusätzlich zur Transparenz und Verantwortung, Integrität als ein neues und essentielles Prinzip eingeführt. Jedes dieser Prinzipien stellt eine „Stammzelle“ dar und gemeinsam bilden diese das „Lean Immunsystem“, das sowohl Lean vor Korruption schützt als auch eine zentrale Rolle in der Korruptionsbekämpfung einnimmt.

Um gegen Korruption wirken zu können, benötigt Lean die Durchführung eines Benchmarking-Prozesses und die Einführung von Best Practices, die für diesen Bereich bereits verfügbar sind. Sie müssen jedoch noch entsprechend der Philosophie des Leans und seinen erweiterten Prinzipien angepasst bzw. neu entwickelt werden. Auch ist es notwendig, die eigenen Werkzeuge von Lean Construction neu zu gestalten und zu erweitern, um die Verschwendung durch Korruption mit einzubeziehen und zu eliminieren. Diese Arbeit, die auf anwendungsbezogener Forschung basiert,

beschreibt neue Ideen und Werkzeuge, deren Einsatzmöglichkeiten im “Lean Anti-Corruption Toolkit” zusammengeführt werden.

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Abbreviations

ABMS	Anti-Bribery Management System Standard
ACE	Association of Consulting Engineers
ACET	Anti-Corruption Education and Training
ADB	Asian Development Bank
AEC	Architecture, Engineering and Construction
AFDB	African Development Bank Group
AMA	American Management Association
ASCE	American Society of Civil Engineers
BEEPS	Business Environment and Enterprise Performance Survey
BIMS	Business Integrity Management System
BPI	Bribe Payers Index
BS	British Standards
CAC	Committee on Anti-Corruption
CB	Capacity Building
CC	Critical Chain
CC	Control of Corruption Index
CIECI	Construction Industry Ethics & Compliance Initiative
CIOB	Charted Institute of Building
CMS	Compliance Management System
CoI	Conflict of Interest
CoST	Construction Sector Transparency Initiative
CPI	Corruption Perceptions Index
CPIA	Country Policy and Institutional Assessment
CPM	Critical Path Method
CRPD	Company Risk Profile Database
DD	Due Diligence
DIN	German Standard
EBRD	European Bank for Reconstruction and Development
EMS	Environmental Management System
ENR	Engineering New Record
EU	European Union
FCPA	Foreign Corrupt Practices Act
FIDIC	Fédération Internationale des Ingenieurs Conseils
FIMS	FIDIC Integrity Management System
G20	Group of Twenty
G7	Group of Seven
GB	Green-Box
GCB	Global Corruption Barometer
GCI	Global Competitiveness Index
GCR	Global Corruption Report
GDP	Gross Domestic Product
GIACC	Global Infrastructure Anti-Corruption Centre
GVA	Gross Value Added
HSE	Health and Safety Executives
IACAC	Inter-American Convention against Corruption
IADB	Inter-American Development Bank
ICC	International Chamber of Commerce

ICE	Institution of Civil Engineers
IDA	International Development Association
IFIs	International Financing Institutions
IGLC	International Group for Lean Construction
ILO	International Labour Organization
IMC	Integrity Management Committee
IMS	Integrity Management System
INT	Integrity Vice Presidency
IP	Integrity Pact
ISO	International Standard Organization
JIT	Just in Time
KIT	Karlsruhe Institute of Technology
LPS	Last Planner System
MDBs	Multilateral Development Banks
MIT	Massachusetts Institute of Technology
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
OEEC	Organisation for European Economic Cooperation
OLAF	European Anti-Fraud Office
P-CoC	Project Code of Conduct (P-CoC)
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMP	Project Management Professional
PPC	Percent Plan Complete
SBDs	Standard Bidding Documents
TFP	Total Factor Productivity
TI	Transparency International
TPS	Toyota's Production System
UN	United Nations
UNDP	United Nations Development Programme
UNGC	United Nation Global Compact
UNODC	UN Office on Drugs and Crime
VDC	Virtual Design and Construction
VDP	Voluntary Disclosure Program
VSM	Value Stream Mapping
WB	World Bank
WBS	Work Breakdown Structure
WEF	World Economic Forum
WGI	Worldwide Governance Indicator
WWP	Weekly Work Plan

Declaration

I hereby certify that this thesis has been composed by me and is based on my own work, unless stated otherwise. No other person's work has been used without due acknowledgement in this thesis. All references and verbatim extracts have been quoted, and all sources of information, including graphs and data sets, have been specifically acknowledged.

I also want to declare that this work is purely a research work and not directed against any country, association, company or individuals. The purpose of this research is to develop and add-value to the construction industry.

Abstract

Corruption is a dangerous phenomenon without boundaries. It can be found in all countries and domains of life without exceptions. It can be found in all industries from food to space. Even football, which is adored by millions around the world, was not safe from this phenomenon as was recently made public and major cases of corruption in FIFA (Fédération Internationale de Association Football) were uncovered.

Unfortunately, the construction industry is the most corrupt industry compared to other industries, and simultaneously, the efforts in this industry to fight corruption are the lowest. Furthermore, researches about corruption conducted in this industry do not suffice this important and dangerous topic. In other words, there is a tendency - intentionally or unintentionally - to overlook this phenomenon.

There is a necessity for a real revolution against corruption in construction and it should come from the inside and from people belonging to this sector. The recent past saw dramatic revolutions in the construction industry, among them the concept of "Lean Construction". Twenty-five years ago, it introduced a new concept of construction management based on the theoretical ideas introduced by Koskela with his Transformation-Flow-Value (TFV) theory, and the practical tool developed and applied by Ballard, the Last Planner System (LPS). However, the most important thing ignored or forgotten by Lean Construction is putting corruption in construction on its agenda. This will be the subject of this research, among others.

A more profound evaluation of the topic of corruption in construction on one hand and understanding Lean Construction on the other, confirmed that corruption has harmful effects on Lean and is a barrier to an effective implementation of Lean Construction. Therefore, Lean should protect itself from corruption which can be achieved by adopting an essential principle: "integrity".

The research determines the three major root causes of corruption (1) lack of transparency, (2) lack of accountability and (3) lack of integrity.

This work confirms the fact that transparency and accountability exist in the philosophy, idea, and tools of Lean, however, integrity is not being fully considered. This research argues that integrity provides the key for protecting Lean Construction against corruption.

The adoption of this new principle into Lean's philosophy will protect Lean from corruption, especially the Last Planner System (LPS). Then, within the scope of Lean Construction, it will be possible to develop tools and policies in order to reduce corruption in construction projects.

This research found two correlating issues for the extension of the Lean Construction principle. First, it adds "corruption as a new type of waste" to Lean. It was found, that corruption is a core waste which causes other wastes. Second, the research introduced integrity as a new and essential principle in Lean Construction in addition to the two existing principles, transparency and accountability. Each principle of forms a "stem cell"; those three combined provide Lean's "immune system" which will protect Lean from corruption and help it play a vital role in fighting it.

Combating corruption with Lean requires Lean Construction to carry out a benchmarking exercise and to adopt best practices already available in this field so that Lean can redesign some of them in line of its philosophy and principles. Moreover, Lean is requested to redesign its own tools and advance them to take corruption waste into consideration and work on eliminating it. This research based on action research presents some of these ideas and tools and summarized their applications in the so-called "Lean Anti-Corruption Toolkit".

Introduction

I will never forget the day I was admitted into the Faculty of Civil Engineering. We heard from our different professors (based on their different fields) about the big role the construction industry played in developing communities and their services. They made it clear that the construction sector was connected to all domains of life. Workers in this domain including us (engineers) have the responsibility of providing proper solutions to serve these different sectors. For example, there is no doubt in the role of construction sector in water, environment, infrastructure and power sectors.

All this has generated a nice feeling and has granted a sense of self-confidence of role engineers or any individual in this industry working to serve the community.

The surprise came from one of the respected professors who had stated in one of his lecture that "most of us, unfortunately, will become thieves after graduation." He explained about corruption, a practice which most engineers will adopt. He spoke frankly about the extent of corruption which is spread within our industry. He did not have to reach far in his speech, giving us the example of the City Hall building under construction just a few kilometres away from our university. In 1980, construction started on this building and was still ongoing until that day the professor was talked to us (in 1996). He reported that each project manager during the past 16 years collected a fortune in a corrupt way from this project which was considered large project in our (developing) country. The building comprised 18 floors in addition to the basement and a two-floor garage. Notable, the building was first inaugurated and put in service in 2008; i.e. 28 years after commencing construction.

At that time, I did not comprehend the words of my professor until I started the professional life and became a civil engineer in different engineering projects. In the professional life, I was able to see that my professor was right, by encountering corrupt actions both small and big.

For me, all this created a motivation to study this dangerous phenomenon in our industry and look for ways to help in isolating it. This simple introduction explains how the preliminary idea of the research inspired the author and how the first step started.

1.1 The Research Aim

The motive behind this research cannot be separated from its aim. The motive forms the starting point to achieve the aim of the research, which can be considered as a dynamic one since it progressed with the research to include two phases:

The primary aim of the research was to study the corruption phenomenon and work to reduce it in the construction industry. This aim led to Lean Construction and its philosophy, ideas, and tools that provided a platform for reducing corruption in the construction sector.

The study of both corruption in construction and Lean Construction with its current theories and tools led to the expansion of the research scope after weak points in Lean Construction were found. It turned out that these would provide fertile ground for corrupt actions, or it could limit the success of implementing Lean Construction itself.

Therefore, the research confirms that it is important to study corruption from the perspective of the Lean Construction so that “Lean” can protect itself from corruption and provide approaches to limit corruption in the construction industry.

These two phrases "Lean protects itself from corruption" and "Lean Construction as an approach to limit corruption" form the research aim as is illustrated in the following Figure 1-1.

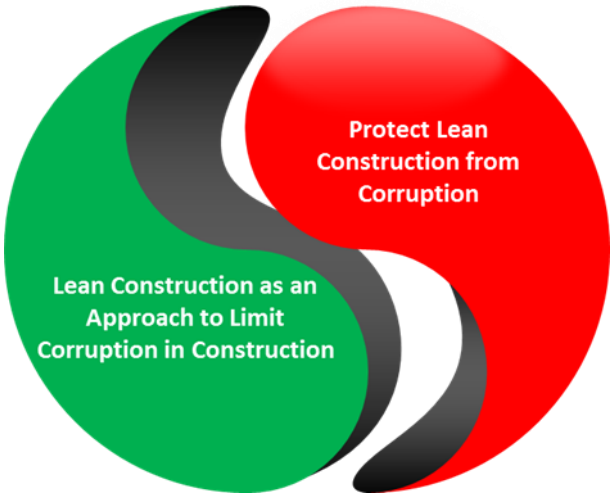


Figure 1-1: The Research Aim

1.2 Research Methodology

The multiplicity of aspects of corruption and their relation to various domains like politics, society and economy makes it a complex phenomenon, and therefore, many methods of research were used in order to study it.

According to Andrig (2000), there are three basic domains in which corruption was studied: (1) politics, (2) anthropology, and (3) economy. Therefore, each of these three domains used different methodologies for the research of the corruption phenomenon.

In general, if we return to the simple definition of the term “research” referred to by Kothari and Gang (2014) “Research is a search for knowledge" and reaching this knowledge, according to them, can be attained by a systematic method. However, Woody sees that “Research comprises defining and redefining problems." (Kathari and Gang, 2014). Based on this, Kothari and Gang' introduce an accurate definition for research as "the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions, either in the form of solutions toward the concerned problem or in certain generalizations for some theoretical formulation."

If we add the word "methodology" to "research", then research methodology is a way to systematically solve the research problem. As a whole, research methodology forms the steps that are generally adopted by a researcher in studying his research problem along with the logic behind it (Kothari and Gang, 2014).

As mentioned above, each domain or science has its own research methodologies that are developed constantly. This development is related to the development of theories and applications within the domain itself.

As this research belongs to construction management, and since one of its major objectives is to fill in the scientific gap resulting from the lack of researches in corruption in construction in general and corruption in Lean Construction in particular, research methodologies available in Lean Construction were used to complete the research.

Koskela (2014) summarizes the research methodologies in Lean construction as follows:

- Design Science / Constructive Research
- Action Research
- Case Studies
- Ethnographic Studies
- Simulation
- Conceptual Research
- Historical Research

However, Formoso (2014), in his lecture "Repositioning Research in the Field of Construction Management and Economics as Design Science Research" called for adopting the third mode of knowledge production, i.e. Design Science Research (DSR). The first mode is natural sciences and the second mode is social sciences and they both are known as traditional modes of knowledge production. Formoso's rationale behind this was that the traditional modes led to describe, explain, and possibly predict a certain phenomenon that exists in the world. He argues that the traditional modes lead to understand the problem which is only halfway to solve the problem while by following the third mode much knowledge is produced by practitioners (Formoso, 2014).

In his book "Real World Research", Robson (2002) called for a new approach of research methodology that goes with Formoso's proposal above. Robson called the researcher working within the real world a "Practitioner Researcher" and defined him as "someone who holds down a job in some particular area and is at the same time involved in carrying out systematic enquiry which is of relevance to the job". Robson sees the advantages of a practitioner-researcher role as following (Robson, 2002):

- Insider opportunities: which give a pre-existing knowledge and experience base about the situation and the people involved
- Practitioner opportunities: there is likely to be a substantial reduction of implementation problems

Robson (2002) argues that practitioner insights and roles help in the design, carrying out, and analysis of useful and appropriate studies. Jenny Lewis (2003) suggests Robson's practitioner-research approach as a way for investigating performance and change.

The basic research methodologies introduced by Robson (2002) in the "Real World Research" are:

1. Evaluation research
2. Action research

Evaluation research

He defines evaluation research based on the definition of the term evaluation; "a study which has a distinctive purpose. It is not a new or different research strategy" where "the purpose of an evaluation is to assess the effects and effectiveness of something, typically some innovation, policy, practice or service". According to Robson (2002), evaluation research is commonly referred to as "program-evaluation". However, the evaluation research is essentially indistinguishable from other research in terms of design, data collection, techniques, and methods of analysis and the main distinguishing factor lies with the purpose. Therefore, the evaluation research can be characterized into two forms based on the purpose as follows:

- Formative evaluation: is intended to help in the development of the program, innovation, or whatever is the focus of the evaluation.
- Summative evaluation: it covers the total impact of the program, not simply the extent to which stated goals are achieved, but all the consequences that can be detected.

Action research

When Robson (2002) moved to Action Research, he distinguished it from evaluation research by the purpose. He proposed action research to influence or change some aspects, or whatever is the focus of the research. According to Robson, action research adds the promotion of change to the traditional research purpose of description, understanding and explanation. He sees improvement and involvement the centre of action research. Furthermore, he argues that collaboration between researchers; those who are at the focus of the research, and their participation in the process are typically seen as central to action research.

In her book, "Researching Real-World Problems" O'Leary (2005) confirms the importance of researching real world problems. She sees that based on this approach researching real world problems opens possibilities for change at the level of professional development, practice, programs, policies and organizational culture (O'Leary, 2005).

O'Leary (2005) further argues that the contribution of most research approaches is limited to "knowledge" and there is a need to enter action research into the research process to make a contribution that can lead to real change, and for her, this is the potential of action research.

According to O'Leary (2005) action research covers a broad array of research strategies, all of which are dedicated to the integrated production of knowledge and the implementation of change. The characteristics of action research, according to her, are:

- Action research addresses practical problems
- Action research generates knowledge
- Action research enacts change
- Action research is participatory

Based on the fact that corruption is a problem in real world (compare to the science and academic world) and since this research belongs to Lean Construction field, the research's methodology is based on the intersection between: real world research and researching real-world problems on one hand and the methodologies suggested by Lean construction on the other as shown in Figure 1-2. Consequently, action research has been adopted as a research methodology:

Figure 1-2: Lean Construction and Real World Research Methodologies

Additionally, attention must be paid to the steps introduced by constructive research which were used as a roadmap for the research. Taking into consideration the similarity between constructive research and action research, Formoso (2014) sees that both involve intervention in an organization, and some sources of evidence are similar in both approaches, e.g. participants, observation, interviews, analysis of documents, etc. According to Fomoso (2014), the steps of constructive research include the following:

1. Find a practically relevant problem with research potential.
2. Obtain a general and comprehensive understanding of the topic.
3. Innovative/construct a solution idea.
4. Demonstrate that the solution works
5. Show the theoretical contribution of the solution concept
6. Examine the scope of applicability of the solution

Generally, action research can be included in constructive research; therefore this research has adopted the action research methodology in line with constructive research steps.

Research Methods

There are important differences in research methods and research methodology. On one hand, research methodology provides a way to systematically solve a research problem - in this research, it is the action research. On the other hand, research methods, according to Kathari and Gang (2014), may be understood as all these methods/techniques that are used for conducting a research. In other words, research methods refer to the methods which are used by researchers to perform research operations. Research methods are defined, in general, as data collection methods. Research methods differ according to the research methodology adopted in the research (Kathari and Gang, 2014). Robson (2002), O'Leary (2005), and Formoso (2014) see that it is possible to use traditional research methods of data collection in action research.

In fact, data collection methods are various and many and all have their pros and cons, and are related to the research methodology. In this research the following methods apply:

Interview

The idea of this method is based on conducting interviews with people through whom a researcher can generate important data and information on a research topic. There are several interviews types, ranging from formal to informal, from structured to unstructured, involving group or individual interviews (Robson, 2002; and O'Leary 2005). This research utilized all these forms of interviews.

Observation

According to O'Leary (2005), observation relies on the researcher's ability to gather data through their senses and it allows researchers to document actual behaviour rather than response related behaviour. The main advantage of observation is its directness (Robson, 2002). This way, the researcher does not need to ask people questions about their opinions or feelings about the topic. Instead, the researcher can directly observe their behaviour and attitude.

In this research, this method is considered one of the most important ones to collect data by observation in both previous projects and for the case study.

Observation, also, has different forms. Observation can range from non-participant to participant, candid to covert and from structured to unstructured (O'Leary, 2005). For this research participant

observation was conducted. Robson (2002) sees observation as an important method in "Real World Research", calling participants observers.

Questionnaires

There is always a connection between surveys and questionnaires. They are the most common methods used to obtain information.

O'Leary (2005) sees survey as a method to gather information from individuals using a questionnaire. Surveys can reach many respondents, offering them confidentiality and anonymity. However, the major advantage is generating standardized, quantifiable, empirical, and qualitative data (O'Leary, 2005). According to her, surveys can be descriptive or explanatory. Thy can involve entire populations or samples of populations to capture a moment or map trends.

This method was applied for the case study in order to discover the current planning and controlling practice in the project. Based on the results obtained, the area of the case study was determined.

Unobtrusive methods

Robson (2002) and O'Leary (2005) consider these useful methods in real-world research because of their ability to enrich the knowledge about a topic. O'Leary sees that unobtrusive methods include the explanation of official data and records, corporate data, personal records, the media, the arts and social artefacts (O'Leary, 2005).

In this research, media was extensively used, e.g. the feature offered by Transparency International in the form of a daily e-mail newsletter containing recent news on corruption mentioned in the world press. This newsletter provided constant information and thus knowledge expansion about the research topic and showed the importance of the topic itself.

Using documents

Robson (2002) describes this method as one where the researcher deals with information produced for some other purpose, i.e. the researcher studies documents derived from different sources, e.g. reports, magazines, newspapers, letters or e-mails, or even documentaries, pictures or drawings and uses their content for analysis that serves his research. This method was applied in this work to study the different situations linked to corruption practices.

Internet

It is imperative to mention the importance of the internet, especially in "Real World Research". This research involved extensive internet searches to visit big construction companies' webpages and international institutions to collect data about their programs to combat corruption. Moreover, searching the internet was a way to accessing to several literature resources for the literature review process.

Research Design

As mentioned above, the research methodology of choice was "action research", which was conducted in line with constructive research. .

Figure 1-3 below shows the research framework which consists of the following steps:

Step 1: intensive research and understanding the topic of corruption in general and corruption in the construction sector in particular. At the same time, following the same methodology to obtain a deep understanding about project management in its traditional form and to expand knowledge on Lean Construction.

During this step, literature review was conducted for the study of previous researches on topics related to this research.

This first step formed the basic theoretical foundation for this research and provided the knowledge required to form the hypothesis which resulted in many research questions. The research presupposed a contradictory relation between corruption and Lean Construction; their mutual existence influencing the effectiveness of the other; i.e. corruption forms a barrier in front of Lean Construction and, on the other hand, Lean Construction has potential to combat corruption. This hypothesis generated a basic question in the research about whether corruption could be considered a type of waste in Lean Construction or not.

Step 2: After building the necessary knowledge foundation to understand the research topics, Koskela's theory (Transformation-Flow-Value theory - TFV) and Ballard's tool (Last Planner System - LPS) were studied in order to detect their proneness to corruption.

This was achieved by studying and analysing documents and examples introduced by the Global Infrastructure Anti-Corruption Centre (GIACC), the Construction Sector Transparency Initiative (CoST), and Transparency International (TI) in addition to data recorded on earlier occasions from observations of previous work in engineering projects and during the case study.

Step 3: Solving the problem of corruption in construction with the problem solving approach introduced by Lean Construction. The four major steps of Lean Construction's problem solving approach were adopted for "solving the problem of corruption with Lean approach". Adopting this approach led to considering corruption as a type of waste in the Lean Construction.

Here, literature reviews and document analyses were performed and interviews with specialists in the field of Lean and in corruption in construction were conducted.

Step three was concluded with the idea about corruption in Lean Construction indicating that corruption is a type of waste in Lean, its main causes being lack of transparency, lack of accountability, and lack of integrity. Therefore (logically), an increase of these principles would lead to the reduction of corruption.

Step 4: In this step, the empirical study was carried out and the feasibility of the researcher's approach to adopt integrity as a major principle in Lean in general and in LPS in particular was proved in numbers.

Within the scope of the action research, a case study was designed to test the implementation of integrity concept into LPS. The execution of the case study was divided into four steps, as shown in Figure 1-3. The aim of the case study was to integrate the integrity into LPS and using the LPS as a main platform to enhance the integrity, in addition to transparency and accountability of last planners which will contribute to elimination of corruption waste.

Step 5: the final step generated the research outputs and the results obtained from benchmarking the best practices in the field of corruption. In conclusion, the research suggests polices, tools, and recommendations that collectively provide effective countermeasures to reduce corruption using the Lean Construction approach. This result was assembled in the "Lean Anti-Corruption Toolkit".

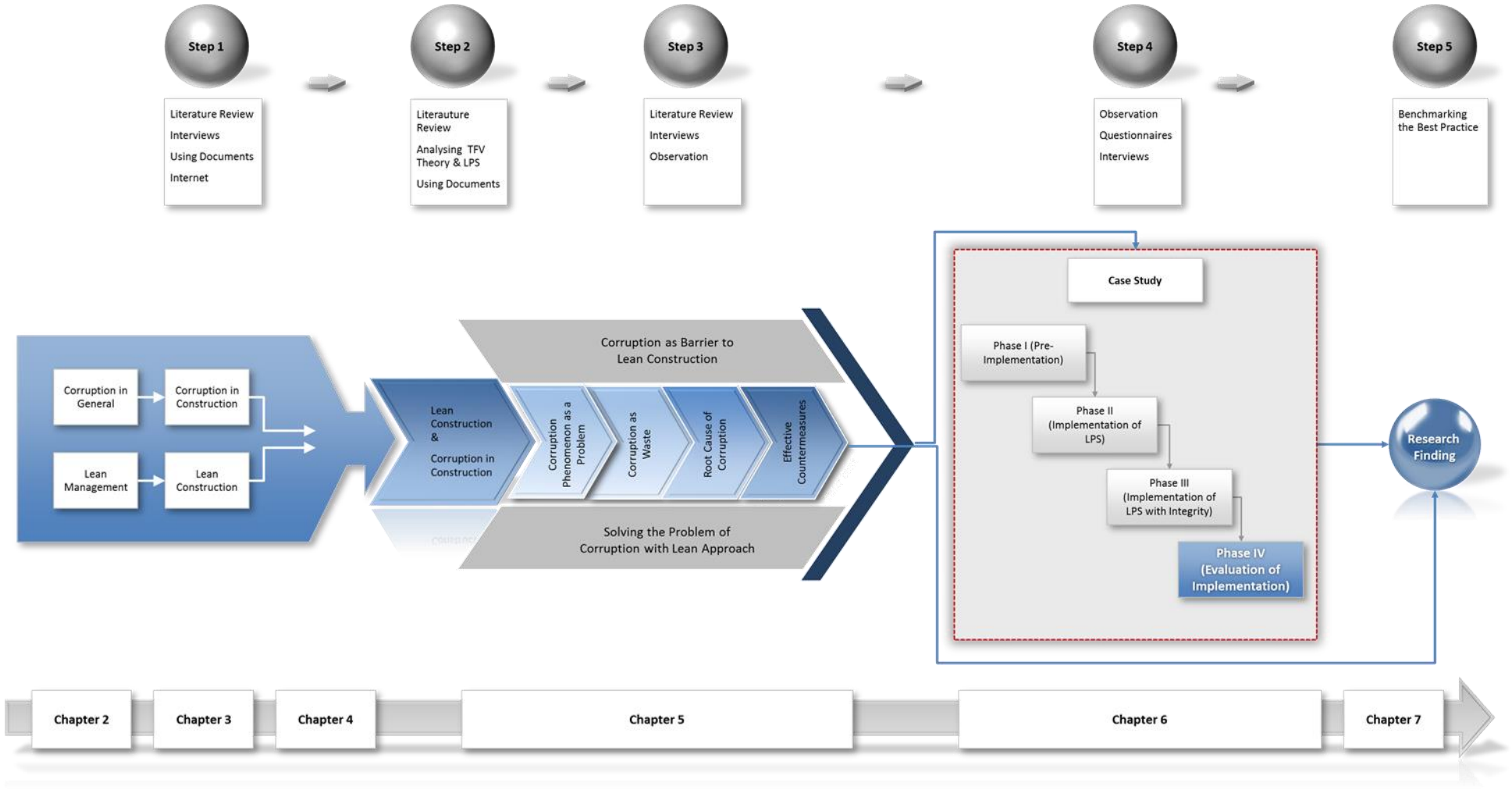


Figure 1-3: Research Framework

1.3 The Structure of the Dissertation

This dissertation consists of eight chapters based on the research methodology referred to in Figure 1-3 above.

Chapter 1: is the introduction to the research. It introduces an idea about the researcher's motives and the aim of the research. In addition, it explains the methodology adopted in this research and research methods used, including the hypothesis and the research question. It ends, with a brief introduction of the chapters that form the dissertation and its structure.

Chapter 2: focuses on studying the corruption phenomenon in general (without concentrating on the construction industry for the time being). In this chapter, important and required knowledge is built about the corruption phenomenon and the related different definition types and forms of corruption. Then, the factors causing corruption and its different consequences in various domains, whether political, economic or social, were studied. To show the importance of this phenomenon and benefit from the experience of others, a study of the efforts exerted in the field of fighting corruption was conducted. It included the local efforts and activities of some governments in addition to efforts of international organizations which either directly specialized in fighting corruption or which adopted combating corruption within their programs.

The last section in this chapter discussed the topic of how to measure corruption. It introduced the most important international indicators that give an idea and help understand and comprehend corruption.

Chapter 3: solely focusses on corruption in the construction industry. After studying the general definitions, types, forms, causes, and consequences of corruption they were applied to construction industry.

To generate a deeper understanding for the reader, this chapter was structured as the previous one to allow for possible comparisons of general and specific similarities (e.g. the causes of corruption in general in chapter two and the causes of corruption in construction in chapter three).

Based on this approach, definitions, types and forms of corruption in construction were studied in addition to its causes and consequences, and areas of corruption in construction were defined. Furthermore, this chapter presents the construction industry's current approach followed to fight corruption.

As in chapter two, initiatives were detected to combat corruption in the construction industry.

Chapter 4: The research focuses on the two topics "Corruption in Construction" and "Lean Construction" and analyses corruption in construction from the Lean Construction's point of view. In this chapter, the focus is on Lean Construction's principles and ideas. And how Lean was introduced to the construction industry and what distinguishes it from classical project management.

At the end of this chapter, the collection of materials and knowledge about corruption in the construction and Lean Construction is complete. This knowledge provides the basis for the chapter five which will discuss Lean Construction and corruption in construction together in the context of the research hypothesis.

Chapter 5: In this chapter, the hypothesis about the contradictory relation between "Corruption in Construction" and "Lean Construction" is concretized. .

First, is proves that corruption is a barrier for the successful implementation of Lean Construction illustrated by the effects corruption has on both the TFV theory and LPS which are the basic pillars of Lean Construction. Then, after proving the negative effect of corruption on Lean Construction, the discussion moves to the concept of Lean where the second part of the research hypothesis is presented; i.e. how Lean Construction can protect itself and at the same time reduce corruption waste. To do that, Lean Construction is required to adopt an essential principle which was formerly ignored to an extent. The chapter introduces the principle of integrity in combination with the two Lean principles transparency and accountability. The chapter presents these three principles as "stem cells" of Lean as they represent Lean's "immune system" which will protect Lean from corruption and will help Lean to reduce it. The three stem cells should be transplanted into any idea, tools or working methods used within Lean Construction.

Chapter 6: In addition to the literature review, studying different published reports about corruption and the interviews conducted for validation purposes, this chapter is considered a part of action research in order to link the achieved theoretical results with the practice through the case study.

The chapter introduces the case study, transplantation of integrity into the LPS. In this way, the research enriched the LPS with the important principle in reducing corruption "integrity" which complements the transparency and accountability already existing in LPS.

Chapter 7: This chapter summarizes the research findings into a "Lean Anti-Corruption Toolkit". This Toolkit is the result of combining the benchmarking principle, the best practices available in the field of anti-corruption, and all the other results presented in the former chapters to provide an applicable format for Lean organizations and Lean projects which can be used to reduce corruption waste.

Chapter 8: presents the conclusion of this research, answering the questions presented and explains the contribution of this research at the level of knowledge and practice. Moreover, it provides recommendations for scholars and stakeholders working in the construction industry either interested in fighting corruption in construction or interested in Lean Construction and how to benefit from this research in their future researches and works.

2 The "Corruption" Phenomenon

2.1 The Several Meanings of Corruption

It is important to refer to the root of the word when we study "corruption" as a phenomenon. What does this word mean? Where is it derived from? *The Online Etymology Dictionary* provides many parts of speech for "corruption" like a *noun* "corruption", an *adjective* "corrupt" and a *verb* "to corrupt" and informs that the first known use of corruption, also stated in *Merriam Webster Dictionary*, was in the 14th century. However, the root of this word goes back to the Latin word "Corruptus" which is the past participle of the verb "Corrumpere" which means "to destroy, to spoil." The noun "corruption" comes from the intensive prefix "com, assimilated to cor- before –r-" which means "together or with "and "rumpere" which means "to break". Subsequently, "corruption" means breaking something shared like the example of *Vocabulary.com Dictionary* "break your good reputation with other."

In the 14th century the *verb* "corrupt" was used with the meaning of "contaminate" or "impair the purity of." In addition, the *adjective* "corrupt" was used in Old French with the meaning of "unhealthy and uncouth." The *noun* "corruption" was used for material things like dead bodies or spiritual things like souls and morals. At the end of the 14th C. and the beginning of the 15thC., it started to mean "prevent the meaning of" or "putrefy" and as a noun for example: "Corruption of public offices."

Nowadays, looking up this word in any dictionary would yield in similar meanings of this word which reflect the behaviour. For example, *Merriam Webster Dictionary* refers to "corruption" as "a dishonest or illegal behaviour especially by powerful people such as government officials or police officers." Another definition is "the act of corrupting someone or something" in addition to "something that has been changed from its original form."

Looking up the word "corruption" in *Oxford Dictionary* for Synonyms shows that synonyms for "corruptions" in English include "dishonesty, dishonest dealing, unscrupulousness, deceit, double dealing, fraud, misconduct, law breaking, crime, criminality, delinquency, wrong doing, and villainy" and other synonyms. While *Merriam Webster Dictionary* shows that the synonyms for the word include "breakdown, decay, decomposition, festering, putrefaction, putrescence, rot and spoilage."

2.1.1 Definition of Corruption

The first problem that arises when studying the phenomenon "corruption" is finding a suitable definition. Elliott (2008) sees that the challenges faced by corruption analysts begin with how to define it. The problem lies in the fact that different people look at it from different points of views which results in different definitions (Elliott, 2008).

Werner (1983) grouped definitions of corruption into three categories: public-office-centred definitions, market-centred definitions and public-interest-centred definitions:

Public-office-centred definition

Nye (1967) sees public-office-centred corruption as a "behaviour that deviates from the normal duties of public role because of private regarding (family, close private cliques), pecuniary or status gain; or violates rules against exercise of certain types of private–regarding influence". Therefore, the basic definition for corruption here is a behaviour that involves the deviation from normal legal and public duty norms (Werner, 1983).

Market-centred definition

Van Klaveren explains market-centred corruption as "A corrupt civil servant regards his office as a business, the income of which he will… seek to maximize. The office then becomes a "maximizing unit." The size of his income depends upon the market situation and his talents for finding the point of maximal gain on the public's demand curve." (Desta, 2004) According to Werner (1983), corruption as "maximizing unit" can be a special type of stock-in-trade, by which public officials maximize pecuniary gains based on the supply and demand existing in their official domains' market place.

Public-interest-centred definition

Friederick offers a public-interest-centred definition, "the pattern of corruption can be said to exist whenever a power holder who is charged with doing certain things, i.e., who is responsible functionary or an office holder, is by monetary or other rewards not legally provided for, induced to take actions which favour whoever provides the reward thereby does damage to the public and its interests." (Desta, 2004)

The first definition shows corruption as behaviour while the second definition shows the economical side of corruption, and the third definition shows the negative role of influential people on society. These three combined let specialized researchers, e.g. from social-, economic- and political disciplines, examine the field of corruption. All this makes corruption a complex, multidisciplinary, and multifaceted phenomenon (Andvig et al., 2000)

Here, it is important to mention that the three categories are interrelated with each other (Desta, 2004) and it is wise to know that the previous three definitions were introduced between 1957 and 1967.Van Klaveren's definition in 1957, Friederick's definition in 1966, and Nye's definition in 1967. However, in the early 1990s, the interest in corruption took another turn when corruption was considered a "world problem" (Collier, 2002; FIDIC, 2003)

Even researchers of religious science have their own studies and definitions of corruption. For example, there are many Bible verses about corruption, Bishop Dr. Cheen Ing confirms that the Holy Scripture condemns corruption, and there are more than 92 verses in the Holy Bible mentioning corruption. For example, a quote from "2 Peter 2:19" "They promise them freedom, but they themselves are slaves of corruption. For whatever overcomes a person to that he is enslaved".

Cheen Ing (2008) argues that corruption is obviously condemned in the Old and New Testaments. He presents corruption based on its semantic meaning, similar to what was discussed at the beginning of this section (the Latin origin of the word) as "break altogether". Therefore, corruption is defined as "breaks the love relationship between God and human beings and among human beings themselves, resulting in the destruction of harmony in the person himself or herself and in the society in which he or she lives".

Islam, like Judaism and Christianity, also has its concept about corruption. A quote from the Holy Quran states in "Hod Sura, verse 11:85" "O, my people! Give full measure and weight fairly, and defraud not men their things, and do not act corruptly in the land, making mischief". In addition, the messenger (PBUH) mentioned corruption and condemned it in his sayings such as "Allah's curse is upon the briber and the person who is bribed".

In the light of the above discussion, it is difficult to define corruption accurately. Therefore, Stansbury (2008) sees that there is no international definition for corruption. There is no legal international definition as well (TI, 2008). While Andvig et al. (2000) argues that choosing a corruption definition

is a convention by itself "Corruption is conventionally understood"; therefore he refers to "working definitions".

In the following, the most common working definitions will be detailed:

Corruption according to the World Bank (WB) is "the abuse of public office for private gain". This definition is very concise and does not directly point out the different forms of corruption and how it occurs (Bannon, 1999).

Corruption according to United Nations Development Programme (UNPD) is "the misuse of public power, office or authority for private benefit through bribery, extortion, influence peddling, nepotism, fraud, speed money or embezzlement" (UNPD, 2004).

While the WB definition is considered concise, the UNPD definition is more comprehensive. However, the weakness in both definitions is that they reduced corruption to the public sphere only (Disch, Vigeland and Sundet, 2009). The definition introduced by Transparency International (TI) overcomes this weakness by deleting the word "public" associated with word "power" which expands the meaning to include both public and private spheres. Corruption according to TI is defined as "the abuse of entrusted power for private gain." (TI, 2007)

The fact that the definition of TI completes the WB definition made it the most widely used. Most literature currently refer to these definitions when defining corruption because they are "short and clear" and they include conclusively all aspects of corruption in both the public and private sectors (Bannon, 1999).

Despite all this, we should not ignore the work of the Organization for Economic Cooperation and Development (OECD), which brought the issue of corruption to the centre of public attention in the early 1990s as mentioned before (FIDIC, 2003). However, OECD has its own way of interpreting corruption definition. It does not give a certain corruption definition like the WB and TI; instead OECD establishes the offences for a range of corrupt behaviours (OECD, 2008). Actually, these offenses and their definitions, which were included in the OECD convention, present many forms of corruption, which will be discussed later.

Indeed, the way how we define corruption depends on three factors; (1) the context in which corruption is located, (2) the perspectives of the definers, and (3) their purpose in defining it (Sohail and Cavill, 2006)

In general, the interrelation among the several meanings of corruption makes researchers focus on three dimensions, (1) the definition of corruption, (2) types of corruption and (3) forms of corruption. Previously, we discussed the definition of corruption. Later, we will tackle the types and forms of corruption.

During the literature review, it became obvious that the majority uses two terms "type-" and "form" of corruption in such a way that we can say that the corruption can be divided into different types and it can take various forms. An exception from this rule is the Centre for Strategic and International Studies (CSIS) when it used the term "type" to express "form." (Hameed, 2014)

2.1.2 Types of Corruption

Disch et al. (2009) carried out a literature review of 150 studies based on nearly 800 studies from books, journal articles publications, and reports from many institutions and academics. They found

that literature distinguishes between different types of corruption; they studied them under term "Typology".

Disch (2009) argues that the literature distinguishes between eight different types of corruption based on three key characteristics: context, scale, and motivation or cause. The different types of corruption are:

- Petty versus grand
- Bureaucratic versus political
- Administrative versus state capture
- Need versus greed

Indeed, the previous distinctions were more detailed while other references use only the two terms "petty" and "grand", where petty corruption includes administrative and bureaucratic; whereas grand corruption includes political and state capture (Disch, 2009).

In the way corruption types are discussed Elliot (2008) differs from Disch (2009). While corruption was classified by Disch based on characteristics mentioned above, Elliot used the term "stylization" instead of "typology" to classify them. Elliot's classification depends on the relationship between "actors". She introduces three styles of corruption as illustrated in Figure 2-1.

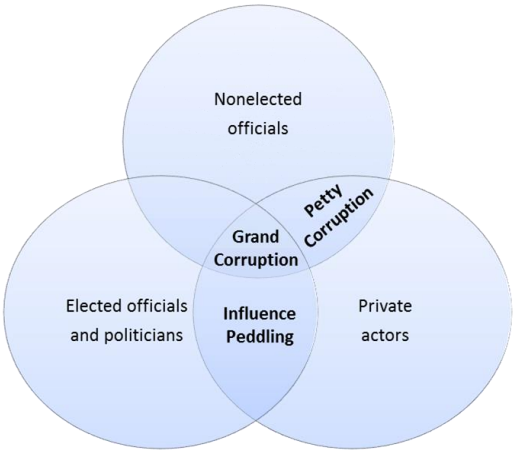


Figure 2-1: Types of Corruption, source (Elliot, 2008)

For Elliot, corruption is "petty" when there is interaction between the private actor and nonelected government officials. This style (type) includes administrative and bureaucrats corruption. This makes Elliot's style identical with the petty type introduced by Disch. This type of corruption is considered lower-level corruption and it is normally motivated by "need" where the transactions here involve e.g. taxes, regulations, and licensing requirements (Elliot, 2008; Disch, 2009).

"Grand" corruption occurs when all actors (private sector, the highest levels of government and political leaders; and the bureaucracy) interact.

The third style results from the interaction between private and elected actors and is called "influence peddling". It is the condition that links businessmen and politicians, and it is a kind of lobbying, for example "lobbing of government officials for private gain." (Ramachandran et al., 2007)

The last style, according to Elliot, is the result of interaction between nonelected and elected officials. Elliot did not specify a name for this kind of corruption; however, she presents some examples for this overlap such as "friendly" judges, e.g. bureaucrats or politicians may bribe a judge in order to avoid

prosecution or reduce a penalty. Another example is "bribe sharing", for example, a high-level bureaucrat involves another lower-level official through passing on a corrupt procedure (Elliot, 2008)

Understanding the different types of corruption is of great value in determining the requirements and challenges and in setting the correct policies to combat corruption. Petty corruption can occur daily and repeatedly; e.g. a traffic policeman in a poor country at a traffic light, motivated by low salary and lack of food for his family, whereas, grand corruption may occur less often but with greater impact. Therefore, understanding the scale, context and motivation is very important.

Before closing this section and moving from the types to the forms of corruption, it is worth mentioning another type of corruption that is rarely mentioned despite its direct relation to our research. It is called "electoral corruption" and is defined as "the abuse of electoral institution for personal or political gain". It has many synonyms like electoral malpractice or electoral misconduct, for example "vote-buying" (Birch, 2011)

2.1.3 Forms of Corruption

After identifying different types of corruption, this section will present the different forms of corruption. In Figure 2-2, the "basic understanding cycle of corruption" consisting of defining corruption, its types and forms. The OECD defines corruption according to its forms as opposed to the CSIS who uses types to express the forms.

Figure 2-2: Basic Understanding Circle of Corruption

According to Amundsen (1999) and Andvig et al. (2000) there are five main forms that may identify some basic verities of corruption, even when they are partly overlapping and at times interchangeable with others. The term "corruption practices" is used to refer to different corruption forms (Andvig et al., 2000; Collier, 2002; Elliot, 2008).

Bribery:

Bribery is to give or to take (payment in money or kind) based on illegal relation (in a corrupt relationship) (Andvig et al., 2000). Amundsen (1999) sees that the bribe should be understood as the essence of corruption. According to Amundsen (1999) and Andvig et al. (2000) the bribery may be a fixed amount of money, or a certain percentage of contract, or any form of favours (money or kind) paid to a state official to get a contract or a personal or commercial benefit. The fact, that two sides exist (giver and taker) gives bribery a "supply side" and a "demand side".

There are several equivalent bribery terms, e.g. gratuities, kickbacks, commercial arrangements, baksheesh and sweeteners, pay-offs, speed and grease money. These payments are made to make things run smoothly. However, to pay or receive bribery is corruption (Andvig et al., 2000).

United Nations (UN) Convention against Corruption, OECD Convention and the Council of Europe's (CoE) Criminal Law Convention on Corruption consider bribery as an offence that should be prohibited and punished. Under Article 2 of the CoE Convention and Article 15 of the UN Convention, one can notice three elements that characterize the supply side of bribery: "Offering", "Promising" and "Giving". Nevertheless, what is the difference in these three elements?

According to OCED (2008), offering occurs when a briber indicates that he/she is ready to provide a bribe, while promising occurs when he/she makes a deal with an official to provide a bribe, whereas giving occurs when he/she (briber) transfer the undue advantage (in money or kind).

Article 3 of the CoE Convention and the same article (Article 15) of the UN Convention deal with the demand side of bribery which is characterized by two elements: "Requesting or Soliciting" and "Receiving or Accepting". "Requesting or Soliciting" occurs when the official indicates to another person that he/she must pay bribe in order the official act or refrain from acting; while "Receiving or Accepting" occurs when the official actually take the bribe.

It is important to know that bribery and any of their five mentioned elements do not require an agreement between briber (supply side) and bribed (demand side).

Embezzlement:

Embezzlement is theft of resources by people who are put to administer it; it is when an employee steals from his/her employer (Andvig et al., 2000). According to UN Convention (Article 17), embezzlement is diversion of property by a public official; however (Article 22) deals with embezzlement of property in the private sector (OCED, 2008). Andvig et al. (2000) see the steal from public funds the most harmful and dangerous embezzlement due to the great negative impact on the country development as we will see later when we discuss the consequences of corruption.

While the researchers on corruption see embezzlement as a form of corruption, the legislative doesn't consider it corruption because it is, from legal point of view, a transaction between two individuals (supply- and demand side as mentioned above) and embezzlement doesn't actually need a second actor. However, in several corrupt countries, embezzlement is a clear form of corruption and even more significant than bribery due to great assets which are systematically extracted by abusing their political office and/or their family members' status (power abuse) (Andvig et al., 2000). In such a case, the UN Convention gives the state the right to get its assets back and the requested state must return assets to the requesting state (OCED, 2008).

Fraud:

Fraud is an economic crime that involves a kind of trickery, swindle or deceit. According to Andvig et al. (2000) Fraud involves manipulation or distortion of information, facts and expertise through public officials who are the link between the citizens and politicians (decision-makers), to achieve a private gain for themselves.

Economists like Fjeldstadand (1999) studied this form of corruption using Principal-Agent-Client framework. This (P-A-C) model provides that fraud occurs when the "Agent" (public official) who is

in charge of executing duties on behalf of his/her superiors "Principal" manipulates the flow of information to gain private benefit from other "Client" (citizens).

Andvig et al. (2000) argues that state fraud occurs when state agencies and their representatives get involved in illegal trade networks or close their eyes on economic crimes, and it is a serious fraud when the state becomes an active participant in it.

Andvig et al. (2000) confirmed that this form of corruption is broader known than the previous forms; "fraud is also a broader legal and popular term that covers more than bribery and embezzlement".

Extortion:

Extortion is to get money or other benefits by use coercion, violence or threats to use force. According to Andvig et al. (2000) extortion and blackmailing are corrupt transactions where money is violently extracted by those who have the power to do it. One classical form of extortion is known as "protection or security money". The well-known mafia style is a good example for this form where organized criminals use insecurity and intimation to extort money from individuals. The mafia style of extortion is usually known as extraction "from below", however, there is also extraction "from above", when the state itself is the biggest mafia, e.g. when state officials may extract "under-the-table" fees and gifts from individual citizens (Andvig et al., 2000).

Favouritism:

Favouritism is a mechanism of power abuse implying "privatization". Amundsen (1999) sees it as corruption as it means power abuse, based on corruption definition, however, Amundsen (1999) and Andvig et al. (2000) confirm that favouritism is a normal human proclivity; i.e. favouring friends, family, and anybody close and trusted. Its most popular form is when powerful public officials or politicians favour their own people (family, tribe, ethnic, religious, and regional group). Another form is called "Nepotism" in which the office holder with the right to make appointments prefers to nominate his proper kinfolk and family members for important positions. This form of Favouritism becomes dangerous when the favoured persons are not well qualified; i.e. giving the wrong person the wrong position.

Andvig et al. (2000) argues that Favouritism is a basic political mechanism in many authoritarian and semi-democratic countries where the president assigns members of his family to high positions in the state. These family members then occupy powerful positions in politics, economy, army, security, and other state corps.

Amundsen (1999) sees Favouritism as a problem of flawed qualifications, lacking skills, and inefficiency.

2.2 The Causes of Corruption

Corruption is a complex phenomenon with multifaceted causes and consequences. This section will discuss the causes of corruption; the following section will deal with the consequences.

Lambsorff (1999) reviewed a large variety of studies on the causes and consequences of corruption. He found that the research on the causes of corruption focused on the absence of competition, policy distortion, political systems, public salaries as well as an examination of colonialism, gender, and other cultural dimensions.

Andvig et al. (2000) found that the scholars studied the causes of corruption from political, anthropological, and economic perspectives.

- From a political perspective, the causes of corruption were believed to be "deficiencies in the political system and in particular in the "democratic deficit"". They argue that there is an opposing relationship between democracy and corruption. Whenever democracy decreases in a political system, corruption increases.
- From an anthropological perspective, the anthropologists argue that in every country corruption is viewed differently. In some countries, corruption is embedded in local cultures. Furthermore in many countries, like African countries, some social norms and behavioural logics exist that facilitate corruption, such as brokers and a system of middlemen, and gift-giving practices, known as "rules of the game".
- From an economic perspective, the scholars do not distinguish between economic and previous perspectives, especially the political one which highly influences the economic development and subsequently the public sector's salaries and openness to international trade. However, they argue that corruption might decrease with positive economic development. Treisman (2000) finds economic development to be an important determinant of corruption and he describes the causation between economic development and corruption as follows: "The causation runs from economic development to lower corruption as well as from corruption to slower development".

Literature summarizes the main causes of corruption in the following points:

- Widespread poverty and a low level of public sector salaries (Lambsdorff, 1999; Desta, 2004; Del Rosaio and Starr, 2011)
- Opportunities presented by complex and unclear or poorly defined rules and regulations (Desta, 2004)
- Ineffective legal frameworks, weak laws and principles, or code of conduct that regulate public officials' behaviours and a lack of institutions or organisations to support this purpose (Desta, 2004; Del Rosaio and Starr, 2011)
- Lack of sanctions against corrupt personnel (Cavill and Sohail, 2007)
- Lack of transparency and accountability (Cavill and Sohail, 2007; Del Rosaio and Starr, 2011)
- Lack of competition (Lambsdorff, 1999; Del Rosaio and Starr, 2011)
- Lack of morals and the fact that public tolerance of corruption may be common (Cavill and Sohail, 2007)

Kiltgaard (1988) went beyond the cause of corruption by investigating the ingredients of basic corruption components. He offers a simple model called "basic ingredient of corruption"

$$\text{Corruption} = \text{Monopoly} + \text{Discretion} - \text{Accountability}$$

$$C = M + D - A$$

This simple relation illustrates clearly that in case a person has monopoly over goods, service or power over clients and at the same time the discretion to choose who gets the product or service without being accountable to anyone to justify this decision, this leads to corruption.

Del Rosaio and Starr (2011) see the numerous causes of corruption specified before as factors contributing to Kiltgaard's equation.

2.3 The Consequences of Corruption

Due to the overlap of corruption causes and consequences, most researchers interested in corruption study both sides at the same time. Lambsdorff (1999) introduced a general correlation between causes and consequences of corruption; "whether corruption causes other variables or itself the consequence of certain characteristics is sometimes difficult to assess". .Andvig et al. (2000) argues almost just the same; that the cause and consequences of corruption are closely interrelated and it is hard to separate them, the simple question shows the interrelation: "Is a country poor because of corruption? Or is it corrupt because of poverty?"

During literatures review, it was noted that some researchers use the term "consequence" and others use term "effect" to refer to the same circumstance.

Literatures summarize the most important consequences or effects of corruption as follows:

- Corruption increases the risks associated with making investments (Lambsdorff, 1999)
- Corruption slows and reduces growth and has a negative impact on GDP (Lambsdorff, 1999; Desta, 2004; Bowen et al., 2012)
- Corruption lowers government expenditure and state fund in important service sectors like education and health and increases them in other sectors like military (Lambsdorff, 1999; Desta, 2004; Bowen et al., 2012)
- Corruption reduces the quality of public services (Bowen et al., 2012)
- Corruption distorts incentives, Tanzi (1998) sees that "in corrupt environment, able individuals allocate their energies to rent seeking and to corrupt practices and not to productive activities"
- Corruption hinders political development and contributes to political instability (Desta, 2004). A good example here is the "Arab spring" where many Arabic countries experienced, and some still do to this day, political turmoil and where corruption was a main underlying problem that drove citizens to the street. Hassan (2011) stated that "the wave of protests that spread through the Arab world this spring drew international attention to the problems of corruption and nepotism in the region".
- Corruption leads to violence and frequent regime change. (Desta, 2004)
- Corruption increases income inequality because it allows well-positioned individuals to take advantage of government activities at the cost of the rest of the population. (Desta, 2004)
- The burden of corruption falls heavily on the poor, as they cannot afford to pay the required bribe. (Desta, 2004)
- Corruption affects the poor since it increases the price of public services. (Desta, 2004)
- Corruption undermines the social safety net and may deter the poor from seeking basic entitlements and other public services. (Desta, 2004)
- Corruption creates an uneven playing field for businesses. (Del Rosaio and Starr, 2011)
- Corruption causes this misallocation of scarce resources thereby exacerbating poverty. (Del Rosaio and Starr, 2011)
- Corruption is the bottleneck for development and distorts the commercial and industrial enterprise development. (Sohail and Cavill, 2008)
- Corruption reduces competition, innovation, and growth of the unofficial economy (Sohail and Cavill, 2008)
- Corruption sparks civil unrest, lowers quality of public infrastructure, and decreases foreign direct investment. (Sohail and Cavill, 2008)

Due to the above catastrophic consequences of corruption some researchers describe corruption as a disease or cancer that consumes the economic, political, and social body. This idea is summarized in a brief speech from Transparency International (TI): "Corruption is one of the greatest challenges of the contemporary world. It undermines good governments, fundamentally distorts public policy, leads to the misallocation of resources, harms the private sector and its development and particularly hurts the poor."(Amundsen, 1999)

According to Amundsen (1999), another approach appeared clearly in some literature where some researchers and many practitioners provide a positive effect for corruption. They expressed that corruption may be a "good thing", and they justify this opinion by saying that corruption can smooth rigid bureaucracy and help get things done. He states "corruption may ease the squeaky wheel of state bureaucracy, unlock doors, and enable private entrepreneurship and promote businesses". In other words, and from an economical aspect, Svensson (2005) argues that corruption is not always bad, especially for business development in corrupt countries where government regulations raise barriers while they give public officials the power to demand and collect bribes. In this sense, some researchers describe corruption as a "second best" reaction to understaffed bureaucracy and inefficient regulators, i.e. according to Elliot (2008) "corruption may be a rational second-best response". This tendency can explain the playful adaption of the word "corruption" where in most cases; "bribes" are described as "speed money", "grease", or "improving the efficiency". The explanation of this theory is that the economic cost resulting from bureaucracy and extensive public regulations may be decreased or even avoided by bribery (Andvig et al., 2000).

Based on the data from three large company-level surveys, Kaufmann and Wei (2000) studied the relation between bribery payment, wasted management time, and cost incurred by the briber due to his using the existing bureaucratic system. They found, opposed to the above "grease theory", that there is no evidence that a business sector that pays bribes enjoys lower bureaucracy but ends up with more, not less, time wasted and increased cost of capital. However, Goldsmith (1999) sees that there are many experiments and parties that support both aspects of corruption, positive and negative. He argues that positive and negative effects of corruption are both "plausible" and it needs a systematic review of evidence to decide which gets the better side of the argument. Meanwhile, Elliot (2008) sees "the condition under which corruption has positive economic effects appears to be fragile". This opinion conforms to that of this research, that corruption, even with some temporary benefits, is a harmful phenomenon for sustainable business development.

2.4 Global Anti-Corruption Efforts

In the early 1990's, corruption received a great deal of attention worldwide when it became evident that corruption is extremely harmful to development. Moreover, due to the globalization of the world economy, its financial risks became much more obvious. In 1989, the OECD's first-world agenda to establish a competitive world by ensuring that corruption did not become a market barrier brought the issue of corruption to the centre of public attention (FIDIC, 2003)

However, before reviewing the OECD's activities and the subsequent international initiatives to combat corruption, it is important to mention the "US Foreign Corruption Practices Act (FCPA)" of 1977.

This law incriminates every person, company, or institution in the US who paid or promised to pay a bribe to a government official for whatever benefit. This law is applied not only for personnel and companies in the US, but also it worked outside the US, including American companies and their foreign affiliates and American citizens who engage in corrupt practice in the US (FCPA, 2012).

This research is going to review the significant international initiatives to combat corruption, not in their chronological but in the following order:

- National efforts
- International efforts
- Political efforts
- Industrial sector efforts

2.4.1 National efforts

The most important national acts against corruption are the U.S. Foreign Corrupt Practice Act (FCPA) and the UK Bribery Act. However, the German national law against corruption is included within the criminal code "Strafgesetzbuch".

U.S. Foreign Corrupt Practices Act (FCPA)

In 1977, the US Senate declared the following:

"Corporate bribery is bad business. In our free market system it is basic that the sale of products should take place on the basis of price, quality, and service. Corporate bribery is fundamentally destructive of this basic tenet. Corporate bribery of foreign officials takes place primarily to assist corporations in gaining business. Thus foreign corporate bribery affects the very stability of overseas business. Foreign corporate bribes also affect our domestic competitive climate when domestic firms engage in such practices as a substitute for healthy competition for foreign business." (FCPA, 2012)

Based on this, the US Congress enacted the FCPA law after the Securities and Exchange Commission (SEC) discovered that more than 400 US companies had paid millions of dollars as bribes to government officials overseas to get businesses there. The Congress saw in the FCPA law an important step in combating bribery, which damages the reputation of American economy and its situation in the market.

The FCPA consists of two provisions, anti-bribery provision and accounting provision.

The anti-bribery provision prohibits individuals and businesses or even companies registered in the US stock exchange from paying bribes to foreign government officials to obtain or retain business.

The accounting provision prohibits individuals and companies from knowingly falsifying records and off-the-books accounting and prompt the company management and investors to rely on a company's financial statements and internal accounting controls to ensure transparency in the financial health of the business, it was designed to strengthen the accuracy of the corporate books and records.

The FCPA (2012) is referring to an important element to combat bribery, namely, education. Therefore, a "Resource Guide to the US FCPA" was developed to provide individuals and businesses with information to help them to understand and implement this law, and to detect and prevent FCPA violation. Violations of the FCPA can lead to civil and criminal penalties, sanctions, and remedies, including fines, disgorgement and/ or imprisonment (FCPA, 2012).

The UK Bribery Act

The UK Bribery Act was enacted in 2010 to boost the British legislative's fight against bribery and to supplement it to include foreign bribery like the FCPA. The Act is described as "An Act to make provision about offences relating to bribery and for connected purpose" (UK Bribery Act, 2010)

According to the new law, companies have to prove through certain procedures that they are combating corruption. (UK Bribery Act, 2010)

Roberts et al. (2013) mentioned that the UK Bribery Act was described as one of the most draconian and far-reaching pieces of anti-corruption legislation in the world; this was because it included extra-territorial reach, provisions for corporate criminal liability, and high penalties.

German Criminal Code "Strafgesetzbuch"

The German law on combating corruption is called "Das Gesetz zur Bekämpfung der Korruption" *in English* "The Act against Corruption". The act is included in the German Criminal Code "Strafgesetzbuch - StGB" in the following paragraphs:

- § 108b Bribing voters
- § 108e Bribery and corruptibility of elected officials
- § 299 Bribery and corruptibility in commercial transactions
- § 300 Serious cases of bribery and corruptibility in commercial transactions
- § 332 Corruptibility
- § 334 Bribery
- § 335 Serious cases of bribery and corruptibility

2.4.2 International efforts

As mentioned above, the international effort to combat corruption started at the beginning of 1990s led by the Organization for Economic Cooperation and Development (OECD) and followed by different initiatives and efforts:

Organization for Economic Cooperation and Development (OECD)

The Organization for Economic Cooperation and Development was officially founded on 30 September 1961, when its convention took effect. However, the OECD was formerly known as the Organisation for European Economic Cooperation (OEEC), established in 1948 after World War II to run the Marshall Plan for reconstruction of war-ravaged Europe. The OECD was established to stimulate economic progress and world trade. It brings around its table 39 countries that account for 80% of world trade and investment, giving it a pivotal role in addressing the challenges facing the world economy (www.oecd.org).

In 1994, the "OECD Working Group on Bribery" issued a recommendation in which the industrial nations were obliged to reduce the supply side of bribery worldwide. This recommendation was an important incentive for other following initiatives. In addition, it was the cornerstone for the OECD Convention on Bribery in 1997.

34 members, who agreed on the provisions of this convention, signed this agreement. In 2012, five non-member states joined in as well (Argentina, Brazil, Bulgaria, Russia, and South African). But all those countries were members of the "OECD Working Group on Bribery".

The working group is responsible for monitoring the implementation of the convention. Each member did a periodic-peer review. The peer-review monitoring system was performed in three phases:

I. Phase 1: review includes an in-depth assessment of each country's domestic laws implementing the convention.
II. Phase 2: review examines the effectiveness of each country's laws and anti-bribery efforts.
III. Phase 3: permanent cycle of peer review that evaluates a country's enforcement actions and results, as well as the country's efforts to address weaknesses identified during the review in phase 2.

Transparency International (TI)

Transparency International (TI) is a non-governmental organization (NGO) established in Berlin, Germany in 1993. Peter Eigen, who worked in the administration of World Bank (WB), which is a main funder of major projects around the world, founded it.

Peter and his friends saw corruption as the main obstacle to project success; therefore, they established this non-governmental and non-profitable organization to act independently in facing corruption on a political, economic, and social level.

Today, TI is considered one of the leading organizations that focus on corruption around the world aiming at combating it and even further eradicating it from the world.

The organization has now 100 local chapters in 100 countries around the world. Each is responsible for discussing corruption in its country. Despite that, there is collaboration among them through the general secretary in TI's headquarter in Berlin which provides them with all forms of support and expertise, and combines all chapters together to unmask corruption on both local, regional and international levels.

The importance of TI started to increase significantly after 1995 after issuing a number of corruption's indicators, and later on, after publishing its annual reports about corruption around the world.

The indicators of TI are the following, and they will be discussed in detail in paragraph 2.5:

- Corruption Perceptions Index (CPI)
- Bribe Payers Index (BPI)
- Global Corruption Barometer (GCB)

The organization does not interfere with investigations of corruption cases (government, companies or individual corruption), rather it focuses on developing tools to measure corruption and combat it by working neutrally with civil communities, companies, and governments.

The neutral work between TI and organizations helps TI to publish its report "The Global Corruption Report". In this report, corruption is studied and discussed by experts from all over the world to analyse and scrutinize its causes and consequences in different sectors. The first report was published in 2001 in a preliminary edition to study corruption all over the world, specify the continuous challenges, and suggest possible solutions. Later, it moved on to study corruption in different sectors;

the last of which was a report in 2016 studying corruption in the sport sector, especially in FIFA. Table 2-1summarized up-to-date GCR reports

Year	Global Corruption Report (GCR)
2001	Inaugural Edition
2003	Access to Information
2004	Political
2005	Construction and post conflict construction
2006	Health
2007	Judicial system
2008	Water sector
2009	Private sector
2011	Climate change
2013	Education
2016	Sport

Table 2-1: TI Global Corruption Reports: Sectors and Year of Publication

In fact, Transparency International is the most successful organisation in always keeping corruption on the list of the world's agenda. It played and is still playing a very important role in motivating international organizations, like the UN, WB and OECD, to continually develop mechanisms to combat corruption around the world. In addition, TI is an important reference for many scholars on corruption through its indicators and reports; e.g. like for this research.

World Economic Forum (WEF)

The World Economic Forum (WEF) is an independent, non-profitable international organization, which committed to improving the state of the world by involving politicians, business and other leaders of society to shape global, regional and industry agendas for a better world.

The German economist Klaus Schwab in Switzerland established it in 1971. Unlike the OECD, the WEF is a community of communities based on the stakeholder concept (WEF, 2012).

The multi-stakeholder communities actively engage leaders from business (WEF members) and the non-business sector (constituents) around three community hubs as shown in Table 2-2.

Multi-stakeholder Communities (three community hubs)		
Government hub	**Business hub**	**Civil Society hub**
Governments International organizations Political leaders	Foundation Members (1,000 companies) Strategic Partners (100 leading global companies) Industrial partners The International Business Council The Community of Global Growth Companies	The Community of Global Faith Leaders The International Media Council The NGO and Labour Organization Community The Women Leaders Community and Gender Parity Programme

Table 2-2: The Multi-stakeholder Communities of WEF

WEF has many important initiatives in different fields like the Global Health Initiative, the Water Initiative and the Environmental Initiative. One of the most important initiatives related to this research is 'The Partnering Against Corruption Initiative' (PACI) which is an initiative launched in

2004 by member companies of WEF in partnership with TI and the Basel Institute on Governance. However, it should be noted that an earlier version of PACI was established in January 2004 for the Engineering and Construction sector. The official name of the 2004 version was "Partnering against Corruption Principles for Countering Bribery" (WEF, 2005). Approximately ten years later the PACI principles have been revised, updated and retitled as "Partnering Against Corruption Principles for Countering Corruption" expanding the focus beyond bribery (WEF, 2014).

The PACI is a forum for the exchange of expertise, attitudes and trends to combat corruption. PACI currently includes 100 international companies. The WEF (2014) states that "The PACI principles serve as a call to action for businesses around the world to join collective action initiatives, which increase public trust in business, deliver fair markets and level the playing field by fighting corruption.".

In fact, WEF through its PACI provides a framework for good business practices and risk management strategies for countering corruption (WEF, 2005).

United Nations Convention against Corruption

The UN did not turn a blind eye on the role of corruption in destroying democracy, violating human rights, and economical and social deteriorating communities. Therefore, early in 2000, it started posing this subject in the General Assembly meeting aiming at finding an effective international legal instrument against corruption. Then, an ad-hoc committee was formed to follow up this subject. Remarkably, this committee started its work in the "UN office on Drugs and Crime" headquarter in Vienna, obviously classifying corruption as "crime".

The ad-hoc committee developed the convention between January 2002 and October 2003. The General Assembly adopted the convention on October 31st and the United Nations Convention against Corruption came into force on December 14th, 2005.

This convention provides a complete set of standards, procedures and rules, which can be implemented by each country to promote its legal regulations and organizations to combat corruption. Furthermore, it calls upon all countries to take necessary preventive measures and to criminalize corruption in both private and public sectors (UN, 2004).

United Nation Global Compact (UNGC)

United Nation Global Compact (UNGC) is an UN initiative and it is the world's largest corporate sustainability initiative. The UNGC is a principle-based framework guiding companies to align strategies and operations with universal principles. It was launched in 2000. It had nine principles divided to three major areas, Human Rights, Labour and Environment. Table 2-3 introduces the nine principles of UNGC.

UNGC areas	Principles
Human Rights	Principle1: Businesses should support and respect the protection of internationally proclaimed human rights.
	Principle2: make sure that they are not complicit in human rights abuses
Labour	Principle3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining
	Principle4: the elimination of all forms of forced and compulsory labour
	Principle5: the effective abolition of child labour
	Principle6: the elimination of discrimination in respect of employment and occupation

Environment	Principle7: Businesses should support a precautionary approach to environmental challenges
	Principle8: undertake initiatives to promote greater environmental responsibility
	Principle9: encourage the development and diffusion of environmentally friendly technologies

Table 2-3: The 9 Principles of UNGC

Because of the world's concern about corruption and the development of the UN convention against corruption mentioned above, a tenth principle was added to the nine principles.

The Anti-Corruption Principle (Principle 10): "Businesses should work against corruption in all its forms, including extortion and bribery".

Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) is a non-profit international organization in the field of sustainability. It was established in 1997, its framework is a reporting system that provides metrics and methods for measuring and reporting sustainability-related impacts and performance. This report is widely used all over the world as a guideline to sustainable global economy. Its mission is "to enhance responsible decision making by promoting international harmonization in reporting relevant and credible corporate economic, environmental, and social performance information" (Sherman, 2009).

The GRI sustainability reporting framework currently consists of three main parts; (1) the guidelines, (2) the sector supplements, and (3) indicator protocols. The guidelines are the core element of the framework. The report itself is divided into three main categories: (1) economic, (2) environmental and (3) social. Each category is divided into sub-categories and studied from different aspects (GRI, 2002). Until now, four generations of GRI reports were issued G1 in 2000, G2 in 2002, G3 in 2006, and G4 in 2013, which is the current version of GRI.

GRI started to add "anti-corruption" as an aspect since G2 in 2002 and was listed under main category "social" and sub-category "society".

As a matter of fact, the inclusion of corruption in the GRI is another indication of the increasing importance of corruption and its role in sustainability. It is important to mention the collaboration among GRI, OECD and UNGC in this domain.

International Chamber of Commerce (ICC)

The International Chamber of Commerce (ICC) was established in Paris in 1919. It is concerned with serving the international business sector by suggesting business sector opinions to promote trade and open new markets for produces and investments. One of its main activities is international arbitration and settling disputes through its "ICC International Court of Arbitration".

The chamber is considered one of the pioneers who worked to combat corruption and commercial crime by its "First Report on Extortion and Bribery in International Business Transactions" published in 1977, which came as a reaction to international bribery scandals of the 1970s. The chamber was the first to recommend the UN to adopt an international convention to prohibit corruption. However, the UN failed in the 1980s to reach such agreement. At the beginning of 1990s, with the focus on corruption and its damages, the leading role of OECD, the pioneer in this field, lead the chamber to modify its previous report and published its modified one in 1999. (ICC, 2005)

Today, the chamber is working actively with OECD, UN and other international organizations to promote awareness and combat corruption in all its forms and types. Based on that, the ICC Commission on Anti-Corruption published in 1999 "Fighting Corruption, A Corporate Practices Manual" which provides detailed practical guidance for compliance with the ICC Rules of Conduct and the OECD Convention. In 2003, the guidance was revised and expanded.

With quick steps taken to combat corruption as well as ICC's work on corporate responsibility and corporate governance, the chamber decided to revisit and rethink the ICC Rules of Conduct and to refine its stance on a number of integrity matters. The available edition now is the 2005 edition entitled "Combating Extortion and Bribery: ICC Rules of Conduct and Recommendations" (ICC, 2005)

These rules of conduct are considered a method of self-regulation by business against the background of applicable national laws so that high integrity levels are promoted in all business transactions between enterprises and public bodies or between enterprises themselves.

The 2005 edition of the ICC Rules of Conduct and Recommendations to Combat Extortion and Bribery consists of three parts (ICC, 2005):

- Part I: contains substantive rules and implementation procedures for voluntary application by enterprises
- Part II: sets forth follow-up activities by the ICC Commission on Anti-Corruption for the promotion of the Rules of Conduct
- Part III: covers the work of the ICC Commission on Anti-Corruption with international organizations and national governments to strengthen the legal and administrative framework to combat bribery and extortion.

The Group of Twenty (G20)

The Group of Twenty (G20) is an international forum with currently twenty members of finance ministers and central bank governors. It was founded in 1999 as a result of a request by the finance ministers and central bank governors of the Group of Seven (G7) who announced their intention to "broaden the dialogue on key economic and financial policy issues among systemically significant economies and promote co-operation to achieve stable and sustainable world economic growth that benefits all" (G20, 2007).

The main reason for establishing this forum was facing the challenges of world financial instability, especially after the financial crisis of developing economies in Asia in 1997. The forum includes 19 countries (Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea and Turkey). The twentieth member is the European Union represented by the president of the European Council and the European central bank (G20, 2007).

In 2000, the meeting took place in Canada where the member states committed on a number of points (nine of them); the fifth point promised "strengthen their efforts to combat financial abuse including money laundering, tax evasion and corruption." (G20, 2007)

In 2010, the leaders of G20 established "The Anti-Corruption Working Group (ACWG)" during their meeting in Toronto; setting up a two-year plan called "The G20 Anti-Corruption Action Plan" to suggest necessary actions to combat corruption. The latest action plan is the "2015-2016 Anti-Corruption Action Plan" in which the G20 renews its commitment to taking necessary procedures

agreed on in the previous action plan in addition to its commitment to taking concrete practical action in 2015-16 on preventing corruption and promoting transparency and integrity (G20, 2014)

G20 and OECD Joined Forces against Corruption: The Annual G20 Business and Government Conference

In addition to the action plan the Group of Twenty develops every two years, together with OECD and supported by UNODC it established in 2011 a joint force against corruption with the "Annual High-Level Anti-Corruption Conference for G20 Governments and Business" to deal with a number of corruption related points. These topics vary from one conference to another; so finally, most points discussed on the G20 agenda and in the action plan were covered. The Fifth Annual conference was hosted in Istanbul, Turkey under the motto "Placing integrity at the heart of business culture" (www.oecd.org)

World Bank (WB)

The effort that the World Bank exerts against corruption is considered one of the strongest and the most successful worldwide. The World Bank, as a big financial institution is responsible for funding large-scale projects around the world especially in developing countries, realized in early stage the risk of corruption on the success of its projects, and its negative effects on the bank's goals.

As mentioned earlier under the corruption definition, the World Bank has its own definition of corruption "The abuse of public office for private gain". That fact, that the World Bank has its own definition - together with OECD and TI - is enough to show the important role of the World Bank against corruption.

Bannon (1999) introduced the strategy of the World Bank in combating corruption, he describes it as "multi-pronged strategy" and it is based on the following five pillars:

1. Preventing fraud and corruption within the World Bank
2. Preventing fraud and corruption within bank-financed projects
3. Adding voice and support to international efforts to reduce corruption
4. Taking corruption explicitly into account in country assistance strategies, country lending considerations, the policy dialogue, analytical work, and the choice and design of projects
5. Helping countries that request bank support in their efforts to reduce corruption

The World Bank's efforts to implement its strategy in combating corruption are varied and obvious in the following mechanisms:

Integrity Vice Presidency (INT)

The Integrity Vice Presidency (INT) is considered one of the main units of the WB General Management Units. The INT is in charge of investigating corruption cases in projects funded by the World Bank. In addition, it oversees interrogating bank officials in case of misconduct; furthermore, it has the main role in developing the bank policies and strategies to prevent corruption. INT also provides the necessary training for employees to improve their abilities in this field (www.wb.org)

Since 1999, the INT investigated more than 3,000 cases of corruption and published transparently its annual report including information available about these cases. To ensure its independency, the INT issued its reports directly to the World Bank's president. (www.wb.org).

Preventive Service Unit (PSU)

In 2011, the Preventive Service Unit (PSU) was established within the INT, as a result of the recommendation of the 2007 Independent Review Panel chaired by Paul Volcker for greater integration of INT with operations. The PSU acts as an advisor for the INT and its major tasks are (www.wb.org):

- Fraud and corruption risk assessment and mitigation advice to operational staff
- Training of WB staff, clients and stakeholders
- Research in area corruption using lesson learned approach and best practices.

Fraud and Corruption Awareness Handbook

The World Bank developed and published a Fraud and Corruption Awareness Handbook that is considered as an educative tool especially for WB's employees in order to prevent corruption in projects funded by WB. Leonard McCarthy, president of INT said that "the handbook offers INT's insights about fraud and corruption in Bank-financed projects; how it happens and how we can detect it before it negatively impacts projects" (WB, 2013)

The handbook shows clearly, how the Bank defines fraud and corruption and for what purpose. In this handbook, the World Bank defines three priority fields in its projects: (1) procurement, (2) contract management, and (3) financial management. The main reason for this classification is based on the fact that INT's investigation cases often find corruption in these three areas. The Bank explains this "due to the large amount of money involved".

The handbook (WB, 2013) uses "a red flag", a tool known from risk management, to indicate possible fraud or corruption in a project. It describes it as an indicator; "A red flag is an indicator of possible fraud or corruption." A simple example from the handbook can be found in bidding documents; i.e. a bid from supposedly different bidders faxed from the same telephone number. Here, a red flag can / should appear. Similarly, the handbook suggests different scenarios in order to train and educate the employees to detect and identify corruption practices especially in the three previously mentioned areas.

Company Risk Profile Database (CRPD)

The World Bank developed a database with names of companies investigated because of reasons related to corruption. In 2013, this database was used by bank staff members more than 7,275 times. (www.wb.org)

Compliance Guidelines and Handbooks

The World Bank published a number of compliance guidelines and handbooks called "World Bank Group Integrity Compliance Guidelines" that follow incorporate standards, principles and components commonly recognized by institutions and entities as good governance and anti-fraud and corruption practices. The guidelines can form the core of a firm's compliance program based on firm profile and its own circumstances. In addition to its own guidelines the bank works with other international institutions in developing guidelines and handbooks. One of these significant products is the "Anti-Corruption Ethics and Compliance Handbook for Business" which was completed in 2013 as a result of a joint effort between the World Bank, OECD and UNODC. Actually, the handbooks were the response to the request of G20 to promote combating corruption in private sector. The handbook is

considered a practical tool for companies intend to implement a compliance program (OECD, UNODC and WB, 2013).

Sanctions Committee

This committee represents the judicial arm of the World Bank. Its special task is to investigate corruption cases sent to it and to decide whether contractors, bidders, suppliers, and individuals are involved in any corrupt practice related to the bank's projects. Thereafter, the committee recommends sanctions suitable to the degree of occurred corruption. These recommendations are sent directly to the president of the World Bank. Of course, this committee has work mechanisms and processes that have to be completed before it reaches its decisions. The possible sanctions that can be imposed on any company, organisation or individual involved in corruption practice will be introduced hereunder (Thornburgh et al., 2002), (WB, 2010).

- Reprimand: the committee suggests sending a formal letter of reprimand to the respondent to blame the respondent for the misconduct. A reprimand may be imposed in addition to other sanctions. A reprimanded firm would be aware that any potential funder would probably watch its future performance more closely than the performance of a firm that had never been sanctioned.
- Debarment: the committee suggests debarring the respondent either temporarily or permanently from entering in any contracts in projects funded by the bank.
- Other sanctions: the committee has the right to suggest other sanctions it considers suitable according to the conditions and circumstances of a corruption case.

It is worth mentioning here that in order to preserve the independency of any investigating committee in a corruption case, the committee members are not chosen from the bank employees, the committee merely acts as an agent of the bank.

Cross Debarment Agreement

In April 2010, the World Bank signed an "Agreement on Mutual Enforcement of Debarment Decisions" with the African Development Bank Group (AFDB), the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the Inter-American Development Bank (IADB), which are known as "Multilateral Development Banks MDBs", in order to mutually enforce each other's debarment decisions. With respect to the four harmonized definitions for practices subject to sanctions or prohibited practices; these include (1) corrupt practice, (2) fraudulent practice, (3) coercive practice, and (4) collusive practice. This agreement is considered an innovative coordinated global initiative to deterrent corruption in MDBs-financed development projects (AFDB; ADB; EBRD; IADB and WB, 2010).

Whistleblower's Protection Policy

The Anti-Corruption Ethics and Compliance Handbook for Business introduced by OECD, UNODC, and WB in 2013 offers an explanation for whistleblowing: when an employee or an individual expresses concern and reports suspicious circumstances about corruption practice, it is called "whistleblowing" and the person (employee or an individual) is called "a whistleblower". Hall and Davies (1999) argue that the whistlers can strengthen the process of combating corruption through providing better information flow and thus increase the chances of successful prosecution. They see that whistlers (supported by UK legislation) may use three different routes to deliver their information.

1. Internal procedures, when the whistler is an employee in the company or organisation in which corruption occurs.
2. Approaching public agencies such as regulators, public auditors or, in a global context, the World Bank.
3. Other outlets using media to publicize an issue.

What is more, there are different types of whistleblowers; Hall and Davies (1999) summarized them as follows:

- Direct employees of companies
- Employees of governments or agencies
- Aid workers employed by foreign government
- NGO employees
- Employees of Multilateral agencies e.g. World Bank
- Accountants and auditors
- Consultants and academic researchers
- Members of the public

Whatever is the type of whistleblower or the way of reporting, there has to be a way to protect them and not to reveal their identity in order to avoid the risk of retaliation. This is the policy of the World Bank to make sure the whistleblowers are safe. Therefore, the World Bank provides whistleblowers with hotlines as a tool to report corruption. This is a private and discreet mode of communication to protect the person who does not want to disclose his/her true identity when reporting a corruption case. The hotline is "operated by an outside firm of trained specialists working under the strictest standards of confidentiality" (Hall and Davies, 1999).

The World Bank encourages companies to implement whistleblowing policies and to train employees accordingly to protect them from retaliation reactions by their managers or superiors (OECD; UNODC and WB, 2013).

Voluntary Disclosure Program (VDP)

In 2006, the World Bank launched this initiative program to provide their contractors and consultants with an opportunity to disclose past misconducts. The bank ensures that their information will remain confidential and that no professional ban procedures will be conducted. This program aims at encouraging all parties to come clean and open a new page by helping them to implement the compliance program and the best practices to combat corruption in the future.

Huguette Labelle, chair of Transparency International (TI), said about this program "When a firm decides to disclose its past corrupt behaviour, this is one more firm that can contribute to ending the plague of corruption. The more tools we have like the VDP, the more we will be able to reduce corruption in a substantial way". The WB sees VDP as a win-win proposition (www.wb.org).

Within the scope of this work, it is not possible to cover all the World Bank's numerous efforts and projects to fight corruption, involving many local authorities and also international organisations and institutions. However, the World Bank's regularly published corruption indicators will be discussed, among others, in the next section (section 2.5).

2.4.3 Political efforts

In addition to the previously mentioned international initiatives, other efforts include political conventions among countries in order to incriminate all forms of corruption and to legally prosecute them.

The UN Convention against Corruption, the FCPA, and the UK Bribery Act can all be classified as political efforts to combat corruption. However, there are several other political conventions in this context such as:

European Convention against Corruption Involving Officials

The Council of Europe (CoE) strengthens judicial cooperation between the member states in the fight against corruption involving European officials of member states of the European Union. Based on this convention, each member of the European Union shall take the necessary measures to ensure that the corruption of officials (in its passive or active form) is subject to criminal prosecution where corruption shall be considered a punishable crime. The convention entered force in 1997 (CoE, 1997).

European Criminal Law Convention on Corruption

After two years, the convention against corruption involving officials has been extended to become a criminal law convention on corruption. Therefore, in 1999, the EU, represented by ministers of justice agreed on the new law. This law consists of 42 articles forming legal instruments, which cover different forms of corruption and require states to provide effective and dissuasive sanctions and measures including deprivation of liberty that can lead to extradition. The states are also required to set up specialized anti-corruption bodies and to protect persons collaborating with investigating or prosecuting authorities. Furthermore, the law provides for enhanced international cooperation in the investigation and prosecution of corruption offences (CoE, 1999).

European Civil Law Convention on Corruption

This law is considered the first attempt to define common international rules in the field of civil law and corruption (www.coe.int). The law requires states to take measures at a national level (i.e. to modify their domestic laws) in order to allow people who have been affected by corruption to defend their rights. Article 1 (purpose) of the law states "each party shall provide in its internal law for effective remedies for persons who have suffered damage as a result of acts of corruption, to enable them to defend their rights and interests, including the possibility of obtaining compensation for damage". The Civil law consists of 23 articles to serve this purpose (CoE, 1999).

European Anti-Fraud Office (OLAF)

This office was founded in 1999, and it works independently to investigate fraud against the EU budget, corruption and serious misconduct within the European institutions. An important task of OLAF is the development of anti-fraud policies for the European Commission (Commission of the European Communities, 1999). Since its establishment until now, the office has investigated about 3,500 cases and was able to retrieve about 1.1 billion euros. On average, the office retrieves about 100 million euros a year.

The Inter-American Convention against Corruption (IACAC)

This is a convention approved in 1996 by the Organization of American States, which includes 35 states. The convention aims at (OAS, 1996):

- Promoting and strengthening the development by each of the state parties of the mechanism needed to prevent, detect, punish and eradicate corruption.
- Promoting, facilitating and regulating cooperation among the states parties to ensure the effectiveness of measures and action to prevent, detect, punish and eradicate corruption in the performance of public functions and acts of corruption specifically related to such performance.

African Union Convention on Preventing and Combating Corruption

The state members of the African Union (AU) signed the Convention in 2003. It aims at the same two purposes mentioned above in the IACAC; however, this applies to all African Union states. In addition, there is a third purpose which is to coordinate and harmonize the policies and legislations between state parties for the purpose of prevention, detection, punishment, and eradication of corruption on the African continent (AU, 2003).

It is important to mention that reaching this agreement and enacting regulations to combat corruption is considered a preliminary step that should be followed by tools and applicable procedures in reality otherwise it will just remain ink on paper and will not result in the goals for which it was set. Transparency International (TI) argued that there are many African countries that failed to implement this convention like South Africa, Algeria, Togo and others did. According to Da Costa (2007), only 16 of 53 African countries have already ratified the AU convention. This situation poses the question about the effectiveness of legislations against corruption, especially in countries classified as corrupt or as non-democratic countries.

The London Anti-Corruption Summit

The most current effort on an international level was the Anti-Corruption Summit in London. On 12th of May 2016, London hosted the Anti-Corruption Summit chaired by UK's Prime Minister. The summit was seeking to galvanise a global response to tackle corruption by bringing together world leaders, business and civil society to agree a package of practical steps to (www.gov.uk: anti-corruption-summit-london-2016):

- expose corruption so there is nowhere to hide
- punish the perpetrators and support those affected by corruption
- drive out the culture of corruption wherever it exists

An interesting question posed during the summit by a Brazilian journalist who asked, "We need a change of mentality, and how can that ever happen?" (Klitgaard, 2016)

2.4.4 Industrial sector efforts

International and political efforts in combating corruption in all its forms and types will not find their success unless they are adopted and committed by all involved parties, officials, organizations, public individuals, companies, and their employees. Therefore, companies' efforts and initiatives within their industries are an important factor in combating corruption in general and in their industries in particular.

Since our research is in construction management and belongs to architecture, engineering and construction (AEC) industry, simplified as construction industry, we will focus on the efforts and initiatives aiming at combating corruption in this industry. This will be discussed in detail in chapter 3

when we study corruption in the construction industry. Meanwhile, under this section the research introduces the effort of International Standard Organization (ISO) in combating corruption.

International Standard Organization (ISO)

ISO is an independent non-governmental organization (NGO) consisting of national standards bodies in 163 countries such as DIN (German Standard), BS (British Standards), and EN (European Standard). Its main function is to develop and publish international standards which comprise over 21,000 voluntary international standards until now.

A standard, as defined by ISO, is "a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose."

In the past, there was no special ISO standard for combating corruption directly; rather corruption was included indirectly in:

- ISO 14001: 2004 Environmental Management System – Requirements with Guidance for Use (EMS)
- ISO 9001: 2008 Quality Management System Requirements with guidance for use
- ISO 3100: 2009: Risk Management Principles and Guidelines
- ISO 26000: 2010: Guidance for Social Responsibility

ISO 14001: 2004 Environmental Management Systems – Requirements with Guidance for Use (EMS)

According to this standard, environment is defined as surroundings in which an organization operates including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

Corruption has a big impact on the surrounding environment, and there are clear negative effects in most corrupt countries that do not comply with environmental regulations and requirements. For this reason, Transparency International (TI) established a special unit to fight corruption in the water sector. In this sector, corruption is widespread and damages drinking supplies, sanitary facilities, agriculture, energy, as well as the environment. Hence, corruption keeps people thirsty and ill (www.transparency.org)

In this context, the environmental policy of the ISO 14001:2004 can be linked to the corruption subject. The top management shall define the organization's environmental policy and ensure that within the defined scope of its environmental management it includes a commitment to comply with applicable legal requirements to which the organization subscribes which relate to its environmental aspects (ISO 14001, 2004). The relevant articles of ISO 14001:2004 are as follows:

- 4.5.2.1: Consistent with its commitment to compliance, the organization shall establish, implement and maintain a procedure (s) for periodically evaluating compliance with applicable legal requirements.
- 4.5.3: Non-conformity, Corrective Action and Preventive Action
    a) Identifying and correcting non-conformity (ies) and taking action(s) to mitigate their environment impact
    b) Investigating non-conformity (ies), determining their cause and taking actions in order to avoid their recurrence.

Internal auditing plays an important role to make sure the system is successful.

ISO 9001: 2008 Quality Management System Requirements with guidance for use (QMS)

Article 5: Management Responsibility demonstrated a clear responsibility of the Management.

- 5.1 Management Commitment: to communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements.
- 5.5.2 Management Representative: c) ensuring the promotion of awareness of customer requirements throughout the organization

Article 6: Resource Management, 6.2 Human Resources

d) Ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the quality objective, and

e) Maintain appropriate record of education, training, skills and experiences.

Article 8: Measurement, Analysis and Improvement

- 8.2.2 Internal Audit: the management responsible for the area being audited shall ensure that any necessary corrections and corrective actions are taken without undue delay to eliminate detected non-conformities and their causes.
- 8.5.3 Preventive Actions:
  a) Determining potential non-conformities and their causes
  b) Eradicating the need for action to prevent occurrence of non-conformities.
  c) Determining and implementing action needed

ISO 31000: 2009 Risk Management

The ISO group believes that the risks facing an organisation might have bad consequences economically and socially or might damage its professional reputation as well as disastrous consequences on safety and environmental. Therefore, risk management is very important in helping companies avoid these risks especially in an environment full of uncertainties.

This is why ISO 31000:2009 was developed as a tool to help organizations build a framework and processes to manage their risks based on a number of principles suggested by the standard.

ISO 31000:2009 can be applied to any type of risks, whatever their nature, whether having positive or negative consequences.

Actually, most of the international organizations and those active in fighting corruption suggest using a risk management framework, as will be detailed in chapter 3 when the joint report of UNODC, WB and OECD, will be discussed where they suggest dealing with corruption using a risk assessment approach. The report states "the corruption risk assessment approach is a structured approach for how enterprises could conduct an anti-corruption risk assessment." Based on this, organizations can rely on the ISO 31000:2009 standard to manage corruption risks.

ISO 26000 – Social Responsibility

ISO 26000 provides guidance on how businesses and organization can operate in a socially responsible way. This means acting in an ethical and transparent way. The standard helps to clarify what social responsibility means and needs.

ISO 37001: Anti-Bribery Management System

With this standard, which is still under development, ISO takes a further step towards combating corruption.

As mentioned before, ISO 14001:2004, ISO 9001:2008, ISO 31000:2009, and ISO 26000:2010 referred indirectly to combating corruption by suggesting principles and requirements and comply with regulations, working within an ethically clean professional environment, preserving the surrounding environment, and the management's commitment to it. However, in 2013, ISO established a working group led by British Standards Institution (BSI) to develop and publish an ISO Anti-Bribery Standard.

The general procedure for developing an ISO standard allows each member body interested in a subject for which a technical committee has been established to be represented on that committee. International organizations, governmental and non-governmental in liaison with ISO also take part in the work to develop standards.

ISO 37001 was prepared by a technical committee called ISO /TC 278 Anti-bribery management systems. The standard ISO 37001 is designed to help an organization establish, implement, maintain and improve an anti-bribery compliance program or "management system." The standard includes a series of measures and controls that represent global anti-corruption good practice (ISO 37001, 2016)

The standard is flexible and can be adapted to a wide range of organizations from small to large no matter if private or public sector organizations including NGOs. Moreover, the standards are applicable in any country. The standard follows the structure of ISO 9001 as a superordinated management system structure for easy integration.

The standard requires a series of measures and controls to help prevent, detect, and address bribery. "The organization shall establish, document, implement, maintain, and continually review and, where necessary, improve an anti-bribery management system, including the processes needed and their interactions, in accordance with the requirements of this International Standard" (ISO 37001, 2016).

The following are the main requirements of the standard:

1) Anti-bribery policy, procedures, and control
2) Governing body, top management and leadership's commitment, responsibility, and review
3) Planning action and objectives of the system
4) Awareness, Training and communication
5) Bribery risk assessment
6) Due Diligence on projects and business associates
7) Monitoring, measurement, analysis, and evaluation
8) Review by anti-bribery compliance function and internal audit
9) Nonconformity and corrective action
10) Continual improvement

The ISO 37001 vote was overwhelming majority; 29 participating countries voting in favour (91%) and 3 against it. The publication of the standard is expected in late 2016.

2.5 Measurement of Corruption

Measuring corruption is not a less controversial issue than defining it and the complexity related to its reasons and consequences. There is a clear controversy among those who are studying corruption as a phenomenon regarding measuring it.

According to Foster et al. (2012), there is until now no generally agreed approach to measure corruption "no generally accepted framework exists for constructing and evaluating measures of corruption". In the same context, Tanzi (1998) argues "if corruption could be measured, it could be eliminated."

As mentioned before, there are many forms of corruption; e.g. bribery, embezzlement, fraud, extortion and favouritism. If the amounts spent on bribery could be measured, this mechanism of measurement would overlook other forms like fraud. If one tries a mechanism to measure extortion and fraud, for example, some other action might be considered and they are neither important nor corrupt act. In addition, it will be difficult to combine measurements for both the amounts of money spent and the actions leading to corrupt acts Tanzi (1998)

For their study, Disch et al. (2009) included a number of institutions interested in combating corruption. The Asian Development Bank acted as a donor. They all find that "the measurement of corruption and governance is one of the key challenges faced by donors in evaluating anti-corruption approaches."

Most researchers and institutions share the same opinion that there is not a direct method to measure corruption; rather the measuring process follows indirect ways to collect information about the spread of corruption. (Tanzi, 1998; Thompson and Shah, 2005; and Treisman, 2007)

According to Tanzi (1998), information about the spread of corruption can be obtained in three main ways:

1. Reports on corruption available from published resources including newspapers, internet, and magazines. Interested persons can subscribe to Transparency International's website and receive up-to-date corruption news from the world press on a daily basis ("daily corruption news"). A subscription to this newsletter for the past three years served as a research resource, some of the content was used to study and analyses corruption cases.
2. Case studies: The most of these studies are confidential and internal or secrecy must be maintained.
3. Questionnaire-based surveys: surveys that measure perception of corruption rather than corruption itself (Tanzi, 1998) and (Olken and Pande, 2011).

The above could explain why Olken and Pande (2011) refer to estimating the magnitude of corruption rather than the measurement of corruption. Other scholars like Gong and Wang (2012) studied measuring corruption tolerance, i.e. "by tolerance of corruption, we mean the extent to which people are inclined to accept it. In a broad sense, corruption tolerance indicates how people understand rules and social ethics and how they react to deviant behaviour."

Whether the term "measurement" or "estimate" is used to define the extent of corruption spread in an organisation, community or country, the important question remains how good or bad the obtained data is?

Organizations and institutions committed or established to fight corruption realized that it is impossible to systematically measure corruption (Bannon, 1999); instead they focused on developing corruption indicators (Disch et al., 2009), mostly depending on surveys (Tanzi, 1998). Today, these indicators pose an important reference to other organization, companies, businesspeople and researchers when they study corruption in any country or a field. Some of the most important corruption indicators worldwide are:

1. Corruption Perceptions Index (CPI)
2. Bribe Payers Index (BPI)
3. Global Corruption Barometer (GCB)
4. Control of Corruption Index
5. Country Policy and Institutional Assessment
6. Corruption Index

The above order in which the indicators are listed does not reflect their importance. They are only organized according to the publishers: TI published the first three indicators, while the World Bank issued the fourth and the fifth, and the last one was issued by the World Economic Forum.

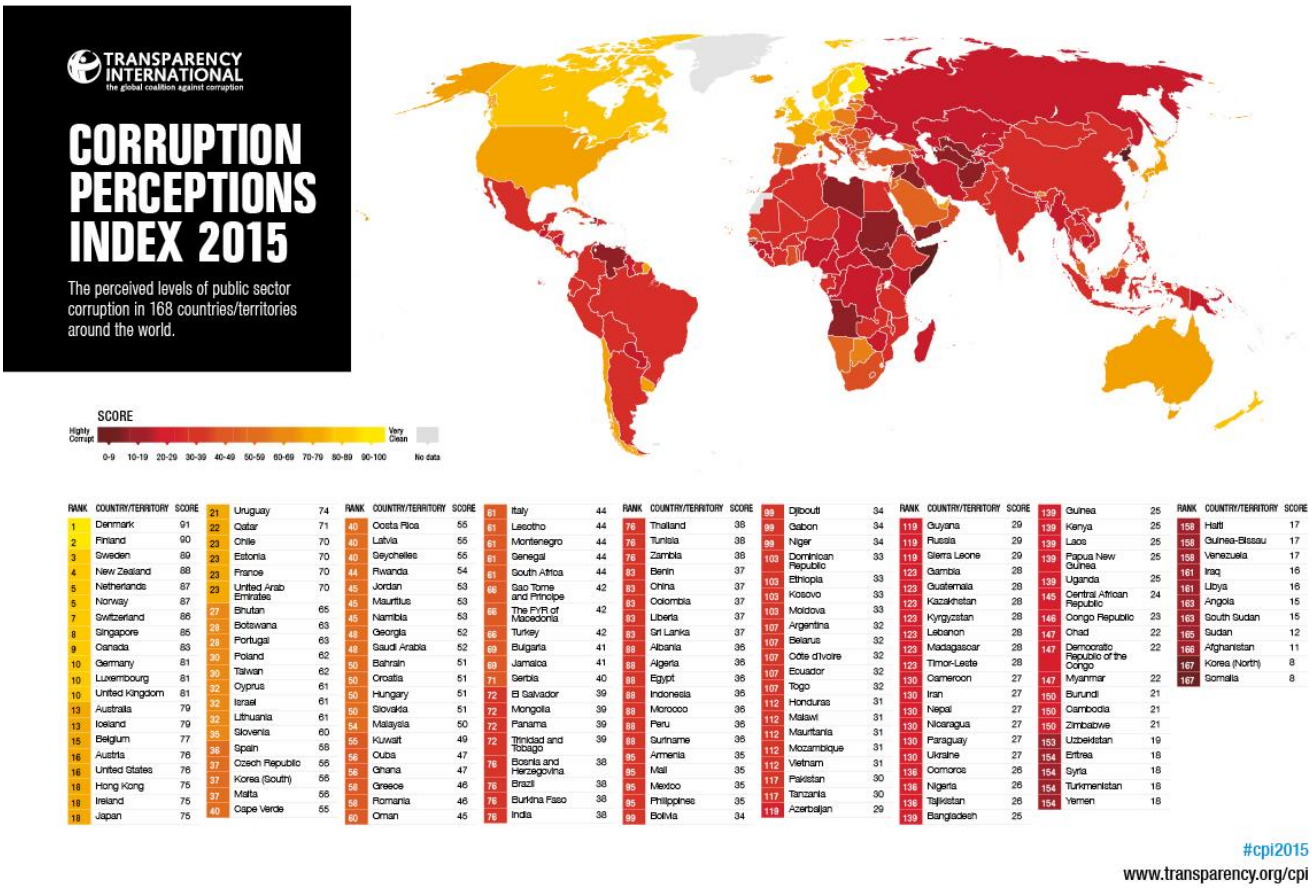
2.5.1 Corruption Perceptions Index (CPI)

The CPI is considered one of the most popular indicators for measuring corruption (Bannon, 1999; and Andvig et al., 2000). The indicator was developed by the German economist, Prof. Johan Lambsdorff and is published annually by TI since 1995.

CPI assesses the degree to which public officials or politicians are believed to accept bribes or uses his/her position to gain a personal benefit (Andvig et al., 2000). CPI, like other indicators, is based on the analysis of survey information. In the case of CPI, the survey is directed at politicians, public officials, in addition to businesspeople and executives. TI itself does not conduct the survey, rather by other independent organizations (TI, 2011) and the number of involved organizations differs from one year to another. For example, in 2011 it was 17 organizations and 12 in 2014.

From 1995 to 2011, the index ranked countries on a scale from ten to zero. From 2012, however, the index comprised of 100 points and now ranks countries on a scale from hundred to zero. The score 100 indicates the country is free of corruption, while the score of 0 indicates the country is absolutely corrupt (www.transparency.org).

Figure 2-3 shows the CPI worldwide, dark red indicates a highly corrupt public sector. Lighter red and orange countries fare a bit better, but corruption among public institutions and employees is still common. Yellow countries are perceived as cleaner, but not perfect (TI, 2016).



RANK	COUNTRY/TERRITORY	SCORE
1	Denmark	91
2	Finland	90
3	Sweden	89
4	New Zealand	88
5	Netherlands	87
5	Norway	87
7	Switzerland	86
8	Singapore	85
9	Canada	83
10	Germany	81
10	Luxembourg	81
10	United Kingdom	81
13	Australia	79
13	Iceland	79
15	Belgium	77
16	Austria	76
16	United States	76
18	Hong Kong	75
18	Ireland	75
18	Japan	75
21	Uruguay	74
22	Qatar	71
23	Chile	70
23	Estonia	70
23	France	70
23	United Arab Emirates	70
27	Bhutan	65
28	Botswana	63
28	Portugal	63
30	Poland	62
30	Taiwan	62
32	Cyprus	61
32	Israel	61
32	Lithuania	61
35	Slovenia	60
36	Spain	58
37	Czech Republic	56
37	Korea (South)	56
37	Malta	56
40	Cape Verde	55
40	Costa Rica	55
40	Latvia	55
40	Seychelles	55
44	Rwanda	54
45	Jordan	53
45	Mauritius	53
45	Namibia	53
48	Georgia	52
48	Saudi Arabia	52
50	Bahrain	51
50	Croatia	51
50	Hungary	51
50	Slovakia	51
54	Malaysia	50
55	Kuwait	49
56	Cuba	47
56	Ghana	47
58	Greece	46
58	Romania	46
60	Oman	45
61	Italy	44
61	Lesotho	44
61	Montenegro	44
61	Senegal	44
61	South Africa	44
66	Sao Tome and Principe	42
66	The FYR of Macedonia	42
66	Turkey	42
69	Bulgaria	41
69	Jamaica	41
71	Serbia	40
72	El Salvador	39
72	Mongolia	39
72	Panama	39
72	Trinidad and Tobago	39
76	Bosnia and Herzegovina	38
76	Brazil	38
76	Burkina Faso	38
76	India	38
76	Thailand	38
76	Tunisia	38
76	Zambia	38
83	Benin	37
83	China	37
83	Colombia	37
83	Liberia	37
83	Sri Lanka	37
88	Albania	36
88	Algeria	36
88	Egypt	36
88	Indonesia	36
88	Morocco	36
88	Peru	36
88	Suriname	36
95	Armenia	35
95	Mali	35
95	Mexico	35
95	Philippines	35
99	Bolivia	34
99	Djibouti	34
99	Gabon	34
99	Niger	34
103	Dominican Republic	33
103	Ethiopia	33
103	Kosovo	33
103	Moldova	33
107	Argentina	32
107	Belarus	32
107	Côte d'Ivoire	32
107	Ecuador	32
107	Togo	32
112	Honduras	31
112	Malawi	31
112	Mauritania	31
112	Mozambique	31
112	Vietnam	31
117	Pakistan	30
117	Tanzania	30
119	Azerbaijan	29
119	Guyana	29
119	Russia	29
119	Sierra Leone	29
123	Gambia	28
123	Guatemala	28
123	Kazakhstan	28
123	Kyrgyzstan	28
123	Lebanon	28
123	Madagascar	28
123	Timor-Leste	28
130	Cameroon	27
130	Iran	27
130	Nepal	27
130	Nicaragua	27
130	Paraguay	27
130	Ukraine	27
136	Comoros	26
136	Nigeria	26
136	Tajikistan	26
139	Bangladesh	25
139	Guinea	25
139	Kenya	25
139	Laos	25
139	Papua New Guinea	25
139	Uganda	25
145	Central African Republic	24
146	Congo Republic	23
147	Chad	22
147	Democratic Republic of the Congo	22
147	Myanmar	22
150	Burundi	21
150	Cambodia	21
150	Zimbabwe	21
153	Uzbekistan	19
154	Eritrea	18
154	Syria	18
154	Turkmenistan	18
154	Yemen	18
158	Haiti	17
158	Guinea-Bissau	17
158	Venezuela	17
161	Iraq	16
161	Libya	16
163	Angola	15
163	South Sudan	15
165	Sudan	12
166	Afghanistan	11
167	Korea (North)	8
167	Somalia	8

Figure 2-3: CPI 2015 – World Map & Country Results (TI, 2016)

Based on Figure 2-3, TI (2016) reported, "The scale of the issue is huge. Sixty-eight per cent of countries worldwide have a serious corruption problem. Half of the G20 are among them. Not one single country, anywhere in the world, is corruption-free".

Andvig et al. (2000) argues that CPI assumes that corruption is a one-dimensional phenomenon. However, corruption is not one-dimensional and the CPI does not distinguish between different types and forms of corruption.

2.5.2 Bribe Payers Index (BPI)

The BPI, too, is another indicator published by TI and is based on "TI Bribe Payers Survey" addressed to business executives from 28 countries of the world's leading economies including G20. BPI provides information on the willingness of companies in the global leading economies to engage in bribery when doing business abroad. Furthermore, all individual economic sectors, e.g. agriculture, mining and construction industry, regardless of global location and situation, were checked on their susceptibility to corruption. This lists the sectors according to the degree of likelihood that companies bribe public officials in the sectors. The result of this survey gives two indicators:

1. Index of Bribe Payers: Business executives were asked with which of the 28 countries they have a business relationship with (for example as supplier, client, partner, or competitor), 'how often do firms headquartered in that country engage in bribery in their own country?' It indicates the tendency of leading economies to gain contracts for their companies in other countries by paying bribes.

2. Index of Bribery in Business Sector: Bribe Payers Survey gathers business people's views on the likelihood of bribes being paid by companies in 19 different business sectors. The results indicate that bribery is perceived to be common across all sectors, with no sector scoring above 7.1 on a 10-point scale.

TI published its first edition of BPI in 1999. Different from CPI, this indicator is not annual, until now it was published in five editions: 1999, 2002, 2006, 2009, and 2011.

RANK	COUNTRY/ TERRITORY	SCORE
1	Netherlands	8.8
1	Switzerland	8.8
3	Belgium	8.7
4	Germany	8.6
4	Japan	8.6
6	Australia	8.5
6	Canada	8.5
8	Singapore	8.3
8	United Kingdom	8.3
10	United States	8.1
11	France	8.0
11	Spain	8.0
13	South Korea	7.9
14	Brazil	7.7
15	Hong Kong	7.6
15	Italy	7.6
15	Malaysia	7.6
15	South Africa	7.6
19	Taiwan	7.5
19	India	7.5
19	Turkey	7.5
22	Saudi Arabia	7.4
23	Argentina	7.3
23	United Arab Emirates	7.3
25	Indonesia	7.1
26	Mexico	7.0
27	China	6.5
28	Russia	6.1

(a)

RANK	SECTOR	SCORE
1	Agriculture	7.1
1	Light manufacturing	7.1
3	Civilian aerospace	7.0
3	Information technology	7.0
5	Banking and finance	6.9
5	Forestry	6.9
7	Consumer services	6.8
8	Telecommunications	6.7
8	Transportation and storage	6.7
10	Arms, defence and military	6.6
10	Fisheries	6.6
12	Heavy manufacturing	6.5
13	Pharmaceutical and healthcare	6.4
13	Power generation and transmission	6.4
15	Mining	6.3
16	Oil and gas	6.2
17	Real estate, property, legal and business services	6.1
17	Utilities	6.1
19	Public works contracts and construction	5.3

(b)

Table 2-4: BPI-2011 Country & Sectors results, resource (TI, 2011)

Table 2-4 (a) shows the country result while Table 2-4 (b) shows the sector results. Sectors are scored on a scale of 0-10, where a maximum score of 10 corresponds with the view that companies in that sector never bribe and a 0 corresponds with the view that they always do (TI, 2011).

2.5.3 Global Corruption Barometer (GCB)

The GCB is the third indicator from TI and is also based on surveys. It is considered the biggest survey worldwide regarding people's opinions, experiences and attitudes about corruption. Different from the CPI, which is directed at politicians & public officials and the BPI, which is directed at business executives, the GCB indicator is directed at normal employees (citizens).

The survey identifies their opinions and expertise about corruption in various areas like political parties, media, education system, medical and health systems, police…etc. The indicator is scaled from 1 (not corrupt) to 5 (the most corrupt). In 2003, TI published this indicator for the first time, then, annual surveys were conducted until 2009, except in 2008, while 2010 and 2011 were joined in one survey. The latest survey was published in 2013 where 11,400 people participated from 107 countries (www.transparancy.org). Table 2-5 shows an example of some countries according to GCB 2013:

COUNTRY/ TERRITORY	POLITICAL PARTIES	PARLIAMENT/ LEGISLATURE	MILITARY	NGOS	MEDIA	RELIGIOUS BODIES	BUSINESS/PRIVATE SECTOR	EDUCATION SYSTEM	JUDICIARY	MEDICAL AND HEALTH	POLICE	PUBLIC OFFICIALS/ CIVIL SERVANTS
Tanzania	3.9	3.5	3.0	3.4	3.2	2.3	3.4	4.1	4.5	4.3	4.5	4.1
Thailand	4.0	3.4	2.8	2.6	2.8	2.4	3.2	3.1	2.5	2.8	4.0	3.7
Tunisia	4.0	3.1	1.8	2.8	3.4	2.4	3.0	3.0	3.5	2.8	3.9	3.3
Turkey	3.9	3.5	2.7	2.9	3.6	3.1	3.4	3.2	3.1	3.2	3.0	3.2
Uganda	3.6	3.6	3.1	2.4	2.3	2.0	3.0	3.3	4.2	3.6	4.5	4.0
Ukraine	4.1	4.2	3.5	3.2	3.4	3.0	3.9	4.0	4.5	4.2	4.4	4.3
United Kingdom	3.9	3.6	2.5	2.6	3.9	3.0	3.5	2.6	2.7	2.6	3.0	3.3
United States	4.1	3.7	2.9	3.0	3.7	3.1	3.6	3.1	3.3	3.3	3.3	3.6
Uruguay	3.5	3.2	2.9	2.5	2.8	2.9	3.0	2.6	3.1	2.9	3.3	3.2
Vanuatu	4.4	4.0	3.1	2.0	2.2	2.0	3.0	3.2	3.3	3.2	3.7	3.9
Venezuela	4.2	3.8	3.8	3.4	3.6	3.0	3.8	3.2	4.1	3.3	4.4	4.3
Vietnam	2.8	2.7	2.8	2.4	2.8	2.2	2.9	3.4	3.5	3.6	4.0	3.6
Yemen	4.1	3.9	4.0	3.5	3.4	3.2	3.4	3.7	3.8	3.8	3.9	3.9
Zambia	4.0	3.3	3.9	3.0	3.0	2.6	3.6	4.1	4.3	3.5	4.7	3.8
Zimbabwe	4.0	3.9	3.1	2.6	3.7	2.9	3.7	3.8	3.9	3.8	4.5	4.0

Table 2-5: GCB-2013 results of some countries, resource (TI, 2013)

2.5.4 Control of Corruption Index (CC)

As mentioned above, the World Bank undertook great efforts in fighting corruption, not only in developing strategies, but also working with other organizations, creating Integrity Vice Presidency (INT) including the Preventive Service Unit (PSU), and developing the Fraud and Corruption Awareness Handbook. Furthermore, the World Bank went beyond that by issuing corruption indicators, and, most importantly, the corruption index (CC).

The CC is one of the six parts of the World Bank's project "The Worldwide Governance Indicator (WGI)". Governance, as defined by the World Bank, "consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of government to effectively formulate and implement sound polices, and the respect of citizens and the state for institutions that govern economic and social interactions among them."

The Worldwide Governance Indicators project constructs aggregate indicators of six broad dimensions of governance:

1. Voice and accountability
2. Political stability and absence of violence
3. Government effectiveness
4. Regulatory quality

5. Rule of law
6. Control of corruption

The aggregate indicators "WGI" cover 215 countries and territories. Between 1996 and 2002, the World Bank issued this indicator every two years. From 2002 on, it was issued annually, however, the latest version was issued in 2014 (www.worldbank.org). The indicators are based on several hundred individual variables measuring perceptions of governance, drawn from 35 separate data sources constructed by 33 different organizations from around the world (Kaufmann et al., 2009).

The indicator relevant for this thesis is the "Control of Corruption (CC)". The CC reflects perceptions on how public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. The indicator ranks countries on a scale from hundred to zero, hundred corresponds to the highest and zero corresponds to the lowest rank.

Figure 2-4 shows the world map based on CC in 2014. Dark red indicates the lowest control of corruption. Green countries are perceived to have the highest control of corruption (www.govindicators.org).

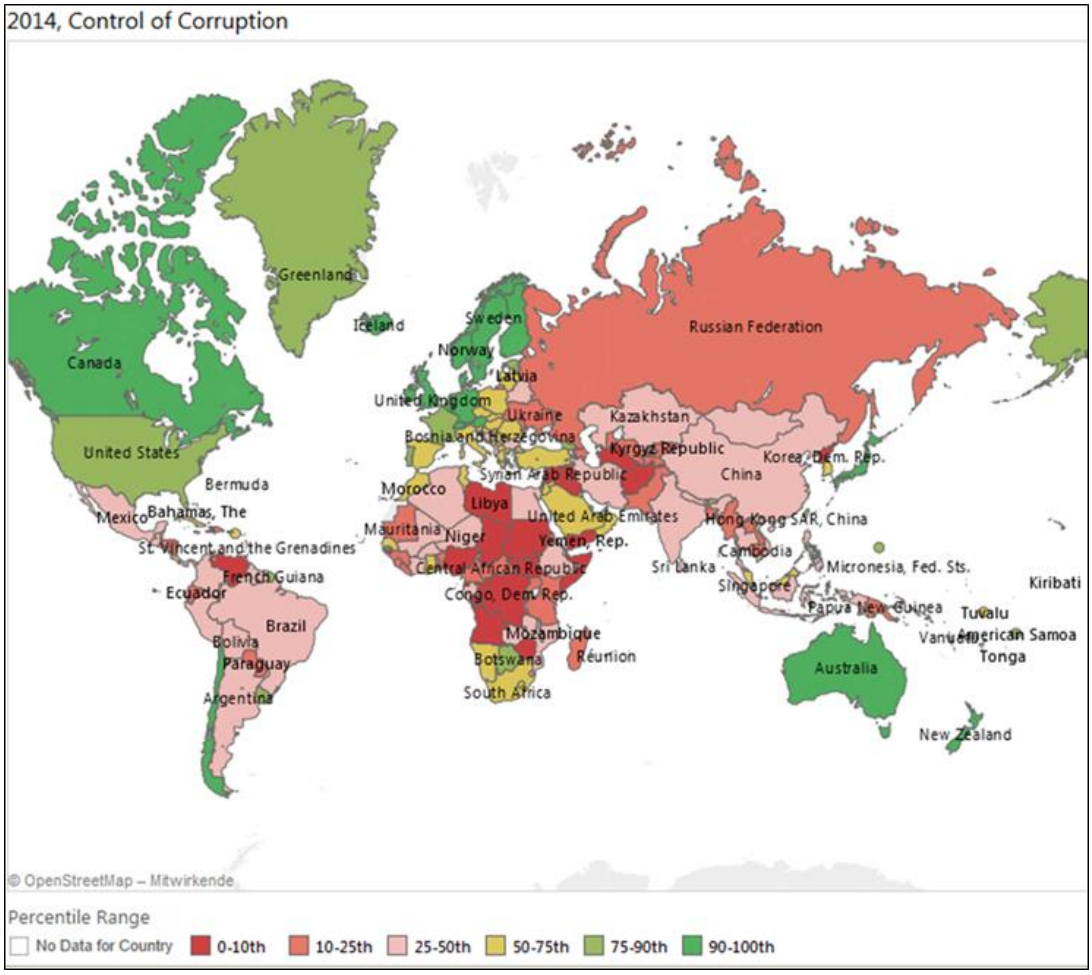


Figure 2-4: CC-2014 World Bank's World Map, resource (www.govindicators.org)

2.5.5 Country Policy and Institutional Assessment (CPIA)

As part of the World Bank, the International Development Association (IDA), established in 1960, helps developing countries to "reduce poverty by providing loans, and grants for programs that boost economic growth, reduce inequality and improve people's living conditions. The WB's experts study

countries known as "IDA eligible countries" within their annual report called "Country Policy and Institutional Assessment (CPIA)". The CPIA consists of 16 criteria grouped in four equally weighted clusters: (a) economic management, (b) structural policies, (c) policies for social inclusion and equity, and (d) public sector management and institutions which includes indicators for the 16 different domains listed in Table 2-6.

CPIA Cluster Group	CPIA Criteria (Indicators)
A. Economic Management	1. Macroeconomic Management
	2. Fiscal Policy
	3. Debt Policy
B. Structural Policies	4. Trade
	5. Financial Sector
	6. Business Regulatory Environment
C. Policies for Social Inclusion/Equity	7. Gender Equality
	8. Equity of Public Resource Use
	9. Building Human Resources
	10. Social Protection and Labour
	11. Policies and Institutions for Environmental Sustainability
D. Public Sector Management and Institutions	12. Property Rights and Rule-based Governance
	13. Quality of Budgetary and Financial Management
	14. Efficiency of Revenue Mobilization
	15. Quality of Public Administration
	16. Transparency, Accountability, and Corruption in the Public Sector

Table 2-6: The 16 CPIA criteria, resource (WB, 2009)

The CPIA uses numerical scores based on questions and answers. In fact, the CPIA was developed and first used in the mid-1970s as a tool. Over the years, the World Bank has periodically updated and improved it to reflect the experience and the evolved thinking about development (www.wb.org).

This thesis mainly refers to cluster D for corruption-related indicators. The index ranges from 1 (low) to 6 (high) and covers, based on the results gained in 2011, 81 countries (IDA eligible countries). Table 2-7 indicates the score for each IDA eligible country in 2011.

Country	CPIA Cluster D. (Public Sector Management and Institutions)	Country	CPIA Cluster D. (Public Sector Management and Institutions)
Afghanistan	2,5	Madagascar	2,8
Angola	2,3	Malawi	3,3
Armenia	3,6	Maldives	3,4
Bangladesh	2,9	Mali	3,3
Benin	3,3	Marshall Islands	2,8
Bhutan	3,9	Mauritania	3,0
Bolivia	3,2	Micronesia, Federal States of	2,8
Bosnia-Herzegovina	3,3	Moldova	3,5
Burkina Faso	3,7	Mongolia	3,5
Burundi	2,7	Mozambique	3,4
Cambodia	2,8	Myanmar c/	NA
Cameroon	2,9	Nepal	2,9
Cape Verde	4,0	Nicaragua	3,2
Central African Republic	2,6	Niger	3,2
Chad	2,2	Nigeria	2,9
Comoros	2,4	Pakistan	3,0
Congo, Democratic Republic of	2,2	Papua New Guinea	3,0
Congo, Republic of	2,6	Rwanda	3,6
Cote d'Ivoire	2,7	Samoa	4,0
Djibouti	2,8	Sao Tome and Principe	3,1
Dominica	3,8	Senegal	3,6
Eritrea	2,6	Sierra Leone	3,1
Ethiopia	3,3	Solomon Islands	2,8
Gambia, The	3,2	Somalia c/	NA
Georgia	3,8	Sri Lanka	3,4
Ghana	3,7	St. Lucia	4,0
Grenada	3,7	St. Vincent and the Grenadines	3,8
Guinea	2,6	Sudan c/	2,2
Guinea-Bissau	2,6	Tajikistan	2,9
Guyana	3,0	Tanzania	3,3
Haiti	2,5	Timor-Leste	2,5
Honduras	3,4	Togo	2,8
India	3,6	Tonga	3,7
Kenya	3,3	Tuvalu d/	NA
Kiribati	3,3	Uganda	3,2
Kosovo	3,3	Uzbekistan	2,9
Kyrgyz Republic	3,0	Vanuatu	3,4
Lao People's Democratic Republic	3,1	Vietnam	3,6
Lesotho	3,5	Yemen, Republic of	2,9
Liberia	2,8	Zambia	3,1
		Zimbabwe c/	2,2

Table 2-7: CPIA score for public sector management and institutions including corruption in the public sector, source (WB, 2011)

The Table 2-7 shows that three countries (Cap Verde, Samoa and St. Lucia) have the highest score with 4 from 6, while Chad, Democratic Republic of Congo, Sudan and Zimbabwe have the lowest score with 2,2 from 6. No results were available (N/A) for Myanmar, Somalia and Tuvalu because there were no IDA projects implemented in these countries in 2011.

2.5.6 Corruption Index

In fact, the Corruption Index is a sub-index under the Global Competitiveness Index (GCI) issued by the World Economic Forum (WEF). Competitiveness, as defined by WEF, is "the set of institutions, policies, and factors that determine the level of productivity of an economy which in turn sets the level of prosperity that the country can earn".

The economist Xavler Sala Martin in collaboration with WEF developed the Index. It combines 114 sub-indicators and essentially deals with productivity. All its sub-indicators are classified into 12 sections such as: institutions, infrastructure, macroeconomic environment, health, primary education,

high education and training, etc. The GCI takes into consideration the Inclusive Growth and Development Framework that also includes a group of indicators for seven basic domains (pillars) divided into 15 sub-domains (sub-pillars) as presented in Figure 2-5.

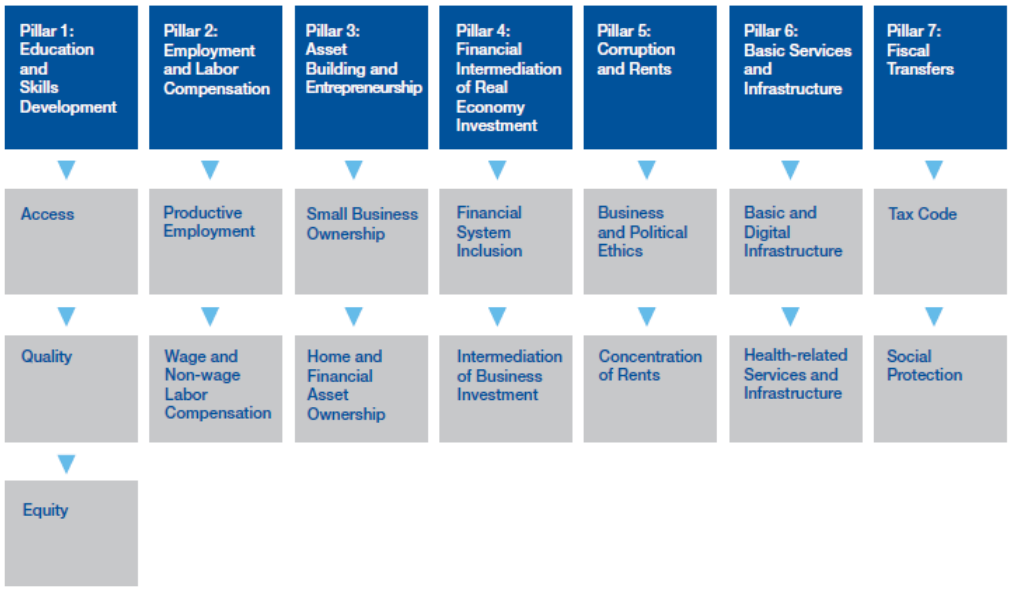


Figure 2-5: Inclusive Growth and Development Framework, source (Samans et al., 2015)

Notably, corruption forms a basic domain (pillar 5) and has an indicator within GCI that shows how difficult it is to perform or start business in a corrupt country. Each country is assigned a score from 1 to 7 per dimension. Table 2-8 shows the score of some countries (country with lower middle income) where the corruption index is clearly displayed in the red rectangle (below).

Lower Middle Income

Bottom 20% Rank in pillar Top 20%

	Education				Employment			Asset Building			Financial Intermediation			Corruption			Basic Services			Fiscal Transfers		
	Pillar	Sub-pillars			Pillar	Sub-pillars		Pillar	Sub-pillars		Pillar	Sub-pillars		Pillar	Sub-pillars		Pillar	Sub-pillars		Pillar	Sub-pillars	
		Access	Quality	Equity		Productive Employment	Wage and non-wage compensation		Small Business Ownership	Home and Financial Ai Ownership		Financial System Inclusion	Internation of Business Investment		Business and Political Ethics	Concentratio of Rents		Basic and Digital Infrastructure	Health Services and Infrastructure		Tax Code	Social protection
Albania	4.28	4.9	3.8	4.1	4.20	3.7	4.7	2.84	4.0	1.7	2.66	2.7	2.6	3.13	2.9	3.4	4.50	3.9	5.1	3.37	3.5	3.2
Algeria	N/A	4.6	3.4	N/A	3.22	3.0	3.5	3.38	3.9	2.9	2.03	2.3	1.7	3.29	3.0	3.6	4.66	3.9	5.5	3.49	3.4	3.6
Armenia	5.05	4.8	4.0	6.5	3.91	3.9	3.9	3.46	4.3	2.6	3.37	3.0	3.8	3.99	3.2	4.8	4.65	4.2	5.1	3.63	3.3	4.0
Bolivia	4.32	4.6	4.5	3.9	3.93	4.0	3.8	3.19	3.3	3.1	2.56	2.9	2.3	3.56	3.4	3.7	4.13	3.8	4.4	3.41	3.5	3.3
Cameroon	3.14	3.2	3.2	3.0	N/A	4.5	N/A	2.91	3.4	2.4	2.50	2.4	2.6	3.42	3.0	3.9	2.85	2.7	3.0	2.96	3.6	2.3
Dominican Republic	3.98	4.1	3.5	4.3	4.01	3.7	4.3	3.40	3.5	3.3	2.65	3.1	2.2	3.21	2.6	3.8	4.77	4.6	5.0	2.63	3.0	2.2
Egypt	3.91	4.5	3.0	4.2	3.26	3.4	3.1	3.15	3.6	2.7	2.22	2.2	2.2	3.27	3.1	3.4	4.73	4.6	4.8	3.14	3.2	3.1
El Salvador	N/A	4.8	3.8	N/A	3.77	3.9	3.6	3.24	3.7	2.7	2.62	2.7	2.5	3.76	3.4	4.2	4.68	4.3	5.0	2.94	3.4	2.5
Georgia	5.09	4.8	4.4	6.0	3.89	3.9	3.9	3.48	4.5	2.5	2.81	3.0	2.6	4.05	4.5	3.6	4.62	4.2	5.0	3.70	3.8	3.6
Ghana	3.75	4.1	4.3	2.9	4.11	4.6	3.6	3.32	3.9	2.8	2.50	2.6	2.4	4.19	3.5	4.8	3.95	3.5	4.4	3.80	4.0	3.6
Guatemala	3.94	4.7	3.6	3.5	4.36	4.7	4.1	2.95	3.4	2.5	2.96	3.5	2.4	3.45	2.9	4.0	4.19	3.8	4.6	3.02	3.5	2.5
Honduras	3.97	4.4	4.0	3.5	3.77	4.3	3.2	3.79	3.9	3.7	3.42	3.0	3.9	3.52	3.0	4.1	4.26	3.5	5.0	2.76	3.5	2.1
India	3.35	3.8	3.1	3.1	3.14	3.6	2.7	3.04	3.2	2.9	3.26	3.0	3.6	3.99	3.5	4.5	3.82	3.9	3.8	2.70	3.3	2.1
Indonesia	4.68	4.8	4.5	4.7	3.71	4.2	3.2	3.37	3.5	3.2	3.27	3.1	3.5	3.96	3.7	4.2	4.43	4.1	4.8	3.42	3.9	3.0
Iran, Islamic Republic	N/A	4.6	4.1	N/A	3.08	3.0	3.2	4.53	4.5	4.6	2.58	3.2	2.0	3.78	3.1	4.5	4.68	4.3	5.1	4.09	4.6	3.5
Jordan	N/A	4.6	N/A	5.4	3.95	4.1	3.8	3.63	4.0	3.3	3.58	3.2	4.0	3.92	4.2	3.6	5.31	4.8	5.8	3.44	3.3	3.5

Table 2-8: GCI Including Corruption Index, based on (Samans et al., 2015)

Again, the data collection method is based on surveys directed at executives, business leaders, and entrepreneurs. GCI is published annually since 2005 and compares two consecutive years. The last edition is GCI 2015-2016 covering 140 countries (or economies).

Having introduced the most important corruption indicators as a means to measure or estimate corruption, however, the question remains as to the quality of the obtained data used to develop these indicators?

As a matter of fact, literature review shows a controversy among scholars about the "validity" of indicators (Disch et al., 2009) and the construction of a "conceptual framework" and the "reliability" of the indicators (Thomson and Shah, 2005). All this is related to how it is calculated and how data is collected. Disch et al. (2009) even goes a step further and discusses whether the indicator is rating or ranking. Specialized scholars are working on improving and developing these indicators in order to make them more realistic. In this context, a quote from TI about its most popular indicator (CPI) analyses the situation as follows: "Corruption indices like the CPI are a "wake-up call" to political leaders and to the public at large to confront the abundant corruption that pervades so many countries".

3 Corruption in the Construction Industry

3.1 Corruption in Construction Industry Is a Fact

Chapter 2 was concerned with the corruption phenomenon, reviewing the controversy regarding the definition of this term; different types and forms of corruption were found.

In general, this research presented some very important reasons and consequences of corruption, some controversy and overlapping. However, factors leading to corruption may result from corruption, too.

Since this research is embedded within construction management and civil engineering specialized in project management, this section will detail the phenomenon of corruption in architecture, engineering and construction (AEC) industry, i.e. the construction industry.

Firstly, it is described how construction industry scientists define corruption, what types and forms of corruption people working in this industry may encounter, which consequences result from this phenomenon, and if there are special efforts exerted to fight corruption in the construction sector. Here, he same approach as in chapter 2 applies to allow for a comparison between corruption in general and corruption in the construction industry. Thereafter, a discussion follows about the definitions of corruption from the prospects of scholars in the construction sector, their special opinions about the forms and types of corruption in construction projects, as well as their opinions regarding its consequences and the exerted efforts to combat corruption in their industry.

It is not a secret that corruption is widely spread in the construction sector, a fact confirmed by all reports and indicators covering corruption as a phenomenon. For example, the Bribe Payers' Index (BPI) published by Transparency International (TI), shows clearly that companies working in construction industry are most likely to pay bribes to get business contracts.

Figure 3-1 derived from Table 2-4 (b) shows how the BPI 2011 ranked the public works contracts and construction with a score of 5.3 from 10 as the most corrupt sector of all economic sectors.

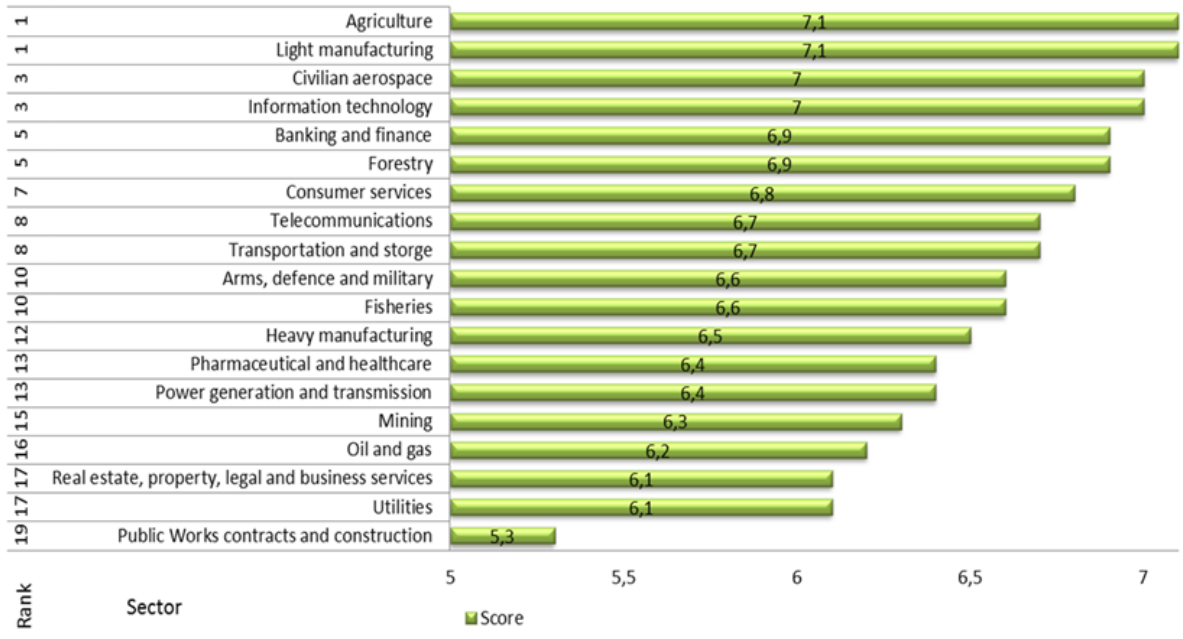


Figure 3-1: Perceptions of foreign bribery by sectors – based on BPI 2011 (TI, 2011)

Kenny (2007) introduces evidence based on the Business Environment and Enterprise Performance Survey (BEEPS), which was conducted for the first time in 1999-2000 and covered over 4,000 firms (local and international firms) in 22 emerging countries. The results confirm once more that construction is an industry particularly prone to corruption. Kenny states, "Construction firms represented in BEEPS have significantly larger 'bribe budgets' than the average firm and they bribe more often. Of their total bribe budget a larger percentage goes to gain government contracts - an average of 23 % for construction compared to 15 % for all firms in the sample".

Literature review and reports have proven that corruption in the construction sector most often comes from outside the sector. Other resources, like the financial and banking sectors or non-governmental organizations such as TI have mentioned and proved that the construction industry is one of the most corrupt sectors worldwide (Stifi; Gehbauer and Gentes, 2014).

3.1.1 Definition of Corruption in Construction

Prior to discussing the definition of corruption in construction, a quick look at how construction corruption researchers in, their academic and professional background, to understand the way they look at corruption in construction. The analysis is based on comprehensive data, classified into several groups:

- Group A1: scientists interested in corruption in construction who belong directly to the construction sector, e.g. civil engineers, structure engineers, mechanical and electrical engineers and architects, etc.
- Group A2: scientists interested in corruption in construction who do not belong directly to the construction sector, e.g. economists, lawyers, social scientists, etc.

Firms and organizations, which are part of both groups; A1 and A2, can also be subdivided into two groups:

- Group B1: firms or organizations working within the construction sector, e.g. engineering companies, construction research institutes, and some non-profit organizations of the construction sector.
- Group B2: firms and organizations working outside the construction sector, e.g. international organizations, banks, research institutes outside the construction sector, and some non-profit organizations.

Based on literature review, Table 3-1 shows a list of scholars interested in corruption in construction, their academic background, and their employing firms or organizations.

Scholar	Background	Group	Firm / Organization	Group
Carsten Ahrens	Construction Physics	**A1**	Dept. of Civil Engineering and Geoinformation Jade University	**B1**
Catherine Stansbury	Law	**A2**	GIACC	**B1**
Charles Kenny	Economics	**A2**	World Bank	**B1**
David Barnes	Business studies	**A2**	The Chartered Institute of Building (CIOB)	**B1**
Emilio M. Colón	Environmental Engineering	**A1**	The World Council of Civil Engineers	**B1**
Felix Atume	Civil Engineer	**A1**	Nigerian Society of Engineers NSE	**B1**
Grat Van Den Heuvel	Law	**A2**	Faculty of Law University of Maastricht	**B2**
Jaime Santamaría-Serrano	Civil Engineer	**A1**	Colombian Society of Engineers	**B1**
Johann Graf Lambsdorff	Economics	**A2**	Economic Theory University of Passau	**B2**
Jorge Diaz Padilla	Civil Engineer	**A1**	FIDIC's Integrity Management Committee	**B1**
Josef Wieland	Economics	**A2**	Leadership Excellence Institute Zeppelin University	**B2**
Kamel Ayadi	Civil Engineer	**A1**	International Co-operation Department at the Waste Water Department (ONAS)	**B1**
M. Sohail	Civil Engineer	**A1**	Dept. of Civil and Building Engineering Loughborough University	**B1**
Marcos Tulio de Melo	Civil Engineer	**A1**	Brazilian Federal Council of Engineering, Architecture and Agronomy (Confea)	**B1**
Martin Manuhwa	Electrical and Energy Engineer	**A1**	Industrial Energy Solutions	**B1**
Mundia Muya	Construction Management	**A1**	National Housing Authority in Zambia	**B1**
Nancy Hite	Political Economy	**A2**	The Fletcher School Tufts University	**B2**
Neill Stansbury	Law	**A2**	GIACC	**B1**
Nikos Passas	Criminology and Criminal Justice (Law)	**A2**	College of Social Science and Humanities Northeastern University	**B2**
Patrick X.W. Zou	Construction Management	**A1**	Department of Civil and Construction Engineering Swinburne University of Technology	**B1**
Paul Bowen	Construction Management	**A1**	Construction Economics and Management The University of Cape Town	**B1**
Peter Edwards	Construction Management	**A1**	School of Property, Construction & Project Management RMIT University	**B1**
Peter Matthews	Politics and Economics	**A2**	Engineers Against Poverty	**B1**
Robert Klitgaard	Economics	**A2**	Claremont Graduate University	**B2**
Roberto Burguet	Economics	**A2**	Barcelona Graduate School of Economics	**B2**
Rumaizah Mohd Nordin	Civil Engineer	**A1**	Faculty of Architecture, Planning and Surveying Universiti Teknologi MARA, Malaysia.	**B1**
Sam Kundishora	Communications Technology Engineer	**A1**	Zimbabwe Institution of Engineers	**B1**
Stephan Grüninger	Economics	**A2**	Konstanz Institute for Corporate Governance HTWG Konstantz	**B2**
Sue Cavill	Civil Engineer	**A1**	Water, Engineering and Development Centre (WEDC) Loughborough University	**B1**
William P. Henry	Civil Engineer	**A1**	President of the American Society of Civil Engineers (ASCE)	**B1**
Yeon-Koo Che	Economics	**A2**	Economics Department Columbia University	**B2**

Table 3-1: Scholars interested in corruption in construction

It shows that almost half of the scholars interested in corruption in construction are not from the engineering field (A2). Most of them are also working for non-engineering organizations (B2) → (A2-B2) and some of them are working directly for engineering organizations (A2-B1). However, in the case of engineering scholars, all of them are working directly for engineering organizations (A1-B1), as presented in Table 3-2.

Group	B1	B2
A1	17	0
A2	5	9

Table 3-2: Scholars' groups based on Table 3-1

The queried scientists and their research institutes did not give a special definition to corruption in the construction sector; rather they depend on the general set of definitions introduced in chapter 2. However, Sohil and Cavill (2006 and 2008) used a general definition for corruption as "the misuse of power for private gain either at one's own instigation or in person to inducements.", whereas X.W.Zou (2006) defines corruption as "a behaviour which deviates from the norms, rules, and duties governing the exercise of a privileged role or office for purpose of private gain". Most of the scientists tend to define types and forms of corruption rather than defining the term corruption itself.

Barnes (2013) confirms that "various definitions of corrupt practice exist." Also, Stansbury (2008) pointed to the same idea when he suggested two views in definitions. The first is the "narrow definition" where he defines corruption based on the general definitions introduced by TI and WB. The second definition in a broader sense includes and defines the forms of corruption. This approach shows that Stansbury is leaning towards the OECD and their definition of corrupt behaviour as well as the definitions of TI and the WB (Stifi; Gehbauer and Gentes, 2014).

3.1.2 Forms of Corruption in Construction

As mentioned in chapter 2, corruption has five major forms: bribery, embezzlement, fraud, extortion and favouritism. Bribery is the most important of these forms and the most widely spread, too. Even in Stansbury's narrow definition (2008), corruption can be expressed by bribery.

When analyzing corruption in construction, more forms of corruption become apparent than in other sectors. It is not an exaggeration, that corruption in this sector not only ranks first, but it also contains the most widely spread known forms, even more so when considering both the narrow and broad views introduced by Stansbury (2008).

The following paragraph will introduce and compare forms of corruption found in the construction industry.

Bribery:

In addition to the general definition of bribery (see chapter 2), researchers and organizations involved in the field of corruption in construction define bribery as "demanding, receiving, offering or giving of an undue reward by or to any person in order to influence his behaviour." (TI, 2006; and Stansbury, 2008)

Bribery in construction has several forms. It can be directly made in the form of cash payment or gifts or indirect when the briber bears certain expenses for the bribed person or organization (e.g. bearing

travel expenses, subscriptions to clubs or other organizations, etc.). The promise to win future contracts can also be a form of bribery.

Notably, there are two ways to make these payments (in cash or in kind) either by paying the person directly, or indirectly making payments to the relatives, friends, spouses, or children. Bribery can occur in any phase of the construction project. Table 3-3 presents some examples of how bribery occurs in different phases of construction projects.

Project phase	Example for corrupt practice (bribery)
Project selection	This case could be especially noted in infrastructure projects when an individual or a group bribes an official or organization in charge to review and approve of a project's feasibility study to decide in their favour. A good example of this is bribing the municipalities in charge of constructing new roads; so that the road passes by areas that benefit the briber regardless of its benefit to the society or the poor people.
Planning	The owner of a project can bribe an official to get a license for his commercial project to be constructed in a residential area.
Design	A contractor bribes a designer for an "over design" and consequently an over-priced project, or to design the project in such way that ensures him winning over others competitors.
Pre-qualification and Tendering	A contractor bribes the representative (engineer) of the owner to win the contract.
Execution	Contractor pays for the third party test laboratory to deliver better compaction test results (e.g. sand cone test)
Operation and Maintenance	Facility management firm pays bribe to win an operation and maintenance contract. Or: a spare part seller bribes facility manager to buy the spare parts exclusively from his company.
Reconstruction/Decommissioning	Paying a bribe for favourable environmental impact assessment associated with deconstruction work like the amount or types of dangerous wastes.

Table 3-3: Examples of bribery in different phases of construction projects

Embezzlement:

Stansbury (2008) sees embezzlement in construction as a form of theft that often involves fraud to conceal it. Embezzlement in construction may occur in different ways like direct theft, misappropriation of money, or misdirecting money. In general, embezzlement is widely spread in the last three phases of the project cycle due to the huge amounts of money, other assets, and resources involved in these phases compared to the other phases. Table 3-4 presents some examples about embezzlement in different phases of construction project.

Project phase	Examples for corrupt practice (embezzlement)
Execution	Project manager uses the money from on-site cash box for his own expenses.

Operation and Maintenance	The person in charge of maintenance violates the maintenance requirements and takes over a part of money deposited for this purpose, like purchasing low-quality products and misappropriating the difference in price.
Reconstruction/Decommissioning	Project manager awards reconstruction contract to a firm at a high price regardless of the potential income that comes from recycling/reselling the structure steel, the company uses the steel sales proceeds to pay him back privately.

Table 3-4: Examples of embezzlement in different phases of construction projects

Fraud:

Fraud is another widespread form of corruption in the construction industry. Stansbury (2008) argues that Fraud usually occurs where a person dishonestly makes some false representation in order to gain financial or other advantages or to cause loss to another person. These two forms of fraud, to "gain advantage" and to "cause loss to others", are very apparent in all project phases. Table 3-5 presents some examples of fraud in different phases of construction projects.

Project phase	Examples for corrupt practice (fraud)
Project selection	During a feasibility study, an official may give false information about the number of tourists or the importance of an area to influence the decision of a funder to build a hotel instead of a hospital because he will benefit from running it later.
Planning	A project owner manipulates the geotechnical report (soil conditions) in order to get a building license on pad foundations instate of raft foundation.
Design	The representative of the owner (engineer) withholds information and maps which are important to the contractor's works. Consequently t the project will take longer and withheld documents will be used for future gain (e.g. negotiating with contractor)
Pre-qualification and Tendering	When a contractor or design company submits its "pre-qualification" file, it feigns the presented information about its expertise, its engineers, and tools/equipment required for successful project execution.
Execution	A contractor provides fake information about the number of workers, vehicles, and equipment available on-site (over claiming time and resources).
Operation and Maintenance	A supplier of material required for operation or maintenance forges certificates of origin; e.g. trying to pass off a pump that has been produced in East Asia (i.e. low quality product) for a pump from Germany (i.e. high quality product). .
Reconstruction/ Decommissioning	A contractor manipulates the degree of soil contamination in order to get a permission to deposit it without pre-treatment.

Table 3-5: Examples of fraud in different phases of construction projects

Extortion:

Chapter 2 introduced definition and different forms of extortion. However, extortion in the construction industry is seen as a form of "blackmail" (Stansbury, 2008) and it occurs where one party makes threats against another party of adverse consequences unless the threatened party meets some demand. This demand is usually for payment of money. Therefore, some countries consider extortion as the "demand-side of bribery" and other countries treat it as a separate form of corruption (Stansbury, 2008).

Considering extortion as the "second side of bribery" makes it existing in all construction project phases. Table 3-6 presents some examples:

Project phase	Examples for corrupt practice (extortion)
Project selection	An official extorts an owner to pay him money to include his property in the new urban plan.
Planning	A government employee extorts a project owner to pay him money to get a building license; else he will face difficulties and a lot of bureaucracy.
Design	A design engineer working for a geotechnical service office extorts a contractor to pay him money to suggest an easy and available method for soil improvement activities.
Pre-qualification and Tendering	A project representative (engineer) blackmails companies to pay him money in order to include them in the vendor list.
Execution	A supervising engineer (owner's representative) blackmails a contractor to pay him money to approve concrete pouring when he inspects the work.
Operation and Maintenance	Accountant of the facility management firm blackmails a supplier to pay him 2% per invoice in order to accelerate payment.
Reconstruction /Decommissioning	An employee of environmental authority blackmails a contractor to pay him money in order to issue permission for deposit, in spite of the fact that the reconstructed materials are complied with the authority requirements and standards.

Table 3-6: Examples of extortion in different phases of construction projects

Collusion:

In chapter 2, collusion was not included as a form of corruption. Some f literature sources and organizations mention collusion independently and often connect it with corruption as (collusion and corruption) like policy roundtables of OECD (OECD, 2010) and Wells (2014). However, in construction, scholars classify collusion as a form of corruption which can be especially encountered in public projects (Stansbury, 2008). Wells (2014) studied the World Bank's reports and he found that the INT of the WB confirms that collusion is rife in the road construction sector in many developing countries.

According to the OECD, collusion "involves a horizontal relationship between bidders in a public procurement, who conspire to remove the element of competition from the process". Stansbury (2008) argues that collusion in construction occurs where two parties or more collaborate to damage or deceive another party. He describes these arrangements as "cartel", "anti-trust" and "anti-competitive".

Collusion in construction usually occurs in the tendering phase. However, it can also occur in the execution phase and in different forms. The most important of which are (Stansbury, 2008):

Bid rigging

In this form of collusion, several contractors agree that they will each pretend to compete on all major tenders, but will agree in advance which of them should win each tender. Each one pretends to have made an offer independently, but in reality, each one of them notifies the others of its tender price, so that the others submit higher prices to ensure that the preselected contractor among them wins the tender. This way, each one of them wins the tender without real competition ant it would have an opportunity to be awarded a tender at a higher price.

Cover pricing

In this form of collusion, a contractor who does not want to win the tender because he is already too busy but wants to stay in the market (retain the impression of competition), agrees with other contractors to bid at higher price than his price to ensure that he will not win the contract. The cost for his bidding process will be covered by the winner; as will be discussed below under "losers' fee". With this procedure, the winning contractor can profit from a higher price although there is no genuine competition.

Losers' fee

In this form of collusion, competing contractors agree to exchange information about their costs needed to prepare their bids. Then, each one of them will include in their tender price the sum of money representing the total estimated tender costs of all competing contractors. Then, the contract winner will divide this sum of money between all unsuccessful contractors who will thereby recover their tender costs. In this case, the project owner will unknowingly pay more than the real cost.

Price fixing

In this form of collusion, a group of suppliers bid against each other on projects but they agree among them that they will never drop below a pre-agreed price.

All forms of collusion undermine genuine competition. Collusion increases project costs while the project owner is deceived into believing he gave the contract to the right firm through genuine competition.

As mentioned before, collusion can be encountered mostly in tendering and execution phases. Table 3-7 presents some examples about collusion in these two phases:

Project phase	Examples for corrupt practice (collusion)
Pre-qualification and Tendering	Contractors agree to let one of them win the tender in return for similar support on another tender in the future.

Execution	A representative (engineer) of the project owner suggests only two companies (subcontractors) to carry out site investigations (geotechnical investigations including borehole drilling, cone penetration test, head falling test, compaction test, etc.). The two companies agree together on a price that neither of them will undercut.

Table 3-7: Examples of collusion in tendering and execution phases

Facilitation payments:

It is a form of corruption and occurs by making cash payments to an employee or an official to do their work properly. Here, we need to distinguish between facilitation payment and bribery. While facilitation payments are paid to someone to do his job properly, bribery is paid to someone to do his job improperly. In other words, facilitation payment a payment made to persuade people to perform their duties properly, without resulting in preferred treatment (Stansbury, 2008).

Facilitation payments can be either small or large payments. Table 3-8 shows examples from construction project phases in which facilitation payments might be encountered:

Project phase	Example for corrupt practice (facilitation payment)
Planning	A project owner is obliged to pay some money to obtain a building license which is normally free of charge.
Execution	During project execution, contractor needs to pay facilitation payment in order to speed up the permission process for a road diversion (e.g. to complete a pipe installation) to not affect the project schedule.
Operation and Maintenance	During project operation, project owner is obliged to pay a municipal officer to get permission to pump out ground water to municipality main pipe, despite the fact that a preliminary approval from the designing and construction phase has already been granted and all requirements are fulfilled.
Reconstruction/Decommissioning	A contractor pays facilitation payment to obtain a permission to use municipal landfill.

Table 3-8: Examples of facilitation payment in different phases of construction projects

Conflict of Interest:

Literature research about conflicts of interest, despite their rarity, is inconsistent as to whether consider conflicts of interest as a form of corruption or not. Transparency International (2006) believes that conflicts of interest may lead to corruption, whereas. Bowen et al. (2012) and FIDIC introduce conflicts of interest as a form of corruption. Reed (2008) explains the difference between a conflict of interest and corruption based on their common definitions; he argues that a conflict of interest is a "situation", while corruption is"behaviour". Reed (2008) stated "The concept of conflict of interest does not refer to actual wrongdoing, but rather to the potential to engage in wrongdoing."

Despite the two different points of views, whether conflict of interest is a form of corruption or a reason leading to corruption, the two parties agree on the following definition for conflicts of interest:

"A conflict of interest is a situation in which a public official has a private or other interest which is such as to influence, or appear to influence the impartial and objective performance of his or her official duties." (Reed, 2008)

FIDIC, the International Federation of Consulting Engineers defines it in the same way by replacing "public official" with "FIDIC members" and referring to "engineering duties", so their definition is "the situation that may involve potential conflict between consulting activities with prior or current obligation to other clients, client's staff, or procurement of goods, works or services." (FIDIC, 2015)

Experience shows the importance of this phenomenon and its impact on the performance of construction projects. Bowen et al. (2012) stressed that "a conflict of interest must be seen as an urgent target for attention." In other words, it is a step in the direction of or a critical threshold to corruption. Therefore, in this research, conflicts of interest are considered a form of corruption. Table 3-9 shows some examples of conflicts of interest during project phases:

Project phase	Examples for corrupt practice (conflict of interest)
Project selection	The chairman of an Olympic committee chooses his city to host the Olympic Games; so many stadiums and sport facilities are constructed in his city despite the lack of such facilities in other cities in the country and the fact that other cities would be more convenient for such a project.
Planning	A member of the licensing committee is a shareholder in a project requesting a license from the same committee.
Design	An owner representative (engineer) requests a study from a designer that is not related to the current project and doesn't have any impact on it. The engineer will use this study in another project where he will be engaged as a designer to profit from this study and save time and money.
Pre-qualification and Tendering	The brother of a member in the tender's evaluation committee owns a construction company and bid to this tender.
Execution	A manager of a large project establishes a concrete plant and awards all concrete delivery to this new established company.
Operation and Maintenance	An official in charge of operating a governmental building establishes a facility management company registered in the name of his wife, and then awards the operation and maintenance contract to this company.

Reconstruction/Decommissioning	A municipal official seeks to demolish an existing facility before its estimated expiry time (reduce its expiry period) on the pretext that a road runs through it, but in reality, the removed facility belongs to one of his relatives and he will be rewarded a large amount of money; i.e. much larger than the real value of facility (overestimation).

Table 3-9: Examples of conflict of interest in different phases of construction projects

Nepotism:

In chapter 2, we found that favouritism is one form of corruption and it is a mechanism of power abuse implying "privatization". It was referred to it as the natural tendency of people towards their relatives, family members, or close friends. Favouritism is also found in the construction industry and it was referred to by Bowen et al. (2012) as "nepotism". Bowen et al. (2012) relates nepotism to conflict of interest, therefore, it can exist in all project phases. An example of nepotism or favouritism in an infrastructure project is when a project manager assigns one of his relatives to manage contracts, one of his children to manage purchases, one of his brothers to manage another lead role. They, also, follow the same trend. Consequently, activities are assigned to unqualified people. This leads to a big malfunction in the project and to negative consequences.

Abuse of Power:

Despite the general definition of corruption as abuse of power, some researchers interested in corruption in construction industry like Stansbury classify the abuse of power as one of the forms of corruption. "Abuse of power is often a separate criminal offence. However, it may also constitute bribery or fraud" (Stansbury, 2008). The above examples can be linked to the abuse of power, like awarding contract with bribery, issuing permit with a facilitation payment, or sending blackmails...etc.

Money Laundering:

Money Laundering is not only a criminal offence punished by law, but is also a form of corruption within the context of corruption in construction. It shapes almost the last stage of corruption. Money laundering, as defined by TI's glossary "is the process of concealing the origin, ownership or destination of illegally or dishonestly obtained money by hiding it within legitimate economic activities to make them appear legal". Stansbury (2008) sees that money laundering occurs where a party moves cash or assets obtained by criminal activities from one location to another. The purpose of money laundering is to hide the source of illegal money. Therefore, money laundering can occur in all project phases; e.g. to hide money resulting from another form of corruption. For example, in the planning phase, a project owner bribes a government official to issue a building license. The government official transfers the bribe paid to another bank account, or he transfers it into other assets (real state, cars. jewellery, etc.)

3.1.3 Relationship between Different Forms of Corruption in Construction

The most important feature that characterizes corruption in construction is the relationship between its different forms. Stansbury (2008) argues that one corrupt practice may often entail additional practices.

Bribery, for example, always involves a degree of fraud, or it may be used to cover a fraud. As an example, a contractor bribes an owner's representative (engineer) to fraudulently approve a claim based on false information. Furthermore, Stansbury (2008) sees that collusion; embezzlement and abuse of power normally involve fraud to hide these practices by presenting false documentation or by making false statements. "The price" of this fraud is bribery. All these practices may end in money laundering to hide the money gained illegally and conceal it from the eyes of governance and legal authorities (Stansbury, 2008).

Figure 3-2 and Figure 3-3 illustrate examples for relationships between different corruption forms in both tendering and execution phases, respectively.

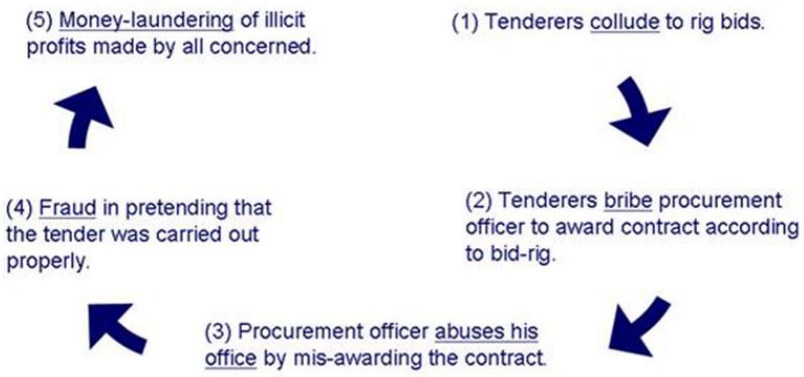


Figure 3-2: Relationship between different corruption forms in tendering phase (GIACC, 2008)

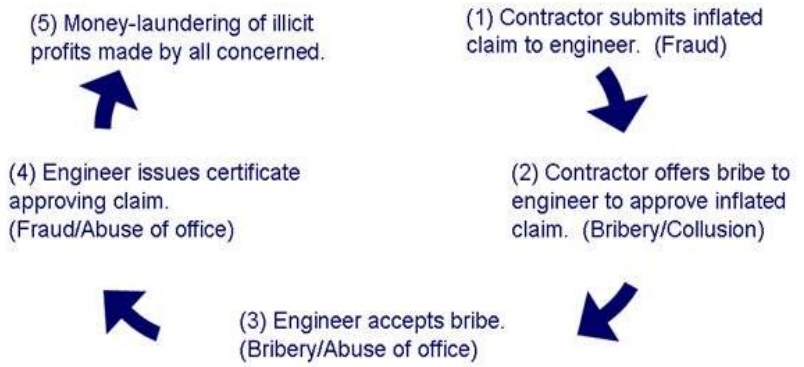


Figure 3-3: Relationship between different corruption forms in execution phase (GIACC, 2008)

3.1.4 Areas of Corruption in Construction

Arumugam (2002) argues that all activities related to the construction industry became subject to corruption. He summarized areas of corruption based on the accumulative experience of researchers and teams of the Chief Technical Examiner of the Indian Government's Central Vigilance Commission. He defined the following areas:

- Administrative Approval
- Detailed Estimate & Technical Sanction
- Consultancy

- Preparation of Tender Documents
- Invitation and Opening of Tenders
- Tender Assessment and Award of Works
- Works Agreement
- Payment to Contractors
- Site Records
- Quality in Construction

Stansbury (2008) used a different approach; instead of discussing the areas in which corruption in construction exist; he refers to the project phases with no exception:

- Project Selection
- Planning
- Design
- Funding
- Pre-qualification
- Tendering
- Execution
- Operation and Maintenance
- Dispute Resolution: where within dispute resolution the witnesses experts or judges may be bribed in order to give false evidence in a dispute proceeding or to give a favourable opinion (Stansbury, 2008)

X.W. Zou (2006) sees that corruption in construction exists with all stakeholders and in all phases of construction projects.

All three scholars (Arumugam, 2002; X.W. Zou, 2006; and Stansbury, 2008) conclude that corruption in construction goes beyond the construction process and its stakeholders and also involves government authorities or departments, management organizations, and officials.

All this increases the complexity and importance of the corruption phenomenon in the construction industry. However, the question remains why there is a lack of interest in this issue in construction.

Sohil and Cavill (2006) tried to answer this question. They consider the negligence of corruption in the construction industry as an "unnoticed" and "understudied" phenomenon.

They found two explanations, either (1) there are those who are not directly and personally involved in corruption and who turn a blind eye to it – especially, when they fail to investigate it or they don't have sufficient evidence. Or, (2) they are project managers faced with corruption in their projects and consciously decide to conceal this fact for personal or professional reasons. Sohil and Cavill (2006) found that "such scenarios make it difficult to ascertain who bears personal, direct responsibility for instances of fraud, irregularities or mismanagement in the sector".

3.2 The Causes of Corruption in Construction

Undoubtedly, construction is a vital sector in every country. It affects and is influenced by the development of a country, especially since its infrastructure sector provides the basis for other economic sectors. Therefore, the general reasons for corruption also apply in the construction industry. In this section, the reasons related to political, economic and social systems, will not be analysed. Additionally, this section will focus on reasons related to the construction sector itself.

According to Kenny (2007), the knowledge as to why the construction sector is highly prone to corruption is extremely limited. However, most scholars in this field argue that the reasons for corruption in construction are related to the nature of the construction project itself which facilitates corruption (TI, 2006; and Stansbury, 2008). They identify the features of a construction project which facilitate corruption as follows (Stifi; Gehbauer and Gentes, 2014):

- *Contractual structure:* Construction projects link many participants together. Each link has its own contractual form where every item of work, acceptance of lower quality work, extension of time or approval of additional payments provides an opportunity for corruption.
- *Diversity of skills and integrity standards:* the construction industry is a very diverse industry in terms of:
    - *Profession:* such as architect, structural engineer, civil engineer, mechanical engineer, electrical engineer, electronics engineer, banker, lawyer, e.g. each of these professions may have a different national professional association with different codes of conduct, differing levels of enforcement of these codes and different culture
    - *Trades:* such as machine operator, concrete pourer, steel fixer, scaffolder, erector, pipe fitter, cladder, brick layer, plasterer, e.g. also each of these trades may have a different national trade association and different culture
    - *Specialist contractors:* such as excavation, foundation, civil, building, erection, insulation, cladding, roofing, turbine, generator, boiler, pipework, pumps, cooling systems, controls and instrumentation

  This diversity leads to varied standards of qualification, integrity, and overview.
- *Project phases:* Projects normally consist of several different phases, each involving different management teams and requiring handovers of a completed phase to the contractors undertaking the next phase. Even if one main contractor undertakes all phases, he will normally sub-contract the different phases. This leads to difficulties in control and impedes the project overview.
- *Project size:* Some projects are very large in scale like nuclear power plants and major infrastructure projects which cost significant amounts of money. It is easier to hide large bribes and inflated claims in large projects than in smaller projects.
- *Unique projects:* Many construction projects, especially larger ones, are unique, subsequently the costs are often difficult to compare which makes it easier to inflate costs and hide corruption.
- *Project complexity:* Large construction projects are complex, and the people working in the project appear not to know the reason why something has gone wrong or why costs have been overrun. This makes it easier to blame others for a problem, and to claim payment for this problem, even if such claims are unjustified. It also creates a reason to pay a bribe, as decisions on cause and effect and their cost consequences can have enormous impact.
- *Concealed work:* Most components in a construction project end up being concealed by other components. For example, structural steel may be concealed by concrete. As a result, enormous dependence is placed by the industry on individuals certifying the correctness of the work before it is concealed. This provides opportunities for fraudulent claims, and the payment of bribes to these individuals to certify too much work, or to approve defective or non-existent work.
- *Lack of transparency:* There is little transparency in the construction industry and without such transparency it is more difficult to detect corruption. The greater the transparency, the more difficult it will be to conceal corruption (TI, 2006; and Stansbury, 2008).

- *The extent of government involvement:* The extent of government involvement in construction projects is significant. Many major international construction projects are government owned. Even private sector projects normally require government approvals, such as planning permission, or agreements to pay for the use of the end product of the development. The power wielded by government officials in this regard, when combined with the structural and financial complexity of the industry as referred to above, makes it relatively easy for uncontrolled government officials to extract large bribes from construction projects.

Cavill and Sohail (2007) add to the above listed features the existence of various organizations as "No single organization governs the industry" where each profession or trade may have a different professional association with different codes of conduct and levels of enforcement to these codes.

Pope (2000) argues that opportunities of corruption in public sector projects are created by the complicated procurement procedure and the large amount of money involved. He sees this as incentive factors for corrupt behaviour. Sohial and Cavill (2006) share his opinion when they referred to bureaucratic systems with complex processes and regulations.

Aside from the nature of construction projects and their complexity, Nordin et al. (2013) studied the human behaviour as a factor for corruption in the construction sector. They define corruption as "a deviant behaviour which deviates from normal duties of a public role, pecuniary, and violates official ethics of public services". In this context, they studied behavioural factors that lead to corrupt action. They found the two main factors are:

- Desire: desire to achieve a private or professional goal through corrupt action
- Intention: intention to achieve a private or professional goal through corrupt action

The results of their study revealed that the power of "desire" to perform corrupt acts is the dominant factor compared to "intention". However, desire can influence intention, and to a certain extent intention can decrease due to control factors such as motivations, laws, regulations, and values of individuals (Nordin et al., 2013).

In the literature, equivalents to Nordin's approach can be found. For example, Sohial and Cavill express this as "lack of morals" (Cavill and Sohail, 2006) and as "morally bad behaviour" (Cavill and Sohail, 2007). While X.W. Zou (2006) expresses it as a "moral tone". Also, the three terms "moral", "honesty" and "ethic" are used interchangeably. The idea is also shared by Stansbury (2008) who believes that corruption is usually done by the "one willing" to do it. He states "corruption usually occurs because some individuals are willing to use illicit means to maximize personal or corporate profit." This also complies with what Nordin et al. (2013) defined with respect to desire and intention.

3.3 The Consequences of Corruption in Construction

As mentioned above, the reasons for corruption in construction are significantly linked to the general reasons of corruption discussed in chapter 2. The aggregated negative effects of corruption resulting from different sectors including the construction sector have economic, political and social consequences.

Experts of science and the industry point out, that corruption in the construction sector has many negative effects; not only on projects level but also on environmental and social levels. First of all, it endangers the life of humans. It is not secret that a big number of buildings around the world collapse due to corruption. As an example, the collapse of the Dhaka Rana Plaza in Bangladesh which led to the death of 1,127 people was caused by corruption (Barnes, 2013). A similar story happened in Dar es

Salaam in Tanzania when the owner and the contractor ignored the maximum number of storeys permitted. The planning permission was for a 10-storeybuilding and it collapsed when it was 16-storeys high. Unfortunately, many similar stories from all over the world exist.

Literature review revealed that the terms "consequences", "effects" and "results" are used interchangeably when referring to the consequences of corruption.

Projects are usually aimed at what classical project management calls the "project management triangle", i.e. quality, cost and time. This generally means to achieve high quality at the least possible cost and in the fastest time. Kenny (2007) argues that the major impact of corruption is the "poor quality construction and low funding for maintenance" where corruption has a "multiplier effect" among the different stages of the project, e.g. lower quality design, lower quality of construction, all leading to increased prices to cover low quality, up to the theft of materials and equipment. In general, he sees corruption as a factor of cost and time overrun "some of these cost and time escalations, as well as poor quality, are linked to weak governance and corruption" (Kenny, 2007).

The various forms of corruption in construction and their existence in the different phases of construction projects lead to many consequences, such as:

- Bribery, fraud and conflict of interest may lead to unnecessary or unsuitable projects.
- Favouritism and nepotism lead to assigning unsuitable persons to unsuitable positions. Consequently, they lead to fatal errors that affect the quality, cost and time of projects.
- Collusion among contractors during tendering leads to extra project costs compared to normal costs resulting from fair competition.

Stansbury assessed the consequences of corruption on stakeholders, from project owners to the public (end user) including project funders, construction companies, consulting engineering firms, suppliers, project officers and employees, and government officials. With respect to the consequences of corruption he even extends the term "consequences" with the notion of "loss and damage". Using these two terms together is, on one hand, evidence to the negative effect of corruption, and on the other hand it shows the "physical influence" of corruption (e.g. cost overrun) and the "mental or moral influence" (e.g. poor quality, impact on environment, or humans life endangered).

Through corrupt actions, the greatest loss and damage caused to stakeholders is presented by Stansbury (2008) as follows:

- Loss and damage for the project owner: The project owner may suffer loss and damage because of corrupt actions within his project, e.g.:
    - Theft of project funds
    - Increased project price
    - Increased maintenance, repair and replacement costs
    - Additional financing costs
    - Increased operating costs and reduced operating profits
    - Loss of business opportunities and investment
    - Damages for civil liability
    - Fines for criminal liability and legal fees
- Loss and damage for the project funders: The project funder may suffer loss and damage because of corrupt actions within the funded project, e.g.:
    - Total or partial loss of investment
    - Reduced profitability

  - Loss of business opportunities and investment
  - Damages for civil liability
  - Fines for criminal liability and legal fees
- Loss and damage for construction companies, consulting engineering firms, and suppliers: The companies in charge in the construction process may suffer loss and damage because of corrupt actions within the project, e.g.:
  - Bribes paid during the tendering phase some or all tenderers will be recovered by inflating the contract price of the successful tender and unsuccessful tenderers will bear the cost of the bribe paid
  - Increased contract operating costs
    - to obtain work permits and import licenses
    - to receive contract payments due
    - to obtain approval for both legitimate or fraudulent claims
    - to remove legitimate or unduly onerous environmental, safety or social requirements
    - to obtain approval of defective works or fraudulent services.
  - Loss of payment or profit
  - Termination of contracts and loss of work
  - Loss of business opportunities and investment due to loss of reputation
  - Loss of business opportunities due to debarment
  - Damages for civil liability
  - Fines for criminal liability and legal fees
- Loss and damage for project officers, employees and government officials: The officers, employees, and government officials working for organizations involved in the project may suffer loss and damage because of corrupt actions within the project, e.g.:
  - Loss of income due to loss of employment
  - Damages for civil liability
  - Imprisonment and/or fines for criminal liability and legal fees
  - Injury or death
- Loss and damage for the public: The public may suffer loss and damage as a result of corrupt actions, particularly when occurring in infrastructure projects, , e.g.:
  - Inadequate infrastructure
  - Dangerous infrastructure
  - Displacement of people
  - Damage to the environment
  - Reduced spending in infrastructure due to loss of confidence in the sector
  - Generally, fewer public expenditure because of depleted public funds
  - Reduced foreign investment due to loss of confidence in the country
  - Loss of quality of life
  - Loss of earnings
  - Increased taxation
  - Injury and death
  - Contributing to endemic corruption

Sohail and Cavill (2006) believe that knowing the consequences of corruption in construction is one of the most important factors to take this issue seriously. Corruption may begin with hiding a wrong doing, e.g. insufficient compaction under foundations, and consequently ends with collapsing buildings, taking the lives of many victims.

In closing this paragraph, the question "Can we measure the cost of corruption?" is worth discussing.

In answering this question, expert literature provides two scenarios. The first gives an estimated value to the cost of corruption in construction, stated in the American Society of Civil Engineering (ASCE) 2004 and TI Global Report (2005): "The global construction market is worth around $3.2 trillion per year which represents 5-7% of the gross domestic product (GDP) in the developed countries and around 2-3% of the GDP in lower income developing countries and corruption accounts for an estimated $340 billion of the worldwide construction costs each year." (Sohail and Cavill, 2008)

A newer study by McLaughlin (2013) demonstrated that "the value of global construction industry is $8.6 trillion now, rising to $15 trillion by 2025 and the cost of corruption is $1 trillion now and if the relevant action is not taken, the cost of corruption will raise to $1.5 trillion by 2025."

The first scenario provides an idea as to the cost of corruption in construction on a global level, accounting for approximately 10-12% of the industry worth as shown in Figure 3-4 below.

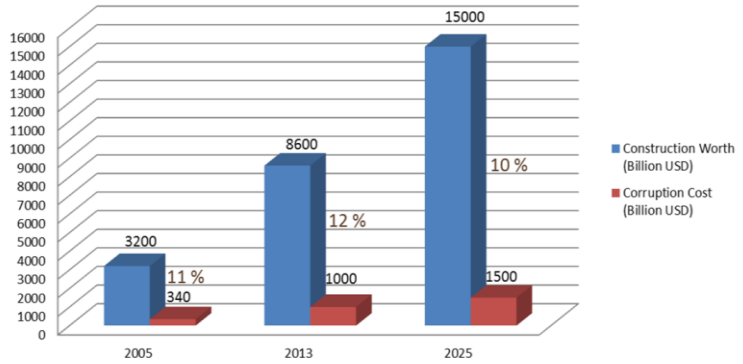


Figure 3-4: The global construction market worth and the cost of corruption, based on (Sohail & Cavill, 2008; McLaughlin, 2013)

The second scenario is suggested by Stansbury who showed difficulty and complexity in calculating the cost of corruption in a construction project. He presumes that the cost of corruption within construction projects is the total sum of "loss and damages" that is caused by all corrupt activities within or related to the project. Stansbury states that "the sum total of that loss and damage (which is unlikely to be wholly identifiable or quantifiable) may be said to be the cost of the corruption in relation to that project. Consequently, calculating that cost is an extremely complex (and potentially impossible) process" since the following points need to be considered (Stansbury, 2008):

- Each corrupt activity that has occurred during or in relation with the project.
- Each stakeholder that has suffered loss and damage as a result.
- The types of loss and damage occurred to each stakeholder.
- The amount of each type of loss and damage occurred to each stakeholder with respect to each corrupt activity.

However, he argues that it is impossible to determine the above points and to give any accurate value on the cost of corruption for several reasons:

- Lack of raw data of proven corrupt activities
- Difficulty in identifying the type of loss and damage that results from proven corrupt activities
- Difficulty in quantifying loss and damage

3.4 Dealing with Corruption in Construction - "Risk Based Approach"

Discussing the causes and consequences of corruption in construction leads to the question is how is corruption currently being fought; specifically in the construction industry?

The literature review shows that construction does not deal with corruption differently than other industries and institutions. All of them deal with corruption in the same way, using a "Risk Assessment Approach". OECD, UNODC and WB (2013) believe that the primary purpose of the corruption risk assessment is to achieve a better understanding of these risks, so that appropriate steps and decisions can be taken against these risks during risk management processes.

Risk management processes will be discussed in detail in the following paragraph prior to analysing corruption risk assessment.

3.4.1 Risk Management

The Project Management Institute PMI (2013) defines risk as "an uncertain event or condition that if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality".

Risk is most probably deemed as "hazard or threat" with negative consequences. However, there is risk which has positive consequences; in this case, it is no longer a "threat" but an "opportunity" (PMI, 2013). Regardless of positive risks (rare) or negative risks (common), many researchers in the construction sector tried to classify types of construction risks into various categories. Perry and Hayes (1985) differentiated risks as perceived by clients, consultants, and contractors. According to Abdou (1996), risks in the construction industry can be related to any of the three: construction time, construction finance, and construction design. Champan (2001) on the other hand referred to four sub-sets of construction risks: client, industry, project and environment, Shen et al. (2001) identify risks in construction based on the country of work and business model. For example, in Chinese construction joint ventures they recognize six categories of construction risks: financial, legal risk, management risk, market risk, policy & political risk, and technical risk.

Zou et al. (2006) identify 20 key risks affecting each of the project objectives. Table 3-10 enlists those 20 risks. These risks occur at various phases of the project; i.e. feasibility, design, construction and operation as perceived by different stakeholders (clients, designers, contractors, suppliers, government, and external stakeholders). Zou et.al (2006) tried to present a consolidation of key risks, stakeholders and project life cycle using a fish-bone diagram, as shown in Figure 3-5.

Risk No.	Key Risk	Abbreviations
1	Tight project schedule	TPS
2	Design variations	DV
3	Excessive approval procedures in administrative government departments	EAP
4	High performance/quality expectations	HPQE
5	Inadequate program scheduling	IPS
6	Unsuitable construction program planning	UCPP
7	Variations of construction programs	VCP
8	Low management competency of subcontractors	LMCS
9	Variations by the client	VC
10	Incomplete approval and other documents	IAD

11	Incomplete or inaccurate cost estimate	ICE
12	Lack of coordination between project participants	LCP
13	Unavailability of sufficient professionals and managers	UPM
14	Unavailability of sufficient amount of skilled labour	USL
15	Bureaucracy of government	BG
16	General safety accident occurrence	GSAO
17	Inadequate or insufficient site information (soil test and survey report)	ISI
18	Occurrence of dispute	OD
19	Price inflation of construction materials	PICM
20	Serious noise pollution caused by construction	SNP

Table 3-10: Key risks impacting project objectives, source (Zou et al., 2006)

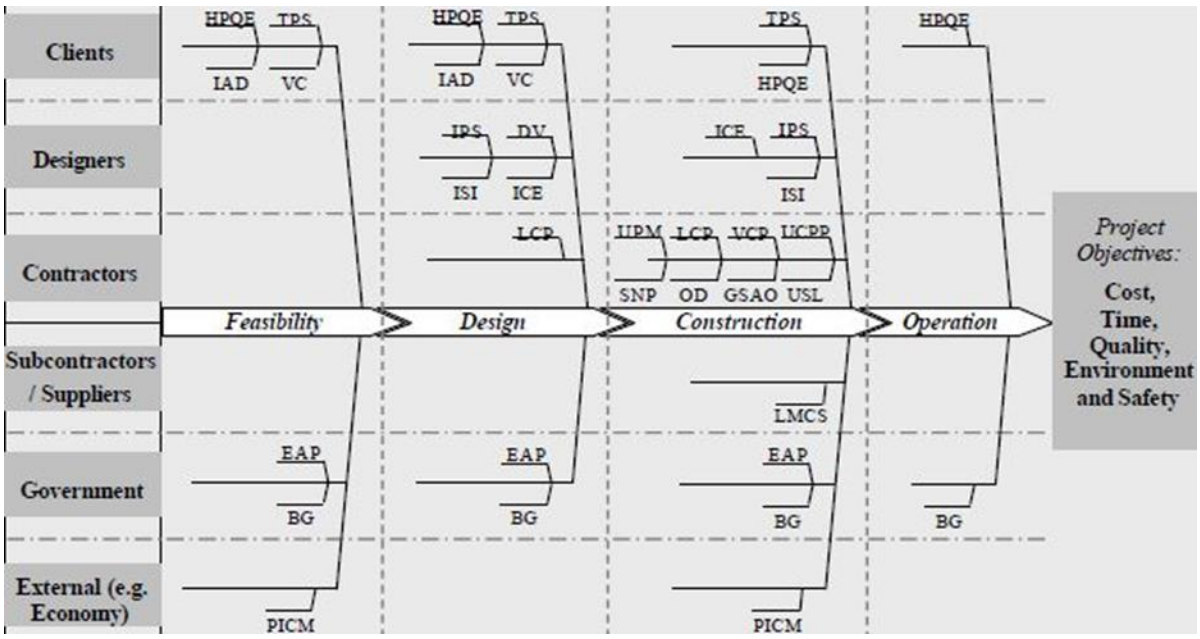


Figure 3-5: Key risks at different phases as perceived by stakeholders, source (Zou et al., 2006)

Actually, managing risks is perceived as one important management process in order to achieve the project objectives. In order to achieve desired project success and deal with unexpected and uncertain events a proper management framework is required which is provided in the form of "risk management". Uher (2003) described risk management as a tool which identifies risk resources, determine the impact of risk and accordingly develop management responses. Despite the importance of risk management in construction industry Laryea (2008) sees that the construction industry lags far behind other industries such as finance and insurance in their sophistication and application of risk management.

Rezakhani (2012) argues that systemic project risk management influences a project`s success. As evidence, he stated that "it has been found that there is a strong relationship between the amount of risk management efforts undertaken in a project and the level of the project`s success".

The Project management Institute PMI (2013) pointed out in its book PMBOK5 that risk management consists of six processes:

- Plan risk management: the process of defining how to conduct risk management activities for a project
- Identify risk: the process of determining which risks may affect the project and documenting their characteristics
- Perform qualitative risk analysis: the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact.
- Perform quantitative risk analysis: the process of numerically analysing the effect of identified risks on overall project objectives.
- Plan risk responses: the process of developing options and actions to enhance opportunities and to reduce threats to project objective.
- Control risks: the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks and evaluating risk process effectiveness throughout the project.

According to PMBOK5 classification, the first five processes are part of the planning process group, while the sixth process (control risks) is part of the monitoring and controlling process. Figure 3-6 shows an overview of project risk management based on PMI's approach including inputs, tools, techniques and outputs of each of the six processes.

Rezakhani (2012) considers only four processes i.e. identifying, assessing, responding, and monitoring and/or reviewing risks. He argues that risk assessment is an important process, thus its methods play an essential role in risk management. Currently, there are two categories for risk assessment methods (Rezakhani, 2012):

- Simple classical methods such as Fault Tree Analysis
- Advanced mathematical models such as Fuzzy Set Theory for qualitative judgments and Monte Carlo Simulation for stochastic quantitative modelling and analysis

Goh et al. (2013) argue that the selection of proper risk management tools and techniques is critical to better decision-making, and thus a successful risk management process. In this regard, they suggest risk management workshops for the identification and analysis of risk, including risk checklists, probability and impact matrices, expert judgment, brain storming and risk registers.

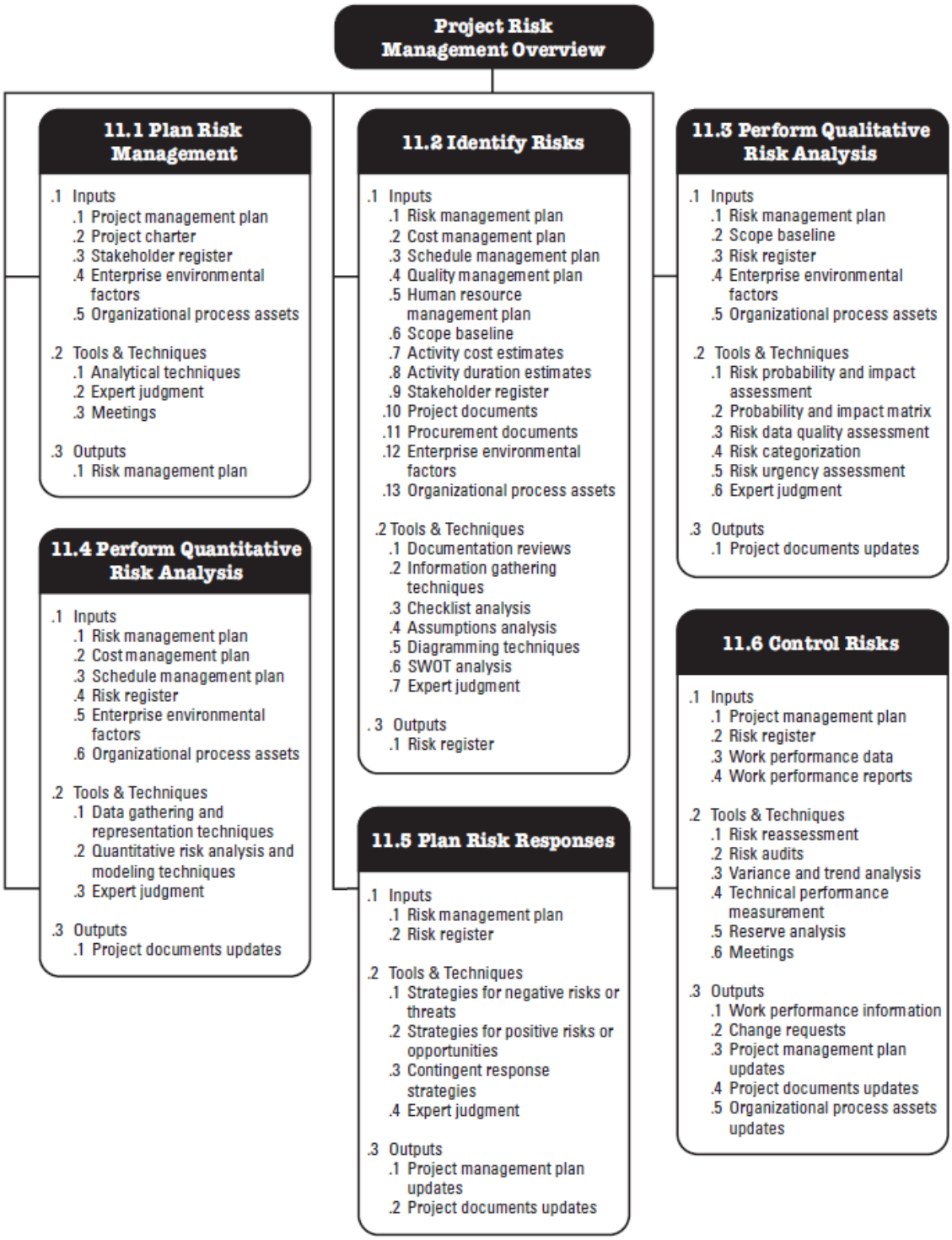


Figure 3-6: Project risk management overview (PMI, 2013)

3.4.2 Risk Management as Framework to Combat Corruption

Since the beginning of 1990s, many international organizations have put the fight against corruption at the top of their agendas. They work to raise awareness of this dangerous development among societies, organizations, companies, and governments. Furthermore, they work together to develop and construct a suitable framework to deal with corruption. They agreed to implement a risk assessment approach as introduced in the "The Anti-Corruption Ethics and Compliance Handbook for Business" published in 2013. This effort has been jointly coordinated by the OECD, UNODC, and the World

Bank. The book refers to all businesses and not a specific industry alone, therefore, it is applicable to the construction industry, too. Moreover, it provides a general framework for any enterprise to use as guidance and develop its own risk assessment to fit their unique requirements as to industry, its size, location and work environment (OECD, UNODC; and WB, 2013).

This handbook provides basic steps for a corruption risk assessment approach as follows:

Step 1: Establish the Process

The first basic step in the approach is the "honest desire" based on a good understanding of corruption risk and its potential legal consequences in addition to the commitment of stakeholders involved in the process taking into consideration the sensitivity of the topic of corruption. Therefore, an introductory workshop to raise awareness with the key person among the stakeholder will be a good start. However, the handbook sees that it is wise to take into consideration the following points when initiating a process:

- Who owns the process and who are the key stakeholders?
- How much time will be invested in the processes?
- What type of data should be collected, and how?
- What internal and external resources are needed?
- What framework will be used to document, measure and manage the corruption risk?

PMI's "11.1 Plan Risk Management"shown above in Figure 3-6 can help in establishing the process.

Step 2: Identify the Risks

In this step, corruption risks are identified. An enterprise might use question techniques to identify risks such as:

- Why would corruption occur at our enterprise?
- How would corruption be perpetrated at our enterprise?
- Where in our business processes is there exposure to corruption risks
- What type of transactions and arrangements with government employees and third parties could result in creating corruption risks?
- What locations where we do business pose a greater corruption risk than others?

However, there are many ways for an enterprise to collect data and facts about how and why corruption may occur. Some of these ways are:

- Desktop research
- Reports from the internal audit function on compliance risk, past incidents of non-compliance, and common corruption risks.
- External sources like research on corruption cases
- Understanding of the specific areas of potential direct and indirect interaction with government employees
- Interviews with individuals from functions such as legal, risk management, ethics and compliance internal audit and procurement, as well as with senior management
- Surveys, including self-assessment of employees and external parties
- Workshop or brainstorming sessions to explore corruption risks

This corresponds to some extent to what Goh et.al. (2013) suggested and to PMI's approach, "11.2 Identify Risks" of Figure 3-6 .

Step 3: Rate the Inherent Risk

The definition of corruption risks is followed by their evaluation. In practice, risks are then prioritized although it would be desirable that enterprises deal with risks on the same level of importance and response. However, since companies usually do not have resources available to efficiently and effectively deal with these risks, the risks are rated according to their probability and impact.

The PMI (2013) explains that "the quality and credibility of the risk analysis requires that different levels of risk probability and impact be defined that are specific to the project context."

A simple relative or numerical scale could be used to classify each probability or potential impact. For example, a simple qualitative scale can be high, medium or low or very high, medium, low and very low.

Combining the probability and potential impact assessment for each corruption risk generates an assessment of inherent corruption risk. The inherent risk represents the overall risk level without consideration of existing control.

It is very similar to PMI's approach (2013) in their "probability and impact matrix" which is defined as "a grid for mapping the probability of each risk occurrence and its impact on project objectives if that risk occurs. Risks are prioritized according to their potential implication for having an effect on the project objectives." As illustrated in Figure 3-6, "11.3 Perform Qualitative Risk Analysis", the probability and impact matrix is one of the tools of risk analysis based on PMI's approach

Step 4: Identify and Rate Mitigating Controls

After identifying, and classifying risks into different priorities levels, now, existing controls and mitigating activities are assigned to each corruption risk. Controls must be based on the results of previous processes – i.e. the inherent corruption risk. Here, it is important to distinguish between preventive and detective controls.

In this step, there are also several ways to rate the design and effectiveness of mitigating controls, either with a simple qualitative scale to classify each set of controls that mitigates a corruption risk or with a quantitative scale with numerical value scores.

This step is similar to PMI's approach "11.5 Plan Risk Response" as in Figure 3-6, where a strategy or a mix of strategies with the most likely effectiveness should be selected per risk. The strategy referred to as "mitigation control".

Step 5: Calculate the Residual Risk

According to the handbook, residual risk "is the extent of risk remaining after considering the risk reduction impact of mitigation controls." Here, it should be taken into consideration that corruption can still occur despite implementing the controls referred to in step 4. Therefore, it is important to consider residual risks in order to assess whether existing controls are effective and proportionate to the level of the inherent risk. The handbook emphasizes that "as with inherent risk, there is an element of judgement involved in assessing the residual risk of each corruption risk". Here, the same mentioned scale to rate residual risk can be used. However, ii is advisable to use the same scale (qualitative or quantitative) for the assessment of both inherent and residual risks.

In this step, "11.6 Control Risks" of the PMI approach as shown in Figure 3-6 applies.

Step 6: Develop an Action Plan

The last step in risk assessment implemented to overcome corruption risks, as introduced in the handbook, is to develop an action plan based on the results of residual risk assessment. Here, the level of corruption risk tolerance set by enterprise's management and approved by those charged with its governance plays a vital role. If a residual risk is within the risk tolerance, then no further risk mitigation is required. Otherwise, an action plan to reduce the risk until it is within the tolerance threshold is needed as "corruption risk response plan".

Here, the PMI approach can also be useful, especially point 11.6 as shown in Figure 3-6; i.e. change requests including corrective actions. PMI (2013) analyses the occurrence of change requests as follows: "Planning for possible risk responses can often result in recommendations for changes to the resources, activities, cost estimates, and other items identified during other planning processes. When such recommendations are identified, change requests are generated and processed through the Perform Integrated Change Control process".

As an associated process to corruption risk assessment, a documentation process is a very important element to record the results and accompanies the above mentioned steps. The tool most used is risk register. It is actually similar to point 11.2 of PMI's approach presented in Figure 3-6, where the output of the "Identify Risks Process" is the risk register. PMI (2013) defines risk register as follows: "The risk register is a document in which the results of risk analysis and risk response planning are recorded. It contains the outcomes of the other risk management processes as they are conducted, resulting in an increase in the level and type of information contained in the risk register over time".

Table 3-11 shows a sample for a template of risk register introduced by the handbook (OECD, UNODC; and WB, 2013).

Location/Region: ABC Business Unit: XYZ								
Corruption Risk Factor	Corruption Risk	Corruption Scheme	Probability	Potential Impact	Inherent Risk	Anti-Corruption Controls	Control Risk Rating	Residual Risk Rating
Local business climate	Bribery of a government officials	Potential improper payments to government officials in order to obtain permits	Medium	High	High	- Global Anti-Corruption Policy and Procedures, including specific content on payments to government officials - Anti-corruption training for employees that is tailored for select regions and key functions - Global whistleblower hotline - Annual anti-corruption audits on payments to government officials	Effective	Medium

Table 3-11: Sample risk register template, resource (OECD, UNODC; and WB, 2013).

The handbook also introduces the "heat map", an additional tool for documentation purposes, to summarize corruption risk assessment results. It presents these results according to their likelihood and potential impact using coloured backgrounds for each risk which gives an idea about the level of risk. In most cases, three colours are used (red, yellow and green) to indicate the level of corruption risk (high, medium and low), respectively. An example of a heat map is presented below in Figure 3-7.

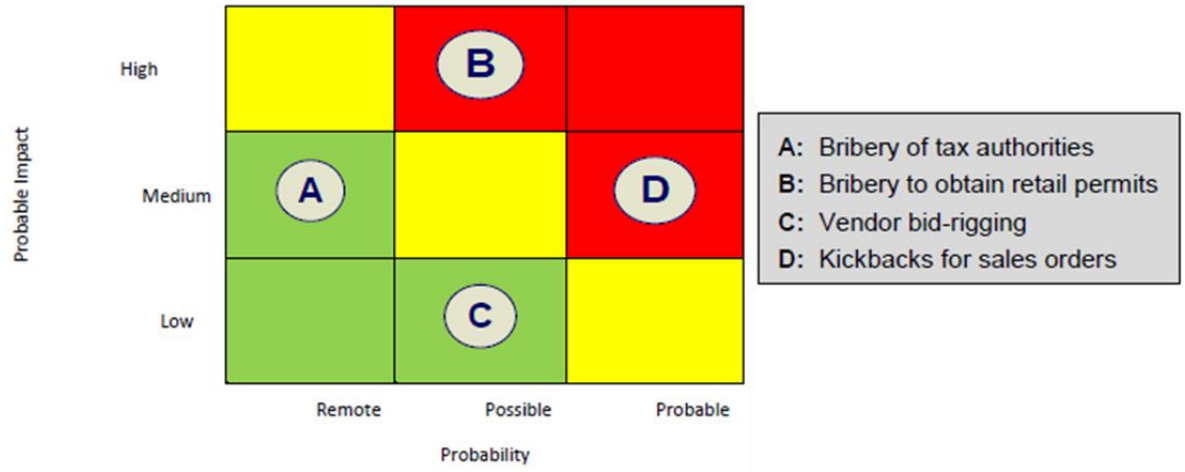


Figure 3-7: Corruption risk heat map (OECD, UNODC; and WB, 2013)

The heat map is similar to the "Probability and Impact Matrix", which is considered one of the tools of PMI's approach as shown in point 11.3 in Figure 3-6. The difference here is in the colour; PMI uses a black and white matrix and the level of risks is identified by different shades of grey. Light grey represents low risk, medium grey represents moderate risk and dark grey represents high risk.

Finally, the corruption risk assessment process based on the previous six steps and associated documentation process as introduced by the handbook of OECD, UNODC and WB can be illustrated as shown in the following Figure 3-8.

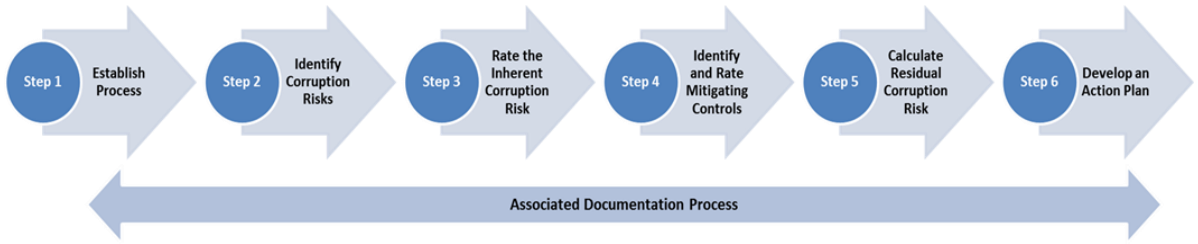


Figure 3-8: Corruption risk assessment process associated with documentation process based on the handbook of OECD, UNODC; and WB (2013).

There are several reasons why fighting corruption in the construction industry is challenging and complex. It is a "sensitive issue" which is often not openly discussed. Moreover, the complexity of construction projects and feeble attempts to fight corruption make it even harder to seriously put an end to corrupt actions. . Even the above introduced "risk management approach" is insufficient due to the fact that risk management to date is neither properly nor professionally implemented in the construction industry. The concept of risk management in construction started lately and despite these extensive researches, a lot of research efforts in this area are still needed. As stated above, Laryea (2008) sees that the construction industry lags far behind other industries when implementing risk management. Perrin (2013) argues that "risk management is done poorly on most projects".

Additionally, the 20 risks identified and studied by Zou et.al (2006) (see Table 3-10 above) do not include a direct reference to corruption as a risk. Nevertheless, risk number 15 mentions "bureaucracy of government", which could be considered as an indirect reference to corruption, even so bureaucracy

is only a petty corruption based on (Disch, 2009) as showed in chapter 2, corruption in construction, however, is much greater than bureaucracy. It is grand corruption.

In the context of the risk assessment approach to deal with corruption in construction projects, Stansbury believes that corruption exists equally in all project phases, which he calls “real risk” versus “assumed risk”. He states that “there is a mistaken assumption that the greatest risk of corruption in the project cycle is in the tendering phase. In fact, an equal risk exists across all phases”. Figure 3-9 (a left side) shows assumed risk of corruption while (b right side) shows real risk of corruption as seen by Stansbury.

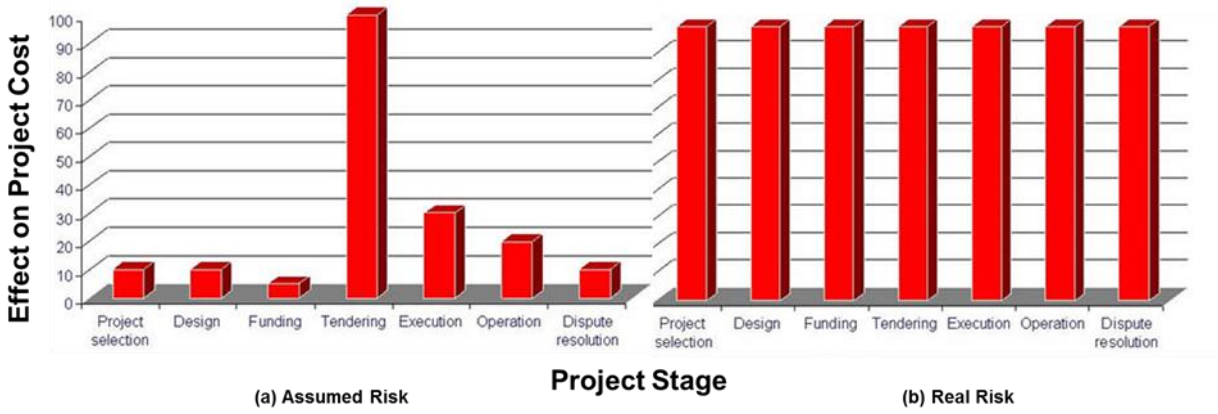


Figure 3-9: The assumed and real risk of corruption among project phases (Stansbury, 2008)

All of the above implies that the current framework “risk assessment approach” used to deal with corruption in construction, at least in its current version, is limited to some extent. However, in more advanced cases, corruption risk assessment is included in a compliance program. Therefore, it is necessary to discuss and understand what “compliance program” or “compliance management” is.

3.4.3 Compliance Management

The term "compliance" is not a new term, although its use is new to some countries, e.g. Vetter (2008) sees it as new term in Germany. He found that the term is rooted in the Anglo-American legal system. The Merriam Webster Dictionary defines compliance as "the act or process of complying to a desire, demand, proposal or regime, or with coercion." Another meaning is "conformity in fulfilling official requirement". The PMI (2013) defines compliance from a management point of view as "a general concept of confirming to a rule, standard, law or requirement."

Schneider (2003) sees that the newness about "compliance" is its extension to become a wide framework involving all organization’s employees, especially executives. It provides a set of arrangements and procedures which aim to ensure running an organization’s business in compliance with the legal requirements that include prohibitions and penalties in case of non-compliance.

Wieland (2010) believes that limiting the definition to the legal aspect makes its less effective. Therefore, he suggests two types of definition of compliance management, a narrow and a wide definition:

- Narrow definition: “Compliance is the set of all precautions to ensure the legally compliant conduct of a company, its organ and employees with regard to all legal regulations affecting the company and its activities”. Another definition based on him is "Compliance refers to all formal and informal governance structures of an organization in which management can efficiently and effectively implement to discover and especially to prevent any malicious acts by members and representatives of this organization". He finds that this definition is still

narrow because it is limited to “malicious act” and it doesn’t include the wide range of social standards, like environment protection, production and work safety or human rights.

- Wide definition: “Compliance can be considered as an organizational model, -process and -system that ensures compliance with the law, internal standards and rules, and with the expectations of stakeholders, so that the company protects and enhances their own business model, reputation and financial conditions”. Wieland refers to this definition as “wide definition” because compliance management considers the expectations of the various stakeholders. This opens the perspective for the social expectations of a compliance system in terms of human rights and social standards, which go far beyond the legal requirements.

Weiland believes that compliance is an essential part of the strategic and operational management of organizations to achieve sustainable, legal, economic, and social aims which are the insurance for continued existence of an organization. In this context, Stessl (2012) believes that the strategic goals of an organization are usually expressed by terms like governance, risk management, and compliance.

Behringer (2010) divided what he called "Intensity of Compliance" into three levels organized in a pyramid as shown in Figure 3-10.

Figure 3-10: Compliance pyramid according to Behringer, source (Reissig-Thust and Weber, 2011)

The legal and other obligatory rules defined by Behringer at the base of the "compliance pyramid" are followed by “Best Practice” on the mid-level, meaning "compliance with non-binding rules" known as "soft law". Good examples of soft law are guidelines and standards pertaining to an industry. At the top of the pyramid, “Social Responsibility” reflects an organization’s commitment to society and the surrounding environment (Reissig-Thust and Weber, 2011).

Grüninger (2010) sees that a close connection between risk management and compliance. Tarantino (2008) distinguished two types of risks; compliance risk and operational risk. He defined them as follows:

- Compliance risk: the risk related to compliance is caused by the failure to act in accordance with regulatory documents.
- Operational risk: a form of risk caused by the failure of internal control over people, process, technology and external events.

An organization will be negatively affected should both compliance and operational risks occur.

Here, it becomes obvious how compliance affects the dealing with corruption risks, when considering major compliance areas as defined by Reissig-Thust and Weber (2011):

- Insider dealing
- Breaches of environmental standards
- Violation of workers and human rights
- Violation of social standards
- Money laundering
- Manipulation of the balance sheet
- Cartel agreement and corruption

This shows the difficulty in identifying corruption when corruption, cartel, and money laundering are concerned. All these terms are included under the term corruption. However, most compliance programs deal with the above mentioned issues even if they use different terms to describe, combine, or express them in detail like in the case of corruption above according to Reissig-Thust and Weber.

In case an organization has a compliance program, it needs a compliance management system to manage it. Knoll argues that a compliance management system can be understood as a type of risk management system designed specially to deal with compliance risks (Wieland, Steinmeyer and Grüninger, 2010). Figure 3-11 shows the compliance management process according to Knoll. It shows that risk management approach is an essential and vital element in compliance management.

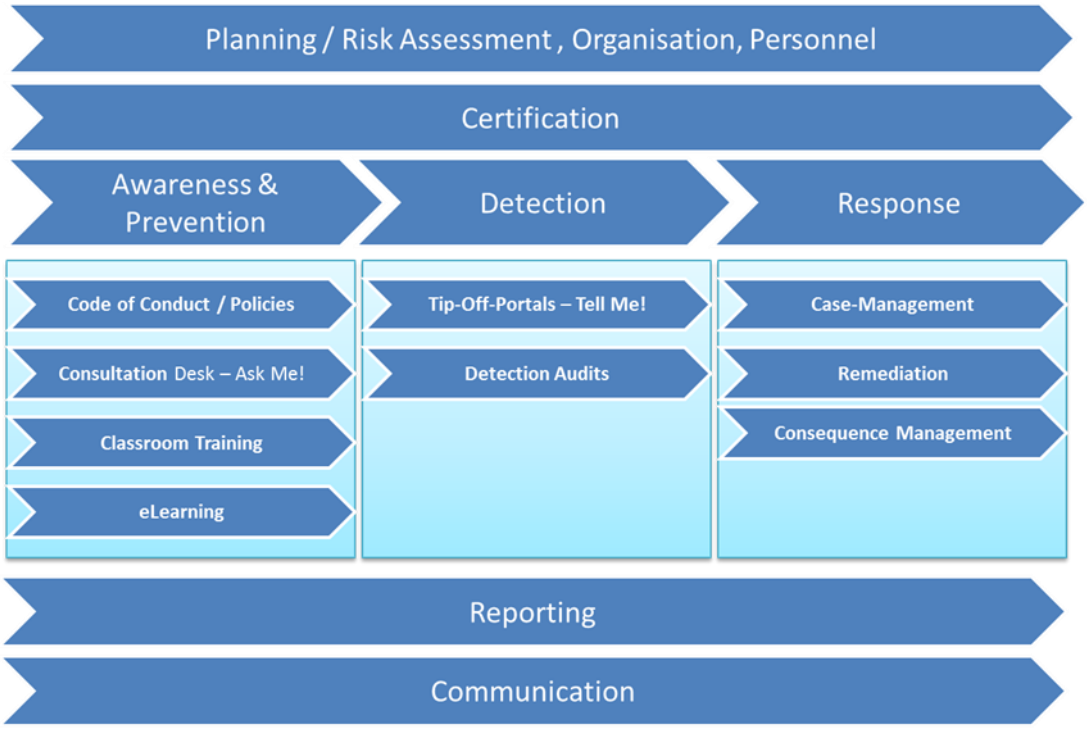


Figure 3-11: Compliance Management Process according to Knoll (Wieland, Steinmeyer and Grüninger, 2010)

In 2012, Deloitte conducted a German study "Compliance Management in the Construction and Real Estate Industry". The study included a survey of 1,171 different organizations from public, private, and financial sectors including major players in construction and real estate industry. The response rate was only 7%, clear signal as to the sensitivity of this study's subject.

The study results found that this specific sector has a definite requirement for the implementation of a "powerful compliance management".

The study also revealed that the development in compliance management in this industry is institutional and systematic and thus requires correction with respect to the value and value-oriented corporate governance.

One of the most important aspects studied by Deloitte is the "existence" of compliance management system in the construction and real estate sector. The study shows that the existence of a compliance management system in German companies depends on the company size; i.e. 90% of the large companies have a compliance management system whereas only 10% of small companies (less than 50 employees) have one.

In general, as shown in Figure 3-12, approximately 30% of all companies have a compliance management system, while 26% are planning to include this system and 44% do not intend to include a system now.

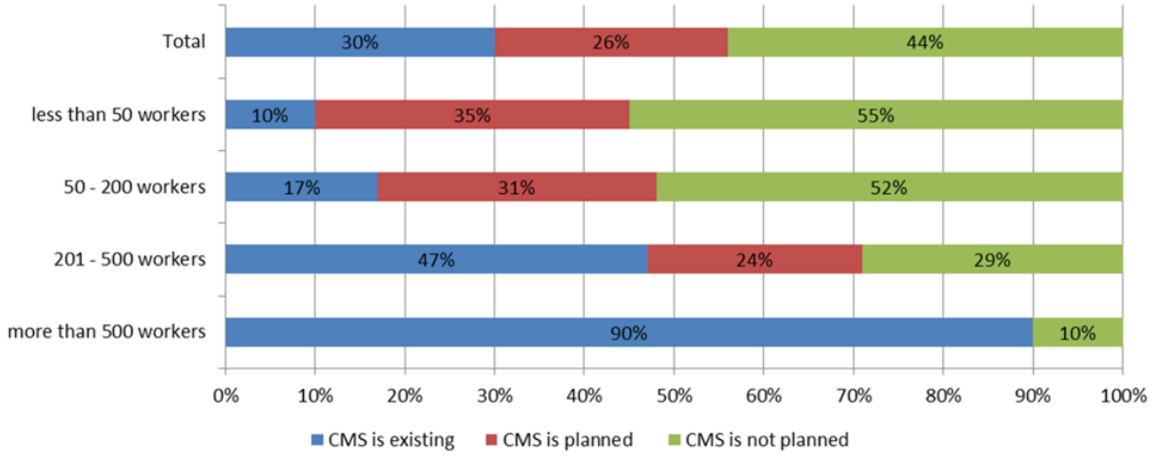


Figure 3-12: Existence of compliance management system (CMS) in German construction and real estate companies (Deloitte, 2012)

In order to determine whether large international construction companies have "a compliance system" or any other similar framework to combat corruption, the top 100 international contractors of the "2015 top 250 international contractors" of the construction industry's most reputable publication, "Engineering New Record" (ENR) were analysed. Table 3-12 on the next page consists of five columns. The first three columns were taken from ENR (2015) directly. The fourth column was derived from the Corruption Perception Index (CPI 2015), and the fifth column lists the type of activity or program the company is implementing to combat corruption within its activities and business. The information gathered in the fifth column is the result of an Internet research based on the companies' English websites/homepages. This research was conducted between 18/12/2015 and 21/12/2015.

RANK (ENR) 2015	Company	Country	CPI 2015	Existence of Compliance Management System (CMS) or other Anti-Corruption Framework
1	ACS, Actividades de Construccion y Servicios SA	Spain	58	Corporate Governance Corporate Responsibility
2	HOCHTIEF Aktiengesellschaft	Germany	81	Compliance
3	Bechtel	USA	76	Ethics & Compliance
4	VINCI	France	70	Sustainability Code of Ethics and Conduct
5	China Communications Construction Grp. Ltd	China	37	Corporate Governance Corporate Culture (Corporate Social Responsibility & Code of Conduct and Compliance Program)
6	TECHNIP	France	70	Corporate Governance Ethics and Compliance
7	BOUYGUES SA	France	70	Corporate Social Responsibility
8	Skanska AB	Sweden	89	Corporate Governance Sustainability (Environmental-, Social- and Economic Responsibility)
9	STRABAG SE	Austria	76	Ethics and Business Compliance System
10	Saipem	Italy	44	Governance (Internal Control and Risk Management System) Sustainability (Commitment to Sustainability, eEnvironment, Health & Safety and Supply Chain Social Responsibility)
11	Power Construction Corp	China	37	Sustainable Development (Health & Safety, Environmental Management and Community & Society)
12	Fluor Corp	USA	76	Ethics & Compliance
13	Construtora Norberto Odebrecht SA	Brazil	38	Ethic line Code of Conduct Sustainability (Economic- & Social Development and Environmental Responsibility)

14	Hyundai Engineering & Construction Co. Ltd	South Korea	56	Sustainability (Ethical Management, Safety & Environment and Social Contribution)
15	Ferrovial	Spain	58	Commitment (Corporate Social Responsibility)
16	Samsung C&T Corp.	South Korea	56	Management Philosophy Compliance Environmental Friendliness Social Contribution
17	China State Construction Eng'g Corp. Ltd.	China	37	Sustainability & Corporate Responsibility (Green Building, Safety & Environment, Staff and Society)
18	Ozturk Holding Co.	Turkey	42	Corporate Social Responsibility
19	Royal BAM Group nv	Netherland	87	Corporate Governance Corporate Social Responsibility
20	Abeinsa SA	Spain	58	Responsible Management (Corporate Social Responsibility and Commitments to The Community)
21	Petrofac Ltd.	UK	81	Corporate Governance Responsibility (Safety, Asset Integrity, Environment, Ethics and Social Performance)
22	Consolidated Contractors Group	Greece	46	Corporate Social Responsibility Sustainability
23	China Railway Group Ltd	China	37	Culture (Social Responsibility and Environmental Protection)
24	CB&I	USA	76	Corporate Responsibility (Ethical and Business Practices, Good Neighbor Practices and Responsible Workplace Practices)
25	PCL Construction Enterprises Inc	USA	76	Culture & Community (Code of Conduct and Ethical Compliance)
26	GS Engineering & Construction	South Korea	56	Sustainability Customer Value Management Ethical Management Social Contribution

27	China Nat'l Machinery Industry Corp.	China	37	Corporate Culture Sustainability (Ethics and Values and Corporate Social Responsibility)
28	JGC Corp.	Japan	75	Corporate Social Responsibility
29	CIMIC Group Ltd.	Australia	79	Corporate Governance Risk Management Sustainability
30	Salini Impregilo SpA	Italy	44	Sustainability (Business Sustainability Model, Anti-Corruption Policy) Internal Control and Risk Management
31	OHL	Spain	58	Commitment (Ethical Channel & Code of Conduct)
32	Tecnicas Reunidas	Spain	58	Corporate Governance Corporate Social Responsibility
33	Lend Lease	Australia	79	Sustainability (Employee Code of Conduct Policy)
34	Daelim Industrial Co. Ltd	South Korea	56	Sustainability (Ethical Management, Green Management, Environment Management and Social Contribution)
35	Obayashi Corp.	Japan	75	Corporate Social Responsibility (Corporate Ethics)
36	Kiewit Corp.	USA	76	Compliance Program Ethics & Business Conduct
37	Renaissance Construction	Turkey	42	Sustainability and Green Building (*in terms of environmental and human health)* Vision , Mission and Values (committed to working with integrity)
38	McConnell Dowell Corp. Ltd.	Australia	79	Corporate (Values, Sustainability & Environment)
39	Chiyoda Corp.	Japan	75	Corporate Social Responsibility Compliance Initiatives (Compliance Program/System) Risk Management
40	Orascom Construction Ltd	Egypt	36	Corporate Governance Code of Conduct Responsibility (Sustainable Development, Health, Safety & Quality and Environment)
41	EIFFAGE	France	70	Charter of Value Commitment (Commitment to Society and Sustainable Development)

42	SK Engineering & Construction	South Korea	56	Ethical Management Compliance Management Environmental Management Social Contribution
43	Daewoo Engineering & Construction Co. Ltd.	South Korea	56	Sustainability Compliance Social Contribution Environmental Management
44	China Gezhouba Group Co. Ltd	China	37	Social Responsibility
45	KBR	USA	76	Sustainability (commitment to quality, health, safety and the environment)
46	Jan De Nul Group	Luxembourg	81	Company Policy (Vision and Mission) Quality, Health, Safety, Security and Environment
47	China Civil Engineering Construction Corp.	China	37	Not found
48	M+W Group	Germany	81	Corporate Responsibility (Code of Conduct, Corporate Social Responsibility, Ethics Line and Sustainability)
49	China Metallurgical Group Corp.	China	37	Not found
50	Danieli & C. OM SpA	Italy	44	Vision (in *terms of innovation*) Scorecard
51	Jacobs	USA	76	Corporate Governance (Code of Conduct, Corporate Bylaw)
52	CITIC Construction Co. Ltd.	China	37	Corporate Social Responsibility (Environmental, Health & Safety and Quality)
53	Kajima Corp.	Japan	75	Corporate Governance System Corporate Social Responsibility (Approach 1 - Ensuring Compliance)
54	Mota-Engil	Portugal	63	Sustainability (Vision and Strategy) Social Responsibility (Corporate ethics)
55	Astaldi SpA	Italy	44	Governance (Internal Committees, Control and Risk Committee) Sustainability (Quality & Safety, Culture and Social)

56	WorleyParsons	Australia	79	Corporate Governance (Code of Conduct, Audit and Risk Committee Charter, Corporate Risk Management Policy) Corporate Responsibility (Fair Operating Practices and Supply Chain)
57	Larsen & Toubro Ltd.	India	38	Corporate Governance (Code of Conduct, Whistleblower Policy) Compliance Sustainability
58	China Railway Construction Corp.	China	37	Corporate Governance
59	POSCO Engineering & Construction (Strategic Planning Dept.)	South Korea	56	Sustainability Ethical Management (Code of Ethics, Cyber Sinmungo “Whistle-Blower System”)
60	Toyo Engineering Corp.	Japan	75	Corporate Governance Corporate Philosophy (Mission, Vision and Value " To carry out the work in good faith…") Compliance
61	ACCIONA Infraestructuras SA	Spain	58	Sustainability (Quality and Environment)
62	Polimeks Insaat Taahhut ve San. Tic. AS	Turkey	42	Corporate (Anti-Corruption Compliance Policy and Commitment to Compliance)
63	Isolux Corsan	Spain	58	Corporate Social Responsibility (Corporate Responsibility principles "Legal compliance") Vision, Mission and Values "Ethical values"
64	China Petroleum Pipeline Bureau (CPP)	China	37	CPP Culture (core Value, Operation Philosophy and Marketing Philosophy " incorruption")
65	Enka Construction & Industry Co. Inc.	Turkey	42	Corporate Governance (Principles Compliance Report) Ethics & Compliance
66	China Petroleum Engineering & Const. (Group) Corp.	China	37	Society and Environment
67	AECOM	USA	76	Ethics & Compliance Program
68	SNC-Lavalin International Inc.	Canada	83	Ethics & Compliance Program

69	Van Oord	Netherland	87	Sustainability (UN Global Compact as frame of reference "principles of the UN Global Compact in the areas of human rights, working conditions, anti-corruption and the environment" Electrical Pre-qualification System
70	PORR AG	Austria	76	Corporate Governance Code of Ethics Corporate Social Responsibility
71	Sacyr	Spain	58	Values and Corporate Responsibility (Corporate Governance)
72	Dongfang Electric Corp.	China	37	Corporate Culture
73	BESIX SA	Belgium	77	Corporate Social Responsibility (Code of Conduct)
74	China Int'l Water & Electric Corp.	China	37	Sustainability (Environmental, Community & Society, Innovation and Health & Safety)
75	Shimizu Corp.	Japan	75	Corporate Social Responsibility (Corporate Governance, Fair Business Practices) Corporate Ethics (Code of Corporate Ethics and Conduct, Compliance with Laws and Regulations)
76	China National Chemical Engineering Group Corp.	China	37	Not found
77	Takenaka Corp.	Japan	75	Corporate Philosophy Code of conduct Corporate Social Responsibility
78	Hanwha Engineering & Construction Corp.	South Korea	56	Corporate Responsibility Ethical Management
79	Joannou & Paraskevaides Group of Cos.	Saudi Arabia	52	Policy (Framework for reviewing and complying with legal, regulatory, statutory and contract requirements)
80	Maire Tecnimont	Italy	44	Governance (Ethics and Integrity) Sustainability (Corporate Social Responsibility and Transparency in Governance)
81	Qingjian Group Co.	China	37	Company Culture (Core Value "Honest Work")

	Ltd.			
82	TAV Construction	Turkey	42	Quality Policy (Comply with all applicable legislation, standards, contract terms and conditions)
83	Andrade Gutierrez Engenharia SA	Brazil	38	Code of Ethics and Conduct Socioenvironmental Responsibility
84	Sinopec Engineering (Group) Co.	China	37	Corporate Governance (Enterprise Management According to Law, legal compliance management)
85	The Arab Contractors Co.	Egypt	36	Policies (we are totally committed to all the laws and legislations governing the construction industry, safety, occupational health and environment)
86	CGCOC Group Co. Ltd. (formerly CGC Overseas Construction Group Co. Ltd.)	China	37	Corporate Culture
87	Penta-Ocean Construction Co. Ltd.	Japan	75	Corporate Governance (Internal Control System) Corporate Social Responsibility
88	Ed. Züblin AG	Germany	81	Mission Statement (Code of Ethics) Sustainable (Compliance and Corporate Social Responsibility)
89	Calik Enerji Saanayi ve Ticaret AS	Turkey	42	Corporate Values (Conformity and Ethics) Social Responsibility
90	Tekfen Construction & Installation Co. Inc.	Turkey	42	Corporate (Code of Conduct)
91	Shanghai Electric Group Co. Ltd.	China	37	Not found
92	Ant Yapi Construction, Industry & Trade Co. Ltd.	Turkey	42	Social Responsibility
93	China General Technology (Group) Holding Ltd.	China	37	Not found
94	Condotte SpA	Italy	44	Model 231 (Code of Ethics)
95	Arabian Construction	UAE	70	Quality and Safety Policy

	Co.			
96	COMSA EMTE	Spain	58	Commitment (Code of Ethics) Social Responsibility
97	BAUER AG	Germany	81	Ethics Management System (Code of Conduct and Ombudsman)
98	Shapoorji Pallonji Engineering & Construction	UAE	70	Corporate Social Responsibility (Quality, Health, Safety and Environment)
99	Kayson	Iran	27	Values (Observing Professional Ethics and Adhering to all Obligations) Policy (Complying with legal requirements (local, national and international)
100	Shanghai Construction Group	China	37	Company's Overview (Harmony, Integrity and Excellence)

Table 3-12: Existence of Compliance Management System (CMS) or other Anti-Corruption Framework within the top 100 international contractors

The search shows that the top 100 international construction companies are from 24 countries. China comes first with twenty-one companies, then Spain with nine companies. Despite China's large proportion, the biggest construction company in 2015 was the Spanish "Actividades de Construccion y Servicios SA (ACS)". The following Figure 3-13 shows the distribution of the top 100 companies per country.

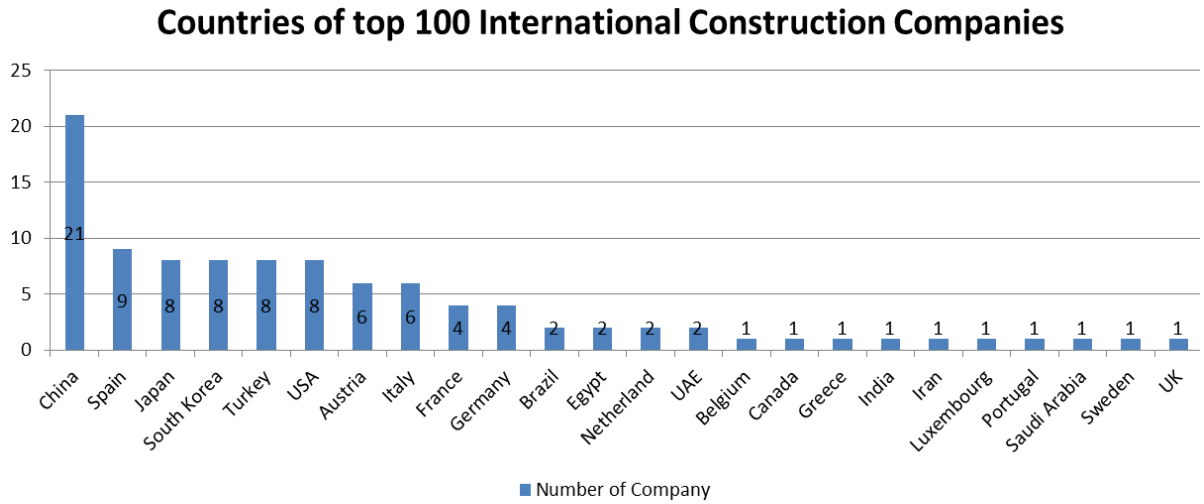


Figure 3-13: Distribution of top 100 international construction companies per country based on (ENR, 2015)

In Table 3-12, where no existing policy or program to combat corruption could be found, it is possible that this kind of information is not presented on the English homepage of the company's website or the homepage is not updated.

As a matter of fact, 96 out of 100 top international construction companies have activities related to combating corruption in their business. It means, that most international companies consider or contain such anti-corruption policies or programs, the least of which starts with vision, mission and values of the company like "Isolux Corsan" which refers to ethical values in the values of company. The same applies to "Renaissance Construction". Some companies refer to this issue in "Corporate Responsibility", e.g. "CB&I" and "Sacyr" or in "Corporate Social Responsibility" like "BESIX SA" and "BOUYGUES SA". Other companies include this issue under Sustainability like "Hyundai Engineering & Construction Co. Ltd" and "China National Machinery Industry Corporation".

In most cases, when the company has corporate governance guidelines, they refer to combating corruption under "Corporate Governance" like "Actividades de Construccion y Servicios SA" and "China Communication Construction Grp. Ltd.".
However, some companies refer directly to compliance and have a "Compliance Program" or a "Compliance System" like "HOCHTIEF Aktiengesellschaft", "Bechtel", "Technip", "STRABAG SE", "Fluor Corp", "Samsung C&T Corp.", and "Kiewit Corp." and others as shown in Table 3-12 above.Table 3-12 does not determine whether a company is corrupt or not. The question remains why corruption in the construction sector is still common and widely spread despite the fact that large construction companies try to fight corruption by implementing different programs.

As a matter of fact, BPI (2011) ranks the construction industry as the most corrupt sector (see Figure 3-1 above). Transparency International (TI) initiated a project, called "Unmask the Corrupt". Here, experts of TI reviewed hundreds of nominations (383 submissions) to identify a final list of 15 symbolic cases of grand corruption according to basic standards developed by this program. Some of these basic standards are: best fit with TI's definition of grand corruption, and history of going unpunished. The result is a list that shows systematic corruption in government, authorities, and institutions, political former presidents, oil companies, social institutes, and exploitation of natural

resource, corporate secrecy haven, bank money launder, political relatives and construction group. Table 3-13 enlisted the cases that symbolize grand corruption identified within the "Unmask the Corrupt" project.

"Unmask the Corrupt"		
Corruption Cases	**Description**	**Comments**
Myanmar Jade Trade	One of the biggest natural resource heists	Jade trade worth US$31 billion. Drug lords, officials make huge profits. Helps fund armed conflict that has displaced 100,000 people.
Lebanon's political system	Systemic corruption in government, authorities and institutions	Private firms routinely bribe officials for contracts. Service delivery failures risk lives of citizens.
US State of Delaware	Corporate secrecy haven	Cross-border crime hub due to secrecy rules. No data collected on beneficial owners. Ordinary citizens hardest hit.
Zine al-Abidine Ben Ali	Former president of Tunisia	Accused of stealing up to US$2.6 billion from Tunisians. Cronies could escape justice.
Felix Bautista	Dominican Republic Senator	Allegedly enriched self with millions in state funds. Political connections appear to make him untouchable.
Ricardo Martinelli and cronies	Former President of Panama and his close allies	Allegedly diverted US$100 million from citizens. Violated basic human rights of children.
FIFA	Football's world governing body	Top FIFA officials accused of stealing millions. 81 money laundering cases probed.
Viktor Yanukovych	Former President of Ukraine	Lived in multimillion-dollar villa. Millions in state assets ended up in private hands. Fled to Russia before charged with embezzlement.
Mohamed Hosni Mubarak	Former president of Egypt	Accused of diverting one billion dollars from Egyptian people. Little political will to bring him and his family to justice.
Akhmad Kadyrov Foundation	Chechnyan body for social and economic development	Makes up to US$60 million per month from people, while 80% live in poverty. Entertains and offers lavish gifts and money to Hollywood stars.
Banco Espírito Santo	run by tycoon Ricardo Salgado	Portuguese Bank allegedly helped the corrupt worldwide. Systemic bad practices blamed for one of Europe's largest corporate collapses.
China Communications Construction Company	State-controlled construction group	Blacklisted by international funding bodies. Courts countries with weak rule of law.
Isabel dos Santos	Daughter of Angola's President	Richest woman in Africa, worth US$3.4 billion. Angola has the world's highest child mortality according to Unicef.
Teodoro Nguema Obiang	Son of Equatorial Guinea's president	Multimillion-dollar empire abroad while 75% of population lived in poverty in 2006. Key target in France's money laundering investigations.

Petrobras	Brazil's state-controlled oil giant	US$2 billion in bribes. Money in bribes reportedly goes to politicians. Tens of thousands of jobs lost.

Table 3-13: Cases of grand corruption identified on "Unmask the Corrupt a project of Transparency International" – based on www.unmaskthecorrupt.org

The fact, that a major international construction company, China Communication Construction Company, is included in the "Unmask the corrupt" list confirms beyond any doubt the role of corruption in construction industry. Table 3-12. Moreover, the table shows that CCCC, according to the information on their homepage, implements corporate governance including corporate culture, corporate social responsibility, code of conduct and a compliance program. They claim to "comply with compliance requirements of adhere to honesty and compliance, maintain fair competition, prevent corruption and bribery, avoid conflict of interest and keep business secrets".

Therefore, existence of a compliance program does not mean the absence of corruption in construction companies. In this context, Girodo (2012) sees that despite the existence of a compliance program within companies many CEOs are clamouring to know "how can we put this problem of compliance behind us so we can concentrate on the business of making money".

Another important point, in this context, is when big companies depend on corruption to gain projects' contracts; this will lead other competitive companies to follow the same practice especially in the most corrupt countries or/and during economic crises. This is called "corrupt competition" which delimitates genuine competition. Furthermore, construction projects executed by big companies often award a big portion of the work to small construction companies; most of which, as seen in the German market for example, do not have a compliance program.

The point here is not the existence of compliance systems in construction companies, but whether their effectiveness. According to Girodo (2012) it is necessary to "consider that the matter of compliance programme effectiveness seems always to be posed "after the fact", after enforcement action has revealed that a bribery offense has been committed". Therefore, it is important to understand the way compliance management works. Wieland (2010) believes that it is necessary to understand the relationship between structure and process of a compliance management system. He argues that a successful compliance system is the system which is integrated in strategic management because usually strategic management defines economic, organizational and social objectives of the company. Based on strategic management, structures and processes are built to achieve these objectives, and compliance management is one of them.

Based on that, Wieland (2012) suggests, as shown in Figure 3-14, a four-step process to build a strategically oriented structure and process of compliance management system.

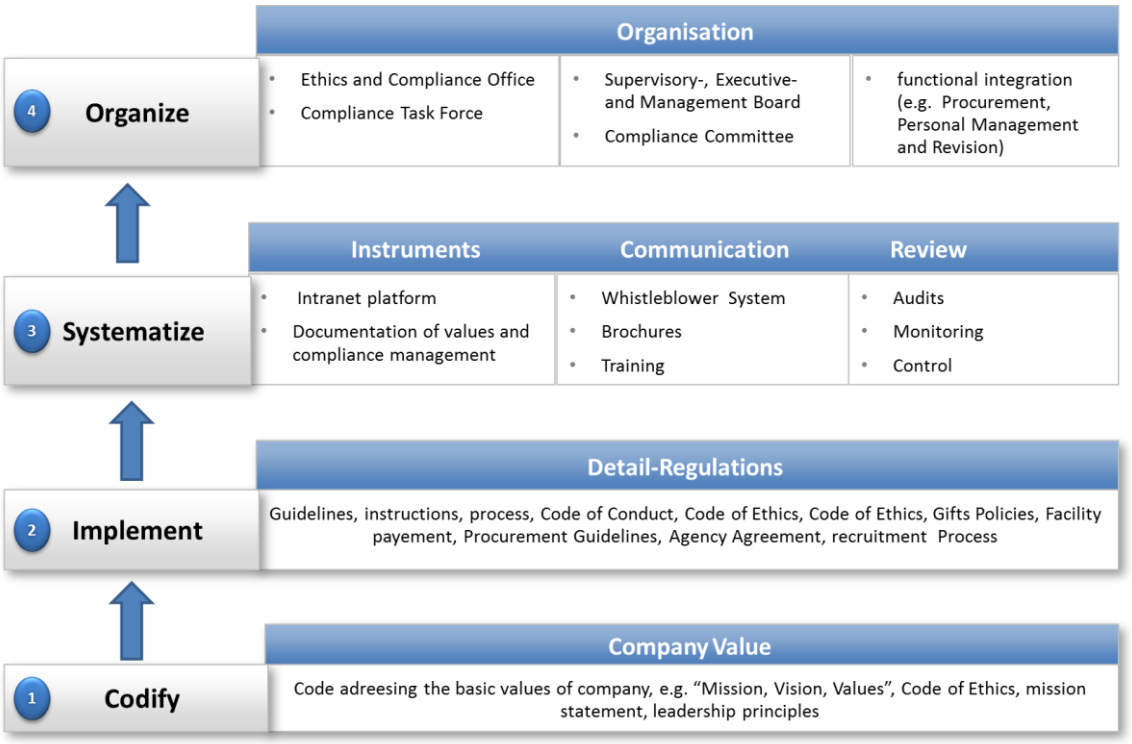


Figure 3-14: Weiland Model - strategically oriented structure and process of compliance management system (Wieland, Steinmeyer and Grüninger, 2010)

However, the process of designing a quality compliance system is differs from one company to another, depending on its activities and its conviction in combating corruption. Organizations experienced in fighting corruption recommend following benchmarking and best practice in designing and developing a compliance program; so that it benefits from the accumulated experiences of other organizations and companies in this field. Sedgwick (1995) argues that benchmarking and best practice are two faces of the same coin. In a detailed explanation, he sees benchmarking as a method of finding and implementing best practice. He defines it as "benchmarking, at its simplest, is the technique for comparing the processes used by an agency to deliver its products and services with similar processes elsewhere, whether in the public or private sectors". Most of mentioned organizations make it easy for companies by providing guidelines explaining the process of developing a compliance system. In the same way, the handbook of OECD, UNODC and WB provides basic steps for risk assessment approach, and the WB published guidelines on how to establish a compliance system.

Table 3-14 indicates the basic components of compliance systems based on the guidelines introduced by the three following organizations (FIDIC, 2015).

- World Bank (in 2010)
- The Ministry of Justice of the UK (in 2011)
- The Department of Justice and the Securities and Exchange Commission of the USA (in 2012)

Organisation	Guidelines	Basic Elements of Compliance Programme
World Bank	**World Bank Integrity Compliance Guidelines**	1. Prohibition of misconduct 2. Responsibility 3. Program initiation, risk assessment and reviews 4. Internal policies 5. Policies re. business partners 6. Internal controls 7. Training and communication 8. Incentives 9. Reporting 10. Remediate misconduct 11. Collective action
The Ministry of Justice of the UK	**Guide to the Bribery Act Compliance Programme**	1. Proportionate procedures 2. Top-level commitment 3. Risk assessment 4. Due diligence 5. Communication (and training) 6. Monitoring and review
The Department of Justice and the Securities and Exchange Commission of the USA	**Guide to the FCPA Compliance Programme**	1. Commitment from senior management and a clearly articulated policy against corruption 2. Code of Conduct and compliance policies and procedures 3. Oversight, autonomy and resources 4. Risk assessment 5. Training and continuing advice 6. Incentives and disciplinary measures 7. Third-party due diligence and payments 8. Confidential reporting and internal investigation 9. Continuous improvement: periodic testing and review

Table 3-14: Guidelines to basic elements of compliance systems (FIDIC, 2015)

3.5 Construction Industry Initiatives against Corruption

Since 1990, international organizations, institutes, and different governments strongly engage in activities and initiatives to combat corruption, thus, positively impacting on the construction industry to implement their own initiatives to combat corruption. The following section, will detail some initiatives of the construction industry and the mechanisms included to achieve their objectives, i.e. combating corruption in the construction industry.

3.5.1 The Global Anti-Corruption Education and Training (ACET)

In the middle of 2006, the group of professionals interested fighting corruption in the construction and engineering Industry collaborated with the American Society of Civil Engineering (ASCE) and called their initiative "The Global Anti-Corruption Education and Training (ACET)".

The method of the initiative depends on a film called "Ethicana TM". This film lasts 42 minutes about corruption in the global engineering and construction industry. The film was created to promote more ethical decision-making among professionals in the industry. The film not only portrays how to avoid falling into the trap of corruption, but also how to have the moral courage to expose corruption.

The film is available in 28 languages. In addition to the film, there is a training guide, a train-the-trainer kit and other training materials designed for this purpose. However, the DVD and included

education and training material are not available free of charge to those who want to educate themselves in this domain. The ASCE website shows that the price of the DVD is $750 and $500 for ASCE members; despite its statement, the initiative is there "to assist poor and underprivileged in all countries of the world." (Smith, 2009)

3.5.2 Construction Industry Ethics & Compliance Initiative (CIECI)

CIECI is a non-profit local initiative established in 2008 and includes American companies working in the construction industry in the USA. The common agreement among its members is their commitment to the highest level of ethics, conduct and compliance with the law (www.ciecinitiative.org).

Signatories to the Initiative have agreed to adopt the following principles (CIECI, 2014):

- To work together sharing best practices for creating an organizational culture in which ethics and compliance are paramount
- In all activities, to seek to advance the objective of maintaining the highest ethical standards and encouraging employees to engage in ethical conduct in the pursuit of all business affairs

The program's elements of CIECI is indicated from its "Blueprint for creating and maintaining an effective ethics & business conduct program" as shown in Figure 3-15 below.

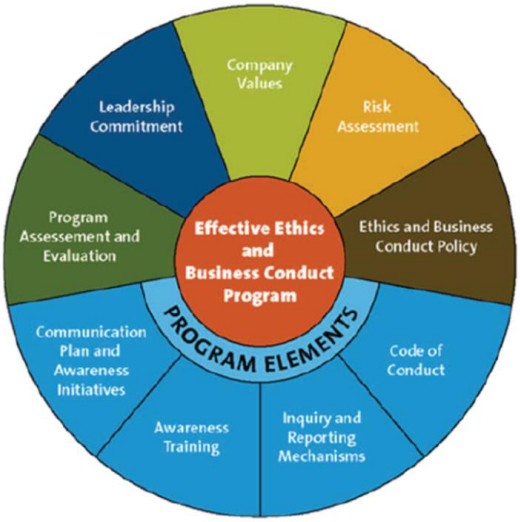


Figure 3-15: Program elements of CIECI (CIECI, 2014)

In addition, companies' members in this initiative benefit from the "Annual Best Practices Forum" at which representatives from governments and the construction industry share approaches to current and emerging ethics and compliance issues.

3.5.3 Construction Sector Transparency Initiative (CoST)

CoST was established in 2012 as a global program in South Africa and the UK with the support of the World Bank. Currently, 14 countries participate in this initiative including Afghanistan, Salvador, Ethiopia, Guatemala, Honduras, Malawi, Philippines, Tanzania, Thailand, Uganda, Ukraine, UK, Vietnam, and Zambia.

The initiative is based on lessons learned from a pilot program which lasted for 3 years from 2008 to 2010 and tested the viability of new governance and accountability processes in order to "to pilot a new multi-stakeholder approach to public sector procurement of major construction projects which increases transparency and accountability". The pilot applied to projects of different sizes in different

countries and from different sectors such as water, schools, roads, and housing (http://www.constructiontransparency.org)

Based on the CoST Initiative, each country established a Multi-Stakeholder Group (MSG) comprising members from government, private sector, and civil society organizations. The MSG appointed a coordinator who manages day-to-day operations. The following are the three basic activities of the CoST Transparency process (CoST, 2010 and CoST, 2015):

1. Undertook a baseline study that profiled the local construction sector, the law and regulations relating to public administration and transparency, the analysed key project information from a sample of recently completed infrastructure projects. For example, the CoST Malawi Baseline Study identified average cost overruns of 97%in road project.
2. Tested the disclosure process in few procuring entities, assembling a list of key project information form a sample of current ongoing projects and publicly disclosing this. This process shows one of the most important goals of CoST which aims at "achieving transparency through the disclosure of information into the public domain". Of course, before publishing this information, it must be checked and confirmed that disclosed information are accurate and completed by experts called "Assurance Team", and they will develop the report "disclosure information".
3. Performing an assurance review of the disclosed project information, identifying causes for concerns and releasing the findings to the stakeholders and public. For example, through the finding of assurance team disclosed in one of their reports and under concern issue "time overrun that were not properly justified" in one of Malawi's projects, they found that a decision to extend the contract was made by the client without the consult; reasons given were irregular payment and increased scope of works. In another example, a project in Zambia, under the same article "time overrun" they found that some project items have no contract time frame. Also, in Zambia, but under a different article "concern on quality issues" the quality of constructed work was not satisfactory, no test samples were taken to laboratories to assure the quality of materials. Many other examples presented in CoST reports can give us an insight into, how corruption occurs in construction projects.

3.5.4 Global Infrastructure Anti-Corruption Centre (GIACC)

The Global Infrastructure Anti-Corruption Centre (GIACC) is a non-profit organization established in 2008. It aims at developing, publishing, and promoting anti-corruption measures for the infrastructure, construction and engineering sector.

GIACC assumes that reducing corruption could be best achieved if all stakeholders (governments, project owners, funders, and companies) worldwide would implement common anti-corruption practices. In order to do so, GIACC believes that they need to have access to the best practices in this field regardless of their ability to pay money for that. Based on that, GIACC established a "Resource Centre" which provides free-online information, tools, and advice to combat corruption within the infrastructure sector.

In fact, this open-resource is what mainly distinguishes GIACC from other initiatives in the construction industry. In comparison; ACET's initiative offers a rather expensive DVD, which is unattainable for persons living in developing countries who wish to educate themselves in this domain.

The following Figure 3-16 shows the major eight components of the GIACC resource centre:

Figure 3-16: Components of the GIACC resource centre based on GIACC

GIACC also offers an online training course "Online Anti-Corruption Module" which provides profound insight of corruption in the infrastructure sector. The training module is available online for free in seven different languages: English, Spanish, German, Italian, Polish, and Romanian. The module is divided into the following five main sections:

1. Section 1: Why is anti-corruption training important? This section discusses the risks of corruption on individuals and companies. It also shows its negative effects and consequences on the people involved in it.
2. Section 2: Overview of Corruption: This section discusses the meanings of corruption and its types.
3. Section 3: The Corruption Offenses: This section looks at principles of the different corruption offenses and gives examples of how they can occur.
4. Section 4: Guiding Principles: This section offers some principles which should be adopted as a person's every day conduct so as to reduce the risk of being involved in corruption.
5. Section 5: Ethical Dilemmas: This section provides the person doing training with fourteen ethical dilemmas which he/she could face.

This is a very useful module for anyone working in the construction industry. The module can usually be completed within a few hours' time and at the end of training, the trainee gets a certificate from GIACC as shown in the Appendix 1.

The GIACC was co-founded by Mr. Neil Stansbury, a renowned scholar interested in corruption in construction, who is currently a director of GIACC. He is the chairman of the International Organization for Standardization (ISO) Anti-bribery project committee, referred to in chapter 2.

3.5.5 International Federation of Consulting Engineers (FIDIC)

FIDIC is an abbreviation of the French name "Federation Internationale des Ingenieurs Conseils" which is in English "International Federation of Consulting Engineers". FIDIC is a non-profit self-supporting organization. It was founded in 1913 by the founding members Belgium, France and Switzerland and has its headquarters in Geneva. In the course of time, other countries joined FIDIC, e.g. UK in 1949 and USA in 1958. In1965, the first developing country, Malawi, joined FIDIC. Today, FIDIC has 100 members; the newest members were the United Arab Emirates, Cyprus, and Kazakhstan in 2014.

Consulting companies represent an important part of the construction industry because they play a vital role in construction projects during all phases. Therefore, their risk of corrupt activities is very high. The FIDIC became aware of corruption in consulting engineering at an early stage.

FIDIC sees itself as the international voice of consulting engineers. One of their main goals in addition to the global representation is improving the reputation of consulting engineers. FIDIC's main philosophy includes quality, integrity, and sustainability as basic principles. Publishing fair and balanced forms of contracts for different types of international and domestic projects is the main activity of FIDIC; additionally, they offer seminars, workshops, training programs, and international conferences. Figure 3-17 shows the organisation's structure:

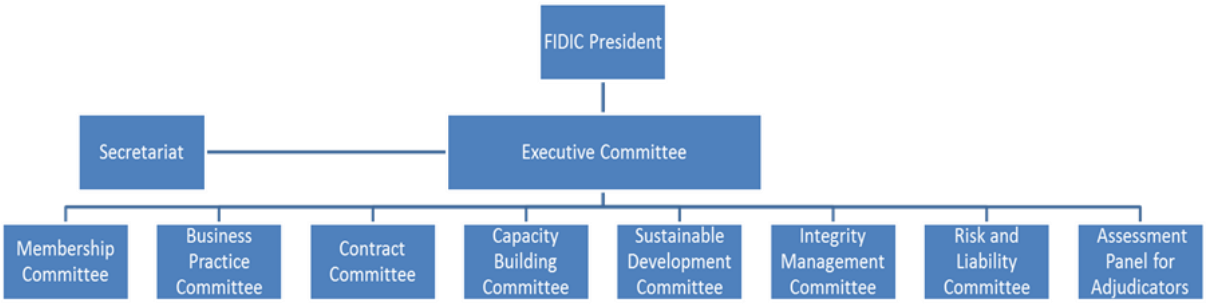


Figure 3-17: Structure of FIDIC

As mentioned above, the most important FIDIC's activity is publishing contract forms i.e. FIDIC Conditions of Contract. Therefore, talking about FIDIC contracts, it means conditions of contracts based on FIDIC approach. Today, FIDIC conditions of contract are based on ICE conditions. After the Second World War, the construction industry needed a similar form of contract but on an international level. Therefore, the Association of Consulting Engineers (ACE) in 1956, with assistance and consultation from ICE, developed the "Conditions of Contracts for Overseas Work mainly of Civil Engineering Construction" (ACE-form or Overseas-form). This ACE-form, which differed slightly from the ICE conditions, presented the first standard conditions for international construction contract.

In 1957, the FIDIC published its first edition of the Condition of Contract (international) for works of civil engineering construction in cooperation with the "Federation Internationale du Batiment et des Travaux Public, today's European construction association". These first FIDIC standard conditions were known as "the Red Book" due to the red cover of the book.

Several years later, in 1963, the FIDIC published conditions of contract for electrical and mechanical works. It was called "The Yellow Book." Over the time, revised, supplemented contract terms and new contract for different purposes were published. The following Figure 3-18 shows FIDIC contracts and the domains in which they are used. Figure 3-19 shows the timeline of their publication.

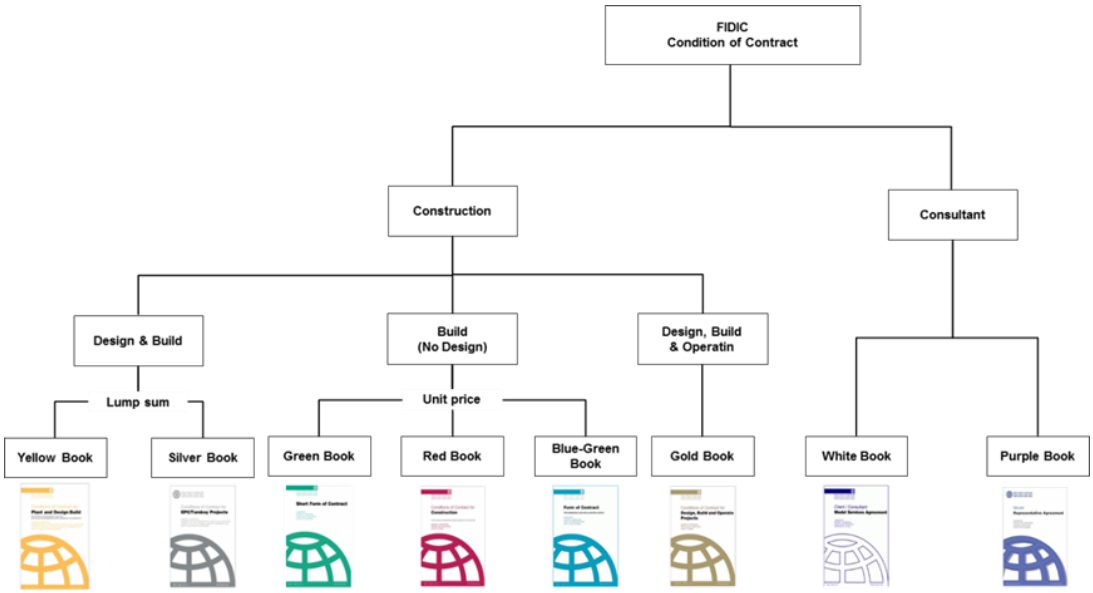


Figure 3-18: FIDIC Contracts - area of application

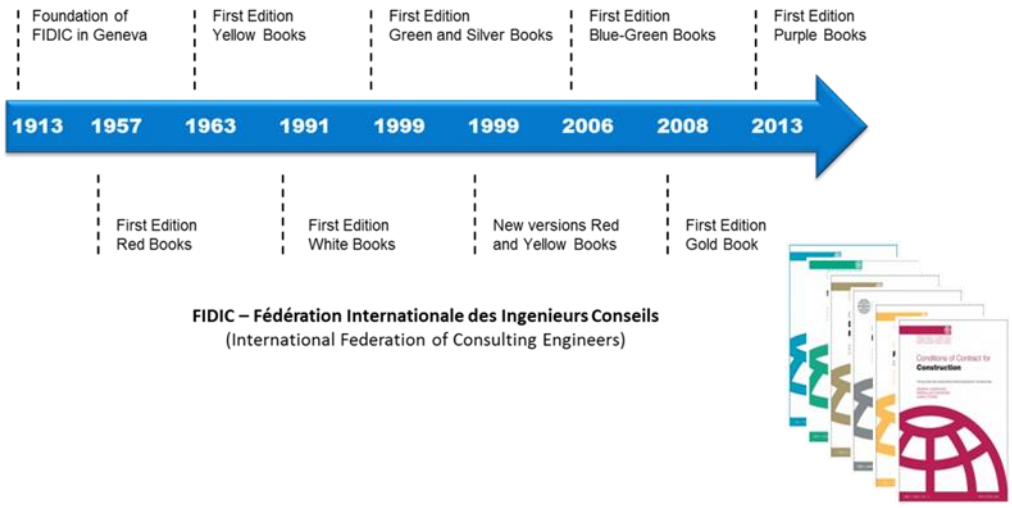


Figure 3-19: FIDIC contracts - timeline of publication

Studying FIDIC contracts has revealed that the issue of corruption is only mentioned but not considered seriously by FIDIC contracts until now. Corruption is referred to within FIDIC contract forms either indirectly as in (clause 1.13) "Compliance with laws": "the contractor shall, in performing the contract, comply with applicable laws, unless otherwise stated in the particular condition", or directly as mentioned in (clause 15.2) "Termination by Employer": "The Employer shall be entitled to terminate the contract if the contractor: "Subparagraph (f)" gives or offers to give (directly or indirectly) to any person bribe, gift, gratuity, commission or other thing of value, as an inducement or reward:

(i) for doing or for bearing to do any action in relation to the contract or
(ii) for showing or for bearing to show favour or disfavour to any person in relation to the contract, or if any of the contractor's personnel, agents or sub-contractors gives or offers (directly or indirectly) to any person or any such inducement or reward as described in the subparagraph (f).

However, lawful inducements and rewards to contractor's personnel shall not entitle termination."

The mentioned two clauses (1.13) and (15.2) from basic FIDIC contracts are the only clauses found which refer to corruption by mentioning “bribery". This being the only reference to corrupt actions, FIDIC requires a revision of its many contracts. In a first step, the FIDIC and the Multilateral Development Bank (MDB) have revised the Redbook for bank requirements, as banks are major investors of big construction projects worldwide, especially in corruption prone developing countries

The special version of the Redbook was published in 2005. The new version is called the “Multilateral Development Bank Harmonized Edition”, also called the “Pink Book”. Corruption clauses were one of the main factors that should have been considered in Pink Book. Other factors are include the terms of banks in the contract in addition to unifying international tender documents known by MDB as “Standard Bidding Documents (SBDs)” in the context, Totterdill (2006) sees that the MDB Harmonized Edition is almost identic in structure to the Redbook, and he indicated three type of changes as:

1. General changes: changes in terminology
2. Bank specific changes: changes and additional clauses related to the role of MDBs
3. Other changes: changes and additional clauses which do not relate to the role of MDBs

Practically speaking, FIDIC’s first official effort against corruption was not through its contract forms, but through developing a practical tool in 1998 that would help engineering consulting companies combat corruption. The FIDIC's executive committee arranged for an Integrity Management Task Force to develop such tool; i.e. a comprehensive Business Integrity Management System (BIMS). The Task Force presented its initiative to the multilateral banks during the 1999 Biennial Meeting of the International Lending Agencies with the Consulting Industry (BIMLLACI). The World Bank endorsed the initiative and proposed the establishment of a Joint Working Group on Integrity (JWGI) under FIDIC's leadership. The Inter-American Development Bank and the Federation of Pan-American Consultants (FEPAC) joined the (JWGI), too. The JWGI worked on the development of a guide for a Business Integrity Management System. The results were presented in 2001 as FIDIC's document called "FIDIC Guidelines for Business Integrity Management in the Consulting Industry". In 2002, a further document entitled "Business Integrity Management System-Training Manual" was published by FIDIC.

The Task Force referred to before; became the "Integrity Management Committee (IMC)" and was responsible for developing FIDIC tools in this domain.

The committee’s first task was collecting remarks and feedback about BIMS from different companies and FIDIC members, in addition to receiving suggestions from international institutes and organizations with experience in fighting corruption. Based on this, the IMC developed a new system called "FIDIC Integrity Management System - FIMS" which is considered a guideline on how consulting firms can develop an integrity management system.

This new system was published in two parts: the first is called "FIMS part 1" and was published in 2011 with the title "A Guideline for Integrity Management in Consulting Industry Part I – Policies and Principles". The second part was published in 2015 with the title "A Guideline for Integrity Management in the Consulting Industry Part II - Procedures".

FIMS I refers to a set of integrity management policies and principles and recommends their application to all firms for the following reasons:

- Integrity is financially good for business.
- Integrity represents the morally and ethically correct framework for providing consulting services; it preserves the respect and reputation for the industry of those interested in using its services.
- Integrity protects the firms and its staff from external influences that may lead to corruption.

- Integrity is important for the long-term sustainability of a firm as it grows, adds staff and provides services to existing and new clients.

Furthermore, FIDIC argues that the first step on the way to fight corruption in the engineering consulting sector starts with its association's members and their companies adopting the following policies and principles:

FIDIC Policies:

- Zero tolerance of bribery, extortion, coercion, fraud, collusion, and conflict of interest:
- Member firms should formulate and subscribe to an internal Code of Conduct
- Member firms should develop their own FIMS

FIDIC Principles:

- Member Associations and their members (firms and individuals) should develop and maintain systems to comply with the highest ethical standards and codes of conduct.
- Member firms should demonstrate their commitment to integrity through the implementation of an Integrity Management System, involving all levels of management and every staff member, focusing on corruption prevention."
- Member Associations should assist member firms in developing their FIDIC Integrity Management System by providing guides, training and general support.
- Member firms should have access to an independent evaluation of their FIDIC Integrity Management System, in accordance with guidelines developed by the industry.
- To reduce the opportunities for corruption in the process of procuring engineering and construction services, quality-based selection procedures for consulting services and competitive tendering for construction projects should be advocated.
- In implementing projects, consulting firms should recommend to their clients the most appropriate and objective procurement process or delivery system, consistent with the demands of the project. Consultants may recommend to funding agencies that an "Independent Engineer" be appointed to assist clients with administration of the procurement process
- Funding agencies should be kept fully informed by the consulting firm of procurement steps as they occur. The consulting firm should notify the agencies of any irregularities, so that cancellation or other remedies may be exercised, in accordance with the relevant loan or grant agreement details.
- Member firms should be aware of local laws regarding corruption and should promptly report criminal behaviour to the proper law enforcement authorities.
- FIDIC Member Associations should take prompt disciplinary actions against any member firm found to have violated the FIDIC Code of Ethics.
- Member Associations should foster and support the enactment of legislation in their own countries aimed at curbing and penalizing corrupt practices. This activity may be pursued with other trade organizations and industries in order to promote the importance of integrity, regardless of project type or industry

One of the important features of FIMS is its "scalability". Member firms are encouraged to develop their own FIMS, i.e. "Integrity Management System is scalable and is based on the firm's objective of ensuring the ethical delivery of its services". FIDIC urges that the approach taken in developing an effective FIMS should be based on the following five essential elements (see Figure 3-20).

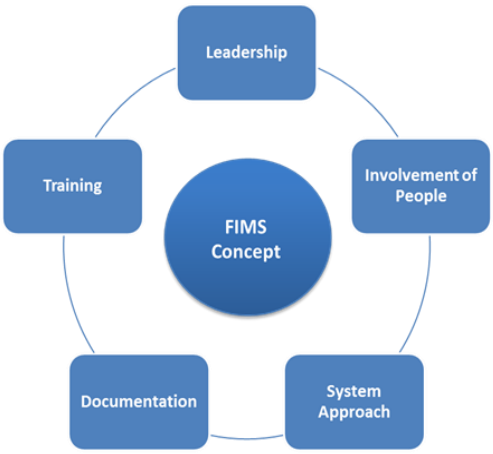


Figure 3-20: FIMS Concept based on FIMS II

1. Leadership: CEOs and senior partners of firms must demonstrate their full commitment to integrity management in a clear and visible way.
2. Involvement of people: the involvement of staff, from FIDIC's point of view, is critical to successful implementation of Integrity Management in a consulting firm. FIDIC believes that effective communication and proper coordination are essential, too.
3. A systems approach: preventative measures to avoid all types of potential corruption require information related to the administrative management of each activity. The information should be recorded based on an organized and consistent approach. Therefore, FIDIC urges that the integrity management system requires a systems approach. The ISO family standard and quality management system can be used.
4. Documentation: FIDIC believes that integrity should be documented for it to be managed, here; documentation is a key element to monitor the FIMS.
5. Training: the awareness training for staff and an advanced training for senior staff and project managers are key issues for the success of FIMS.

While, FIMS I (2012 edition) details policies and principles of integrity management systems, the FIMS II (2015 edition) aims at providing consulting firms with guidance on how to:

- develop a FIMS that is scalable to the needs and risk profile of individual firms
- illustrate a process that can yield a suitable FIMS framework
- describe how they can design and operate their FIMS

Based on FIMS II, the development process of an integrity management system consists of three main steps as indicated in Figure 3-21.

Figure 3-21: Development Process of FIMS

1. Establishment of the FIMS framework: This step consists of two tasks
    a. The formation of the firm's code of conduct
    b. Defining the firm's integrity management policies.

FIDIC recommends an adequate consultation among key members of the firm since higher and middle management (the future leader) personnel is very important to set up a successful FIMS framework.

2. Design of firm specific FIMS: the FIMS's design is a structured approach which includes many steps and tasks.
3. FIMS operation: this step forms the basic processes of integrity management system and it reflects FIMS operational phase and provides the useful roadmap for a successful implementation. Figure 3-22 illustrates the operation process.

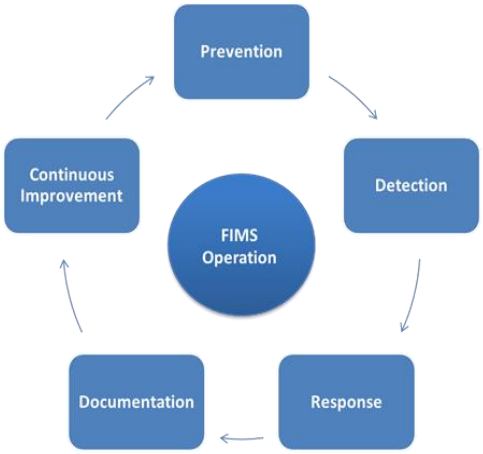


Figure 3-22: FIMS Operation Process

The FIDIC approach followed in FIMS is "prevention" where FIDIC sees integrity management as a proactive approach to ethical behaviour. The two documents FIMS I and FIMS II should be read together as they consist of complementary parts on how to develop and operate the FIDIC's Integrity Management System.

After developing the FIMS, the Integrity Management Committee currently looks to other FIDIC committees. The Contract Committee is of special interest since they develop new clauses within the FIDIC contracts that contribute to fighting corruption in construction projects. To date, two activities were accomplished in this context: the first is the publication of the "Model Representative Agreement" in 2013. Here, FIDIC took up the idea that some engineering consulting companies seek representatives or agents to develop their businesses and to help them gain contracts in foreign countries. In this case, the representative could resort to illegal ways, e.g. paying bribes, to win business for the company. Therefore, developing a "Model Representative Agreement" is a positive step in combating corruption by companies and at the same time protecting the company from any corrupt practice the representative may engage in, especially in a country where corruption is spread widely. This FIDIC publication is the "Purple Book" and it includes a clause (15) called "Anti-corruption". The following paragraph is a quote from the sub-clause 15.1:

> (a) The representative hereby represents, warrants and covenants that he/she will not participate, directly or indirectly, in bribery, extortion, fraud, deception, collusion, cartels, abuse of power, embezzlement, trading influence, money laundering, or any other criminal activity".

The agreement goes further than making sure the representative stays away from any corrupt practice as mentioned in clause 15.1 above, it provides that the representative must present what proves his/her commitment and compliance with the code of conduct of the company and its compliance program, as mentioned in "sub-clause 15.2: "In conjunction with the requirements under sub-clause 15.1, the representative at the consultant's election shall either:

(a) demonstrate to the satisfaction of the consultant that it adheres to a documented code of conduct and associated compliance program, or
(b) confirm its specific agreement to the principles of the consultant's Integrity Policy Statement and the consultant's code of conduct by confirming annually in writing throughout the duration of the agreement acceptance of the particular conditions."

The second FIDIC activity which is considered the most recent in this domain now is the revision of "The Client/Consultant Agreement", also known as the "White Book". It was published in 1990 for the first time and regulates the contract between a client and a consultant. Initially, the White Book was developed for pre- and feasibility studies, but today it covers consulting engineering services including: planning, construction and project management services. Until now, the White Book had eight clauses of general condition which are: (1) General Provisions, (2) The Client, (3) The Consultant, (4) Commencement, Completion, Variation and Termination, (5) Payment, (6) Liabilities, (7) Insurance and (8) Dispute and Arbitration. The FIDIC contract committee reviewed suggestions from internal contributors and peers of the construction industry with input from representatives of employers, contractors, consulting engineers, architects and law firms. Accordingly, a final draft was completed in August 2015. In its revised version, the White Book now has 10 clauses: (1) General provisions - definitions and general matters, (2) The Client - duties and obligations, (3) The Consultant - duties and obligations, (4) Commencement and Completion, (5) Variations to services – (a new section), (6) Suspension and termination (a new section), (7) Payment (8) Liabilities, (9) Insurance and (10) Disputes – adjudication and arbitration.

The major adjustment can be found in the General Provisions where Anti-corruption was added based on some clauses from the Representative Agreement, additionally, the concept of good faith and mutual trust in all dealings was also introduced.

All efforts of FIDIC's Integrity Management Committee and other committees in fighting corruption are designed for consulting firms to fight the "demand-side" or "supply-side" of corruption. However, FIDIC believes that the solution to corruption must also include the "condoning side". The following Figure 3-23 shows aspects of corruption from FIDIC's point of view:

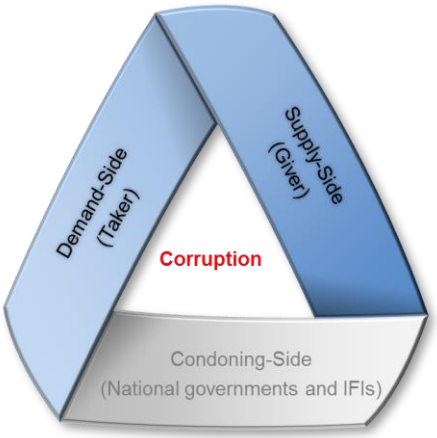


Figure 3-23: Corruption sides based on FIDIC's point of view

IMC works and cooperates with different international organizations to compact all aspects of corruption. IMC collaborates with the World Federation of Engineering Organization (WFEO), Transparency International (TI), Organization of Economic Co-operation and Development (OECD), World Economic Forum (WEF), Confederation of International Contractor's Association (CICA), International Organization of Standardization (ISO) and the United Nations (UN). It also liaises with the International Financing Institutions (IFIs) for complementing and supporting their Anti-corruption

initiatives. A good example of FIDIC support to one of above mention organizations is FIDIC's support to ISO in reviewing the draft of Anti-Bribery Management Systems.

3.5.6 World Federation of Engineering Organization (WFEO)

The last example in this chapter is the effort of the World Federation of Engineering Organization (WFEO). The WFEO established an "Anti-Corruption Committee" or "Committee on Anti-Corruption - CAC". The CAC is a standing committee with the purpose of engaging the worldwide engineering community in the global efforts to fight corruption. The committee was established in 2007 with the vision to be the leading promoter of zero tolerance to corruption and the best advocators for the reduction and eradication of corruption in the built environment, construction and engineering projects through the enforcement of sound management systems and ethical professional practice.

The WFEO's Committee on Anti-Corruption of has the following Terms of Reference or "Mandates":

- Encouraging and supporting CAC theme leaders to organize training (international webinars, seminars and workshops) related to their developing a strategic plan.
- Developing and promoting anti-corruption policies, strategies, and practices to fight corruption.
- Drafting practice guidelines and policies related to anti-corruption
- Representing WEFO and CAC in international meetings related to corruption
- Communicating with WFEO and the international community on the work of CAC

Like FIDIC, WFEO has partnerships, cooperation and global alliances with organizations and different international institutions with a similar vision on combating corruption.

Of course, there are other different international and national activities and initiatives in several countries, organizations and instantiations to combat corruption in the construction industry. Among those efforts are Compliance Programs of any construction companies or organisations.

However, the most recognized initiative was reviewed and introduced. The trend is working at an organizational level like FIDIC to develop systems to help combating corruption in addition to working with other organizations to achieve this purpose. However, fighting corruption in the construction industry is an intertwining process in which all stakeholders must be educated and involved without exception.

4 Lean Construction

4.1 The Journey of Lean

Before introducing Lean Construction, it is important to understand the meaning of the word “Lean”. Is it a method, a specific framework or a special philosophy? And how did it come to be a part of our industry?

Answering these questions will help to create an understanding of this section of the research and will provide the base for understanding Lean’s concepts and tools. First, the history of Lean and its development will be reviewed. How did it start? What conditions accompanied its creation? How did it finally reach the construction sector?

Most scholars in the field of Lean think that this concept originated in the manufacturing industry, particularly in Japan. Here, the engineer “Ohno” pioneered to the implementation of Lean in the automobile industry at his employer Toyota, one of the largest automobile manufacturers in the world. Ohno aimed to reduce lead time by the systematic reduction or elimination of wastes (Alsehaimi, 2011) and thus, sustainably increase productivity (Gehbauer, 2012).

In the 1950s the concept of Lean, as implemented by Ohno, was not conceived as a definition or term; rather it referred to Toyota’s Production System (TPS) which is synonymous for Lean (Gehbauer, 2012). However, Ohno was not the first to introduce the term Lean; rather John Krafick (1988) used the term "Lean Production" for the first time in a paper published by the Massachusetts Institute of Technology in the Sloan Management Review in the Fall of 1988 (Volume 30 - number 1). The article was titled: "Triumph of the Lean Production System" and it was about a scientific project called "MIT International Motor Vehicle Program - MIT IMVP". Krafick’s paper led a comparison between two production systems; Ford in America and Toyota in Japan. He pointed out how Japanese engineers translated the system established by Henry Ford in the early twenties to Toyota’s factory. However, they were face with different conditions, adapted the philosophy of the craftsmen era, merged it with the work standardization and assembly line of the Fordst system, and added the glue of teamwork for good measure. Another distinguishing fact were the inventory levels; the main philosophy for the "just-in-time (JIT)" system. According to Krafick, the Japanese depended on this philosophy of low-inventory levels, while Ford depended on huge volumes. Krafick believes that Ford ignored this important principle, whereas the Japanese considered it.

Other important principles distinguished between the two sides in production. According to Krafick, the Japanese were more creative in using the Fordist system in the middle of the 19th century and translated it to what is known as “Toyota's Production System” which proved its effectivity especially after the World War II until the 1980s.

Comparing the two production systems (Fordist and TPS) led Krafick to the introduction of the term Lean. Hence, he called Toyota's system a “Lean System” and Ford's system a “Buffered System”. At this point, Krafick introduced Lean as a management policy or a way of thinking which is based on Toyota's philosophy, both in production and in operation. Some of Krafick’s main Lean principles were: inventory levels were kept at an absolute minimum, costs could be shaved, and quality problems quickly detected and solved. Furthermore, he cites that "productivity and quality by lean production were substantially better than other systems” (Krafick, 1988).

After the publication of Krafick’s paper and the introduction of the Lean concept in 1988, Womack and Jones introduced the theory of Lean thinking in their book "Lean Thinking: Banish Waste and

Create Wealth in Your Corporation", published in 1996. Based on this theory and its principles, Lean was implemented in the construction industry. Therefore, Lean Management in the Construction Industry is nowadays adopted by researchers and scientists from the construction industry; is called "Lean Construction".

Figure 4-1shows the development of lean over time, when Lean appeared and how Lean Construction came to exist. Compared to the production industry in terms of Taylorism (organization of process and work flow), automation, and production management, the occurring interruption or shortage which the construction industry suffered from is noticable.

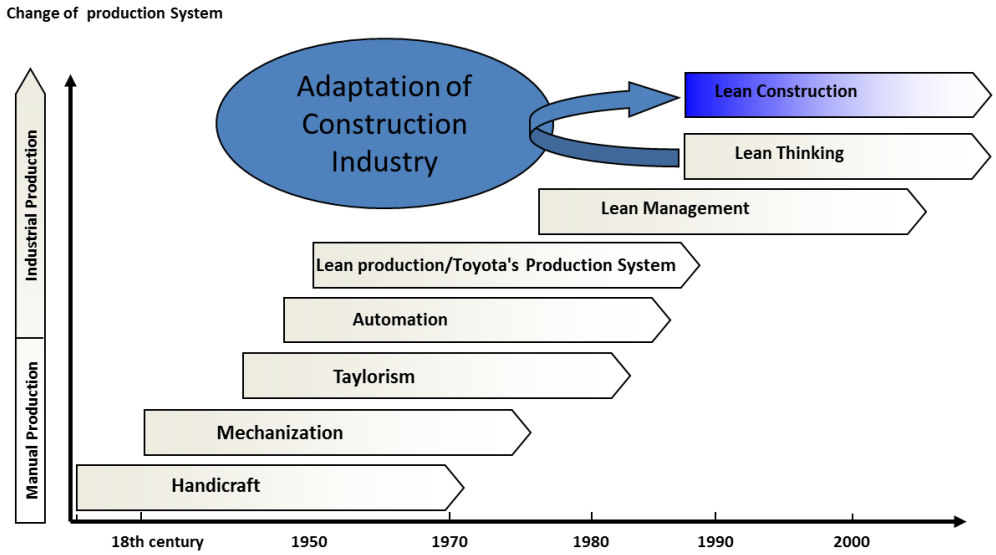


Figure 4-1: Development of Lean Construction (Gehbauer, 2012)

4.2 The Fundamental Principles of Lean Thinking

As shown in the previous paragraph, the concept of Lean developed from the concept introduced by Krafick in the 1980s (a management policy or a way of thinking) to an independent theory (Lean Theory) introduced by Womack in his book "Lean Thinking". In his theory Womack defined Lean Thinking's five main principles as follows (Womack and Jones, 1966):

1. **Principle 1: Value**
   The initial point of Lean Thinking is to specify customer value. However, the value is not easy to specify because it is different from one customer to another, and depends on the conditions and image of the product that he/she wants, whether it is material like goods or in kind like services, whether the image is related to price or the delivery time, etc. Womack emphasized that what defines the value is the "ultimate consumer based on his requirements in terms of what specific good or services he needs at a specific price and time".
   Lean's philosophy starts from the value principle by defining non-add-value activities and processes, then working on eliminating them; consequently, this process is in the interest of value and increases add-value.
2. **Principle 2: Value Stream**
   After specifying the value, the second step is defined, including all actions and activities (including value-add and non-add-value) required to deliver the product to the customer (either goods or services). Womack emphasized the fact that specifying the value stream is not limited to production only, but should also include the organization itself with its supply chain

from the design phase to sourcing raw material through to delivery. Specifically, this point shows that Lean Thinking established quite a different approach that seeks “value” and takes into consideration a product's journey from start to end, based on the philosophy of the organization producing it. Therefore, Gehbauer (2012) believes that "Lean is not mass production, and not trade; it is a third form of the organization of a production system."

3. **Principle 3: Flow**
   After following the first and the second steps, where value has been specified and accordingly the add-value and non-add-value (value stream) has been defined, the third step is to make the value-creating actions flow in the process of production. Such flow can be achieved by removal of unwanted steps and associated wastes within process (during production).
4. **Principle 4: Pull**
   After specifying the value, identifying it and creating the flow of it, the features of Lean start to appear in the next step (the fourth step), which is the pull principle in a production process. Pull, according to Womack, means nobody produces any product prior to a previous order. Womack calls the successor in this process a "customer", so the term "customer" is used in a wider sense. Not only does it refer to the customer who uses the product after its production, but also it refers to many customers within the production process until it reaches the final customer who is the end user.
   Applying this concept in the production process means a new view on the process, moving it from the Push principle (i.e. from beginning to end) to the Pull principle (i.e. from end to beginning). This principle is what makes focusing on “Customer Value” possible. Here, the requirements of the customer in the right time come directly from him/her. Womack refers to this process as "pull the value by customer" whether the customer is an "internal customer" who participates in the production process or an "end customer" who uses the product later or the product was produced for him/her.
5. **Principle 5: Perfection**
   After specifying the value, identifying it, creating the flow of it based on the pull principle, the last step of Lean thinking, i.e. the fifth principle, is achieving perfection. "Perfection" in Lean Thinking differs from the generally known and perceived perfection in many organizations in different industries. This perfection in Lean Thinking contains special features:
   I. First, the way to achieve it: one can achieve it by "radical improvement"; however, in Lean, the right way to achieve it is through "continuous improvement".
   II. Second, Lean not only describes perfection but also brings it to existence. Perfection in Lean is seeking to reduce the effect, time, space, cost and mistakes associated with the production process to be as close as possible to the customer's needs and desires.

All these principles depend basically on the possibility of an organization to see the customer's value. Womack considered the ability to see the value highly important, moreover, he put a special emphasis on transparency By saying that "the basis of perfection is transparency in the system" Transparency is considered one of the distinguishing features of any Lean System where all stakeholders, including the end-customer, can see clearly what each one is doing, and how they are contributing to the value.

Figure 4-2 illustrates the five basic principles that form, according to Womack, the bases of Lean Thinking.

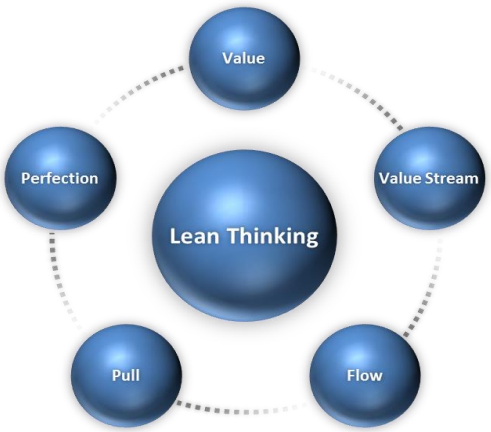


Figure 4-2: Fundamental Principles of Lean Thinking

4.3 Lean as a Management Methodology

Linking the term "Lean" with "Management" was first found in the paper of Krafick when he referred to Toyota's production system as "Lean production management policy". Later Womack introduced Lean as a theory based on five basic principles. And since good understanding of the theory is followed by good application, Womack coined the phrase "from thinking to action" with respect to Lean Management. He called this phase "The Lean Leap". This leap from the theoretical world to the real world needs a strong volition to implement a change in almost everything no matter how small or big it is. However, the change has to depend on enough knowledge of the theoretical background of Lean. In addition, it has to include the organization structure itself, its way of thinking, and it has to set up new methods and frameworks: whether relations among employees, employees and their superiors and both employees and superiors with the organization's customers. Production system and contracts must also change. According to Womack, this leap towards "Lean Management" can be considered a revolution (Womack and Jones, 1996).

After Womack, Jeffery Liker (2004) undertook a remarkable effort in studying Lean as management. In his book, "The Toyota Way" published in 2004, he introduced 14 management principles based on Lean. Liker identified fourteen management principles and organized them according to his own 4P-Model in four categories:

1. Philosophy
2. Process
3. People and partners
4. Problem solving

Liker's 4P-Model and associated 14 management principles form a triangle as can be seen in Figure 4-3.

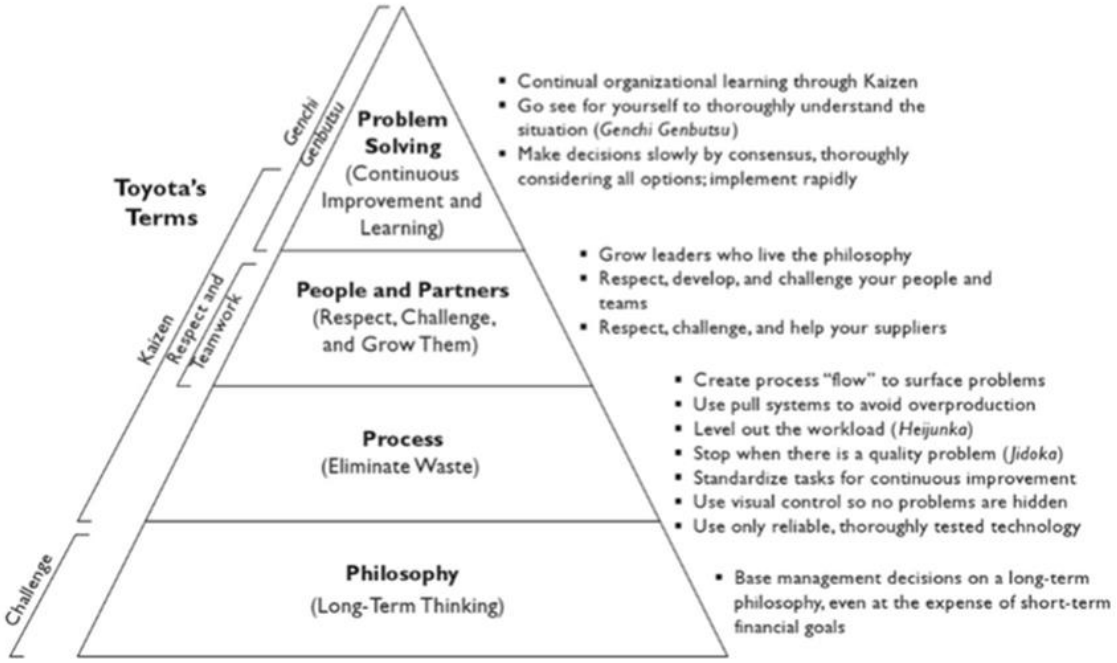


Figure 4-3: 4P model of Toyota Way (liker, 2004)

According to Liker, the key principle of Lean is identifying the waste (in activities and process) and then to eliminate it.

4.3.1 Classic Project Management

The Project Management Institute (PMI) is one of the oldest institutes interested in studying and developing project management. It was established in 1969 as a non-profit organization which aimed at offering knowledge and training to its 2.9 million members around the world. It supplies and supports them with knowledge, tools and methods set by the institute itself in the field of project management. Most projects around the world, until now, were implemented following PMI methodology in management. If "Lean" is an innovation in management, PMI's methodology is rather "traditional or classic".

PMI publishes periodically its book "A Guide to the Project Management Body of Knowledge (PMBOK Guide)" which is well known in the industry. Published in 2013, the fifth edition of this book defines a project as "a temporary endeavour undertaken to create a unique product, service, or result." Some of the project characteristics are:

- A project is a time-scoped
- A project has a beginning, middle and end.
- A project creates a unique product, service or result.
- A project is a "progressive elaboration", i.e. the iterative process of increasing the level of detail in the project management plan, as greater amounts of information and more accurate estimates become available.

Considering the project definition, two terms require clarification: The term "temporary": refers to the execution of the project and not to the product of the project which is projected to deliver a sustained outcome. An example is the build of a new nuclear power plant, the construction can take up to five years, however, the operation will continue for the next 60 years.

The term "unique" refers to project results which are without like or equal, but this does not mean that every aspect of the project is unique. The project may contain repeated elements such as processes or elements like in the above-mentioned plant project, however, the location and the design criteria are unique (at the least).

As for the term "Management", PMBOK does not give a specific definition of "Management". It rather leaps from the definition of management to the definition of "project management". According to Montana and Charnov (2000), there are many different definitions of the term "management" in various texts, and all are variations of the same themes. They focused on two definitions. The first was introduced by the president of the American Management Association (AMA) in 1980: "Management is getting things done through other people." The second is called the "current definition": "Management is working with and through other people to accomplish the objectives of both the organization and its members." However, the definition introduced by Taylor, the father of scientific management, and Fayol, the father of modern management both provide their own definitions of the term "management". Taylor defines management as "an art of knowing what is to be done and seeing that it is done in the best possible manner." whereas for Fayols management is "to forecast, to plan, to organize, to command, to coordinate and control activities of others." (Montana and Charnov, 2000)

The two definitions resemble each other. Taylor's definition is general; however, when he talks about "knowing what is to be done", he means "planning". Furthermore, when he says "seeing that it is done in the best manner", he means "control".

Project management according to PMI is "the application of knowledge, skills, tools and techniques to project activities to meet the project requirements." Based on PMI methodology, project management is accomplished through the appropriate application and integration of the 47 logically grouped project management processes which are categorized into five process groups, namely initiating, planning, executing, monitoring and controlling and closing as indicated in Figure 4-4.

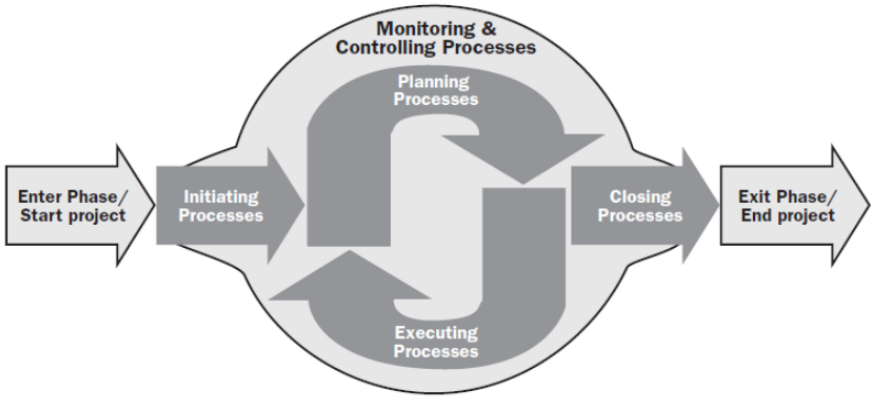


Figure 4-4: Project Management Process Groups (PMI, 2013)

It is called the IPECC Cycle which is originally based on Shewhart-Deming's Plan-Do-Check-Act Cycle (Perrin, 2013).

The success of a project based on PMI approach is measured in terms of completing the project within the constraints. Until the 5th edition of PMBOK (before 2013), constraints of projects were cost, schedule and scope. Barnes (1988) called these constraints "the iron triangle" which form a triangle whose its vertices are cost, time and quality as shown in Figure 4-5.

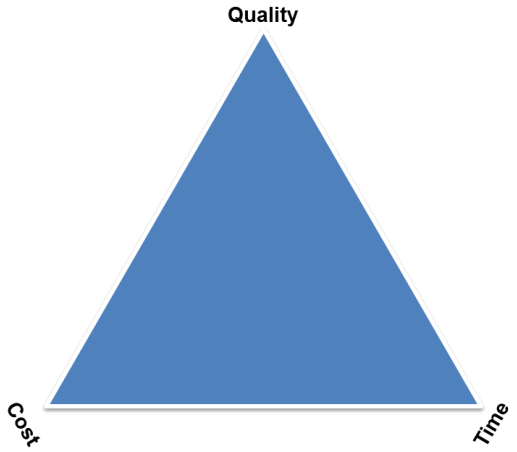


Figure 4-5: The Iron Triangle (Barnes, 1988)

Since the fifth edition, PMI expanded this model by six key constraints: Scope, quality, schedule, budget, resource and risk (PMI, 2013).

According to PMI, each project to be managed has 4 phases: initiation, planning, execution and close out. PMI considers and defines 10 knowledge areas. A knowledge area represents a set of concepts, terms and activities yielded from professional areas. These ten knowledge areas are (PMI, 2013):

- Project integration management
- Project scope management
- Project time management
- Project cost management
- Project quality management
- Project human resource management
- Project communication management
- Project risk management
- Project procurement management
- Project stakeholder management

Perrin (2013) criticizes that many organizations implementing the PMI project framework in their organizations make the mistake of thinking that the five process groups constitute project phases. They do not. According to PMI "The Process Groups are not project life cycle phases". The interplay between the knowledge areas and the project management process groups are shown on Table 4-1below.

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Time Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

Table 4-1: Project Management Process Group and Knowledge Area Mapping (PMI, 2013)

The Table 4-1 shows there are 47 project management subsidiary processes (under the main five) and they are grouped into ten separate knowledge areas. PMI followed a unified form in all subsidiary processes applied to any knowledge area as illustrated in Figure 4-6.

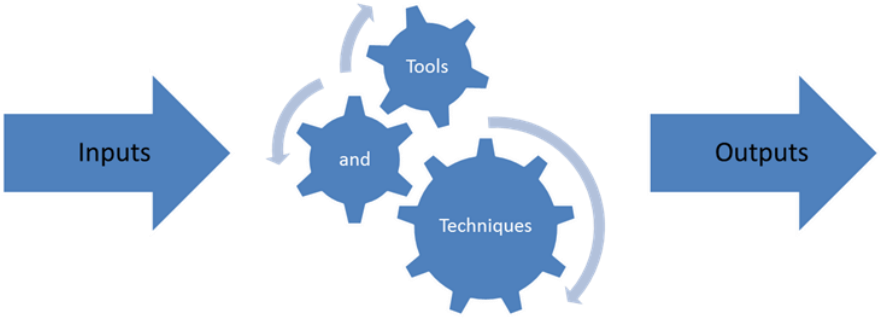


Figure 4-6: PMI Process format (Perrin, 2013)

- Inputs: are the documents and processes that contain the data and information from the project which are then acted upon by tools and techniques.
- Tools and Techniques: This can include formal analysis, the use of mathematical models and templates to produce outputs
- Outputs: which are the desired results of the process

4.3.2 Project Management under Lean Thinking "Lean Management"

"Lean Management" is the practical application of "Lean Thinking", which is deeply rooted in the production system. Marchwinski and Shook (2014) define "Lean Management" as "a series of practices that develops people to understand and own their problems, and aligns resources to achieve the purpose of the organization. It engages everyone in designing processes to continuously solve problems, improve performance, and achieve purpose while consuming the fewest possible resources." This comprehensive definition of "Lean Management" should always be read with the basic understanding in mind introduced by Womack as a philosophy aiming at value and working to eliminate all obstacles in the way of achieving this aim.

Lean Management is project management with the principles of Lean Thinking; however, this does not ignore or abandon everything that has been accomplished in the field of project management in the past. It rather involves adopting a new management philosophy based on the five principles mentioned by Womack in his book "Lean Thinking" and the expansion provided by Liker with his "4P-model" including the 14 principles as shown in Figure 4-3 above. Regardless of the project's industry be it automobile, construction, banks, food or even healthcare, the result of the project (or any internal process in it) is a product (as referred to by Womack which could be either goods or services). The focus on the value, which the customer is looking forward to within the production process, is the core of Lean Management. This new philosophy requires a change in structure and in the way an organization works when applying it. Thus, project management under Lean does not only depend on processes as in the PMI framework, it rather depends, in the first place, on the people involved in these processes who are able to constantly and continuously improve them depending on the principles, tools and techniques of Lean. Some of those are: just-in-time, Kaizen, Kanban, 5S, pull principle and value stream analysis (Gehbauer, 2012).

However, it is possible to apply the Lean Management philosophy on the PMI methodology and its knowledge area & management process by improving and developing these processes and incorporate some changes in the structure of the organization that go with the essence of Lean. Of course, this is not easy and cannot happen overnight. It is a continuous improvement process. Womack (1996) set up a logical way to move to Lean Management by the following steps (Lean.org and Womack (1996))

1. Find a change agent: the one who will take personal responsibility for the Lean transformation like Art Byrne and his Lean story by General Electric Corporation.
2. Get the Lean knowledge: via seminars, training and Lean workshops. It is important to find people with Lean knowledge who can teach and train the team. Nowadays, there are many Lean consultants available worldwide, some of them later on wrote the book "Kaizen".
3. Forget the grand strategy for the moment.
4. Map the value streams: Start with the current state of material and information flow. Then draw the future state of how they should flow, and based on this, create an implementation plan with a timetable.
5. Begin as soon as possible with the implementation
6. As soon as you have got momentum, expand your scope.
7. Create an organization to channel the value stream by creating a Lean promotion function and involvement for people.
8. Implement a business system to encourage Lean thinking by teaching Lean thinking and skill to everyone and pay people in relation to their performance; therefore, performance should be transparent and measurable.
9. Complete the transformation by convincing suppliers and customers to play with and by converting from the top-down leadership to a leadership model based on coaching and teaching, rooted in the scientific method of “plan-do-check-act”.

In one summarized sentence, project management under Lean thinking is a project-based production management (Gehbauer, 2012).

4.4 Lean Management in the Construction Industry

Lean Management in construction goes back to Lean Management in production. Despite the obvious difference between construction industry and production industry, the application of Lean’s management philosophy in construction proves to be feasible by adopting the basic principles of Lean and working to develop new tools and techniques based on these principles, and at the same time consider the features of the construction industry (Gehbauer, 2012).

Therefore, before entering the world of Lean management in construction, it is important to look at the construction industry and the kind of management applied therein and how Lean found its way into the construction industry.

4.4.1 The Construction Industry

According to Moavenzadeh and Koch-Rossow (1975), the construction industry plays a major and important role in the economy of countries, especially in less industrialized nations. Construction is the only way to create physical facilities which directly contribute to the fulfilment of various major national goals and play a critical and highly visible role in the process of developing nation. They see the construction industry as the sector of economy which transfers various resources (construction material, effort of labour and knowledge) into constructed facilities through construction processes which include planning, design, and construction, maintains and repair, and operation.

The economic system of a country is divided into three basic sectors (Rico, 2001):

1. Primary sector: whose products are obtained directly from nature such as raw materials
2. Secondary sector: the activities carried out in this sector to transform raw material into finished or semi-finished product
3. Tertiary sector: the service sector, producing no goods but services

According to Rico (2001), construction is only assigned to the secondary sector. However, he believes that due to importance of the construction industry, this connection be extended to the primary and tertiary sector as well. Llorca and Fernandez (2006) see that the importance of the construction industry in the economy is based on three essential characteristics: its size, its consideration as an investment good and its dependence on the public sector. This is why the construction industry is considered "the Powerhouse of economy". For example, the construction industry in Spain plays a vital role in the Spanish economy. It affects and is affected by any economic crisis. During an economic boost, the positive contribution of construction to an economy becomes increasingly obvious, and during an economic recession and or economic crisis, the effect is reversed. Figure 4-7 shows the Gross Value Added (GVA) from construction to the Gross Domestic Product (GDP) of the Spanish economy. It shows a rise in the share of construction in GDP from a low 7.3% in 1997 to 12.6% in 2006 coinciding with years of economic boost. The recession was notable in 2008 and 2009, and is still continuing until now, with a decrease in the share from the maximum 12.6 to 7.9 in 2013.

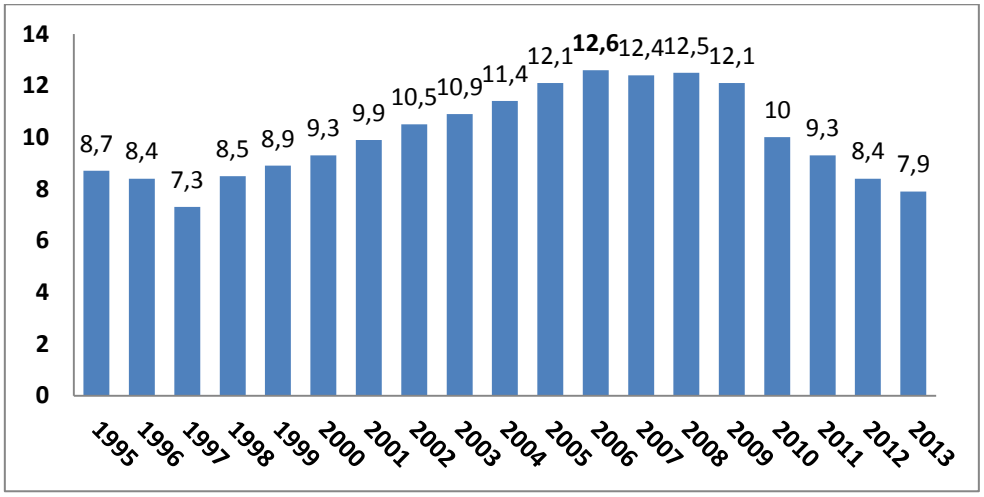


Figure 4-7: GVA participation of the construction industry in Spanish GDP

This industry is both important and highly complex, owing to the fact of very diverse participants and stakeholders. Moavenzadeh and Koch-Rossow (1975) divided this industry's participants into three traditional groups: the client, the professional, and the contractor. Rico (2001) on the other hand, sees that there are many agents involved in the construction industry and each agent tries to defend their respective interests, for example:

- Customer: promoter who orders the construction. The customer can be public or private, depending on whether the work is a public or private construction project. Pellicer et.al (2004) believe that over 90% of the construction investment in civil work, which is the construction and maintenance of infrastructure such as roads, dams, canals, and ports, etc., are funded by government (public customer).
- Designers: professionals who design and develop all necessary documents so the construction work can be started. Professionals are architects, engineers and consultants (Moavenzadeh and Koch-Rossow, 1975).
- Contractors: construction companies who are responsible for the execution of the work.
- Sub-contractors: main contractor and other construction companies outsource parts of the work or activities which require specialized companies.
- Manufacturers and suppliers: are responsible for supplying of needed materials and equipment.

- Construction staff: composed by site manager who manages the site and supervises the development of the construction. Labourers are responsible for the proper construction of the facility.
- Buyers and users: final customers who use/enjoy the facility.

In addition to the wide spectrum of participants in the construction industry there are special distinguishing characteristics that make it unique in many aspects. Rico (2001) lists some characteristics that differentiate construction industry from other industrial sectors.

- The construction activity usually takes place outside.
- The final product is not transportable: The production centre is located in the place where works will be carried out, and once they are completed, the production centre is demolished or dismantled.
- Diversity of products: All building products are different.
- The sector is related to unequal demands and differing requirements as to function, size and location. The customers are public and private.
- Market fragmentation: The differences that exist between the building and civil engineering construction classify the activities of construction companies.
- Intensive use of labour: The construction industry uses largely low-skilled and highly mobile labourers.
- Close relationship with the economic cycle: The more developed a society, the greater the demand for construction activities.
- Poor organization of production: This is a result of a large number of factors involved, and there are many materials and many different forms to reach the same result.
- Greater reliance on local suppliers: especially in international projects; a big portions are awarded to local suppliers/subcontractors.
- Strong environmental impact: The mining of raw materials is an activity that strongly degrades the landscape. Manufacturing construction material requires a lot of energy.
- Long product life: During the life of a product many maintenance costs are involved.
- Overspending: Practically all works end up costing customers more than originally budgeted. Theses deviations arise from what is been projected and finally executed.
- Participation of many professionals, landowners, professionals for project development (roads engineers, technical architects, architects), local governments, municipalities and communities, builders and installers, notaries and registrars property, legal and tax advisors, brokerage firms, the housing market, publicity and advertising companies, banks and savings, public finance clients (Llorca and Fernandez, 2006).

The economic importance of the construction industry, the complex relation network connecting its participants and its characteristics require a more detailed study of the management methodology applied in this industry which can be found in the following paragraph.

4.4.2 Classic Construction Management

Moavenzadeh and Koch-Rossow (1975) believe that understanding the construction management process requires understanding the construction process itself and the relationship between its participants. They argue that the participants in this process belong to different organizations. Most of them are chosen based on price and / or qualifications. The relationship that combines them is based on project-by-project which makes construction a project-based industry. Alhuja (1994) defines the most important characteristics of construction projects as follows:

- Objective: what is the project designed to achieve.
- Schedule: the duration of the project and its target dates must be met.
- Complexity: the technological requirements such as the construction of a nuclear power plant.
- Size and nature of the task: a project involving thousands of workers and several years of construction time.
- Resources required: every project requires unique materials and individuals to complete it.
- Information and control system

Gehbauer (2012) explains that construction management is an American English term which describes the process of managing construction projects by staffs working for a construction company and where the project manager is responsible for managing the project according to the agreed project contract. CIOB (2002) defines construction project management as "the overall planning, coordination and control of a project from inception to completion aimed at meeting a client's requirements in order to produce a functionally and financially viable project that will be completed on time within authorized cost and to the required quality standard." As a matter of fact, the three terms "time, authorized cost, and required quality standard" are the focus of attention for participants in construction projects. These constraints form the iron triangle introduced by Barnes (see Figure 4-5).

Clough and Sears (1994) suggest a simpler definition for construction management that shows the importance of Barnes's iron triangle. Construction management, according to them, is "the judicious allocation of resources to complete a project at budget, on time and at the desired quality" (Gehbauer, 2012). To achieve this, Corsten (2000) believes that project management processes that include planning, organization, execution and control, must be based on these important constrains suggested in the definition of construction management; namely cost, time and quality. Other scholars like Walker (2002) and Fewings (2013) connected the definitions of "construction management" and "process of management" when they adopted the definition of "the planning, coordination and control of a project from conception to completion" which is found in CIOB (2002). In fact, in classic construction management, all involved are concerned with planning and control. Alsehaimi (2011) found that the planning and control processes form the foundation of project management in construction. Others limited it by considering planning as the core competence of project management, thus they considered control as part of planning itself. This corresponds with Laufer and Trucker (1987) who believed that planning in construction management has five basic functions: execution (action planning), coordination, control, forecasting, and optimization.

Gehbauer (2012) noticed also the important role planning and control plays in classic construction management. He found that the purpose of these two basic processes was to focus attention on the three constrains: cost, time and quality. Thus, he explained that the exerted efforts and research activities in construction management of the past aim at developing methods and tools to serve this purpose (lowest cost and shortest time).

Many tools and methods were developed to serve the management of construction projects based fundamentally on establishing a scope of work following a structured approach. This involved creating the work breakdown structure (WBS) which is the process of subdividing project deliverables and project work into smaller, more manageable components (PMI, 2013). The developed WBS is the starting point to develop the work plan. Globerson (1994) sees the WBS as the "backbone" of proper planning, execution and control of a project because it is the base of classifying work in groups, so that one can predict the resources needed; consequently, estimate the required cost. According to him, the WBS established the framework for:

- Defining the work to be accomplished

- Constructing a network plan
- Summarizing the cost and schedule status of a program for progressively higher levels of management

The smallest element in WBS is called "work package", and it includes several activities, which are interconnected by a network between these and other activities from other work packages.

Figure 4-8 shows the methodology of PMI in managing the scope which is divided into six sub-processes: plan scope management, collect requirements, define scope, and create the WBS. These sub-processes are included under planning process group, whereas validation of scope and control scope are included under monitoring and controlling process group. The Figure 4-8 also illustrates both the input and output of each process in addition to the tools and techniques used or could be used.

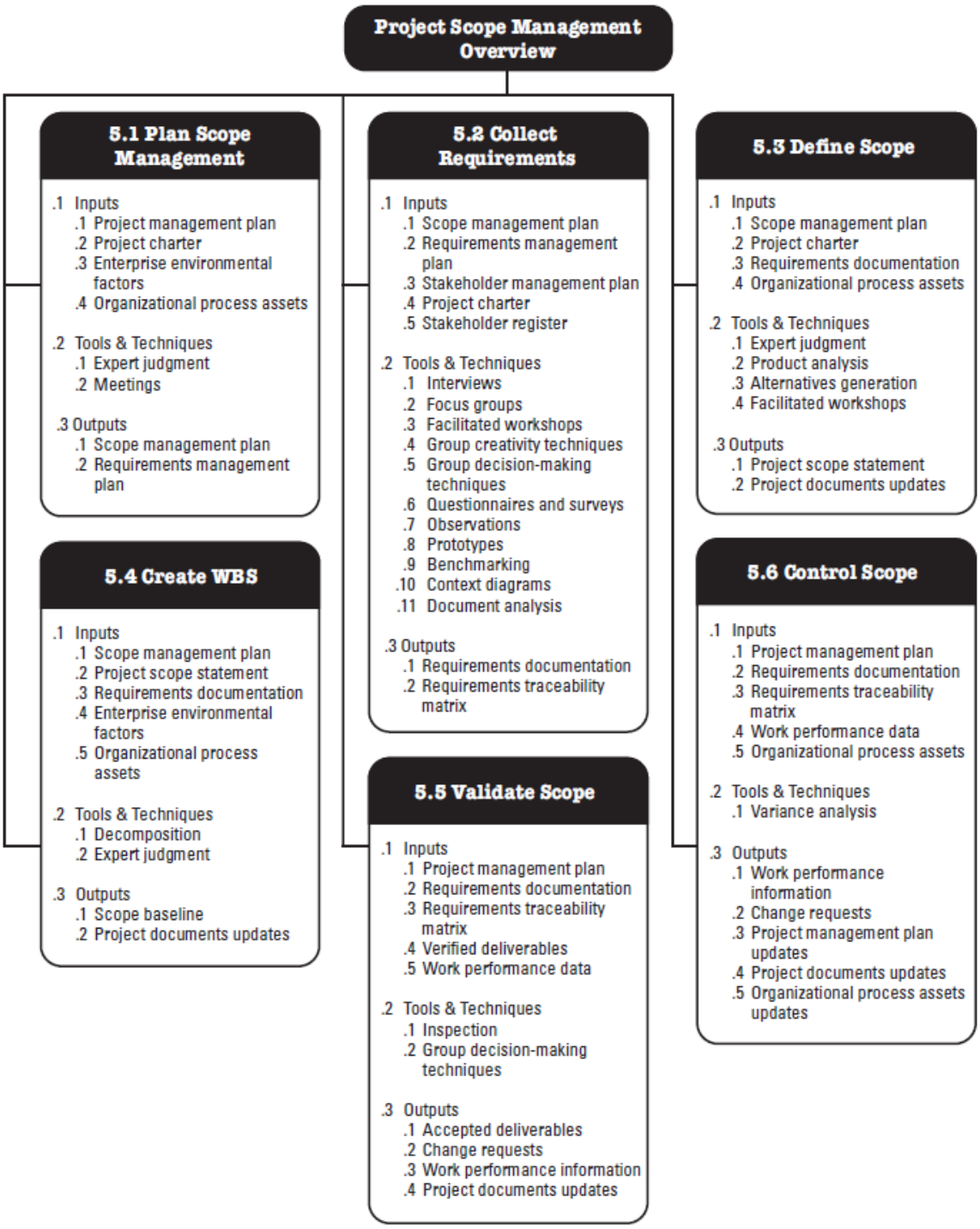


Figure 4-8: Project scope management process, based on PMI (2013)

As soon as the WBS is created, planning the project time comes next through project time management. Figure 4-9 shows the methodology of PMI in managing time, which is divided into seven sub-processes: Plan schedule management, define activities, sequence activities, estimate activity resources, estimate activity duration, develop the project schedule, and control schedule as a control process. Similar to Figure 4-8, Figure 4-9 shows both the input and output of each process in additional to the tools and techniques that can be used.

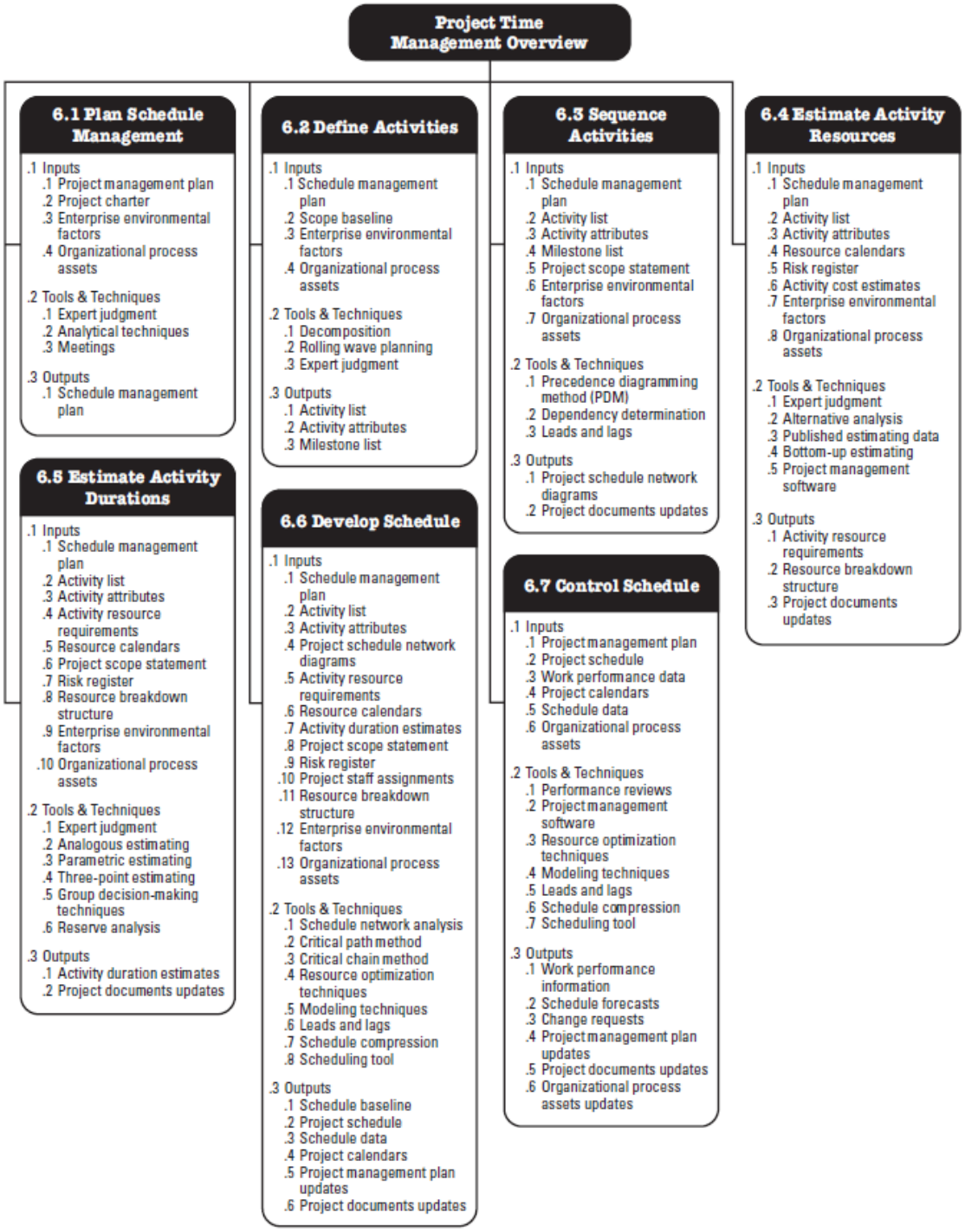


Figure 4-9: Project time management process, based on PMI (2013)

Planning time is followed by cost management. Managing cost includes four sub-processes: plan cost management, estimate costs and determine budget, then control costs as a control process. Figure 4-10 shows, similar to the previous two figures, both the input and output of project cost management along with the tools and techniques used.

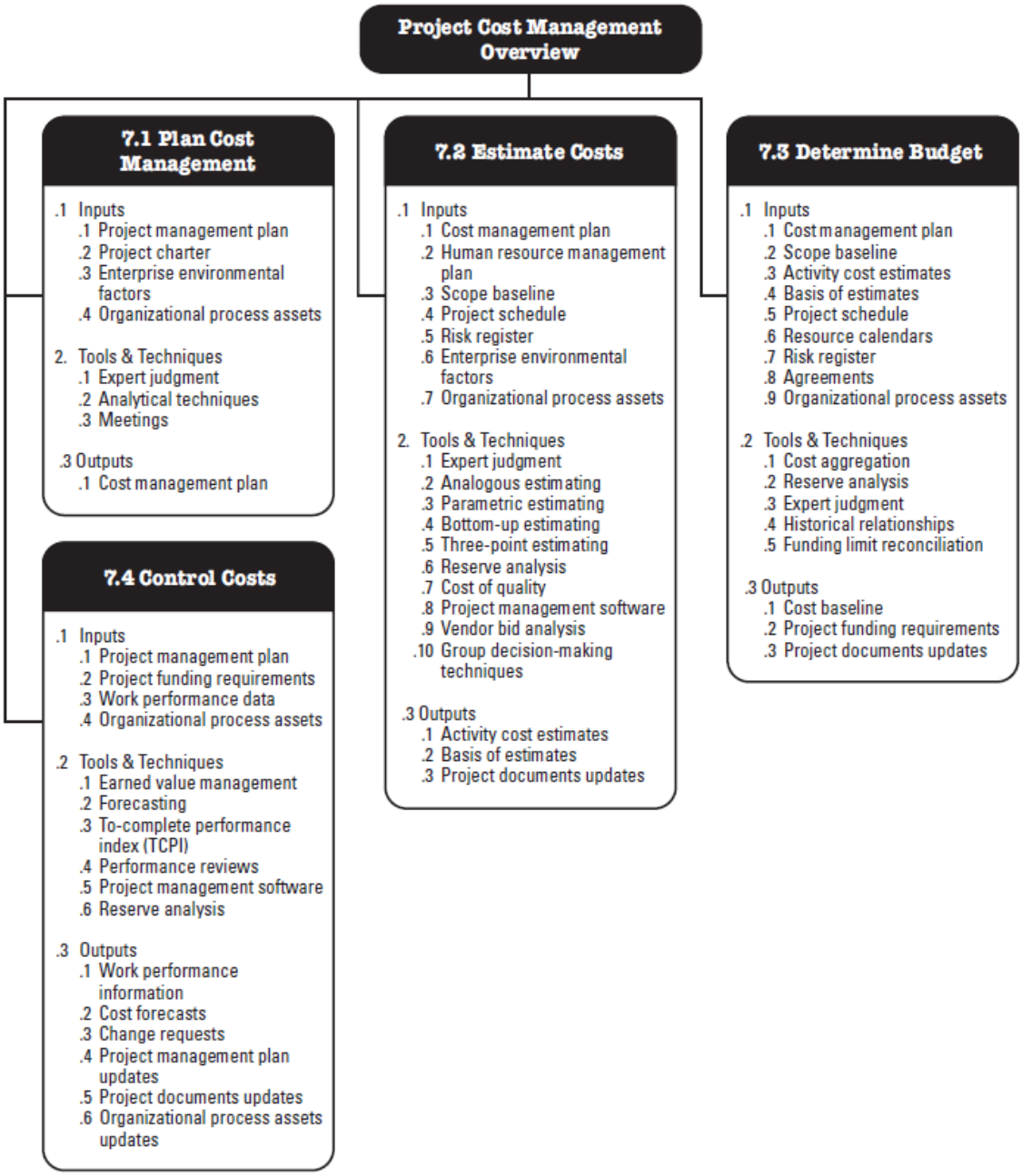


Figure 4-10: Project cost management process, based on PMI (2013)

Here, it is necessary to note the basic principle classic project management is based on: “creating a baseline”. The output of the scope management process is the "scope baseline", for the time management process the output is "schedule baseline", and for the cost management process it is "cost baseline". This is followed by the monitoring and control process were the planned “baseline” is compared to what is being executed in reality through the execution phase, then the necessary correction steps are being taken.

Alsehaimi (2011) studied in detail planning techniques used in classic construction management. He summarized them as Line of Balance (LOB), PERT, Critical Path Method, and Critical Chain Project Management. The following Table 4-2 summarizes the method and principle which they are based on.

Planning Technique	Concept
Line of Balance (LOB)	Planning technique for repetitive work. Basically, this technique serves to find the resources required for individual stages or operation, so that the following stages are not delayed and target outputs can be achieved. It shows clearly the rates of actual and expected progress and provides an excellent measure of achievement. It is unsuitable for non-repetitive work.
PERT	It is used in planning and controlling new projects where the uncertainty associated with cost and schedule needs to be evaluated. PERT, like, CPM, uses logic diagrams to analyse performance times. PERT charts are drawn as activity (narrow) diagrams focusing on the event (nodes). The outcome of a PERT calculation is the probability of achieving performance of all activities which define an event. PERT provides a basis on which time and cost performance can be estimated. PERT permits more information than LOB.
Critical Path Method (CPM)	It is an extension of the Gantt bar chart to mathematically determine the sequence of activities required to allow a project to finish in the shortest time possible. Apart from determining which sequence of activities is critical for the timely completion of a project, it is also possible to calculate the acceptable extent of a delay to the start of non-critical activity before it affects the overall program.
Critical Chain (CC)	The CC of a project is the longest chain of dependent events, taking task dependencies and resource conflicts into account. The method is based on the theory of constraints with its three improvement questions: What to change? To what? How to cause change?

Table 4-2: Planning techniques used in classic construction management based on Alsehaimi (2011)

Koskela and Howell (2001) studied PMI's methodology of project management which represents the classic project management approach. In their study, they focused on the three processes: planning, execution, and controlling which form the core processes of project management compared with the remaining two processes: initiating and closing. They found that the present style of PMI's project management approach is based on two theories:

1. The management as planning (for planning and execution)
2. Thermostat model (for control)

They illustrate the relationship between the three processes based on two theories in a closed loop as shown below in Figure 4-11.

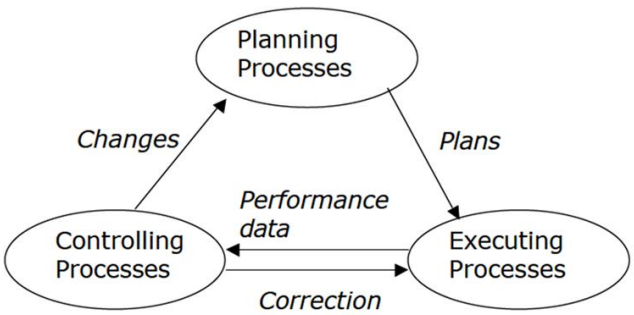


Figure 4-11: Managerial processes in project management according to PMI's approach (Koskela and Howell, 2001)

On the other hand, they studied the current situation based on several examples of different construction projects. They found that practice contradicts theory because empirical evidence indicates that critical interfaces are disconnected between the main management processes. They argue that:

- The planning system itself is not in control
- Execution does not try to realize plans, as lower level plans are not tested against reality.
- Control leads to negative impact on execution, rather than correction.

Taking this analysis of reality and theory as a starting point, they introduced some reasons for these discrepancies which they consider to be interacting and reinforcing each other (negatively) (Koskela and Howell, 2001):

- Possibility of poor implementation of project management principles in some cases.
- Poor theory of project (production), the normative advice suggests that a project consists of a series of sequentially related activities, when in reality activities are often interdependent.
- The lack of underlying management theory in project management.

According to them and other scientists in the construction management field, these theoretical problems in understanding management in addition to the empirical evidence make a strong base and an important motive for intensive demand to a comprehensive change in the theory of management and its practical applications. The next section introduces the response to this intensive demand where it presents the reform in construction industry.

4.4.3 Lean Construction

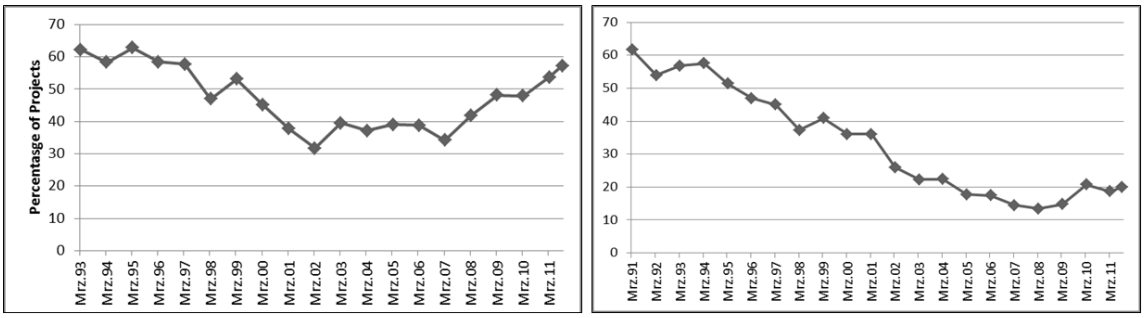
Project management process based on the two theories explained by Koskela and Howell (2001) above (management as planning and thermostat model) is poor. They state "unfortunately, both theories can be shown to be heroically simplistic and insufficient for the point of view of project management reality." Of course, an application of an inappropriate theory will lead to inappropriate consequences. Therefore, they also found that the practice of project management suffers from three shortcomings (Koskela and Howell, 2001):

- The role of planning is not realistically defined, and short term planning (that is critical from the point of view of execution) is customarily poorly carried out or simply neglected.
- There is no systematic way of managing execution, i.e. taking into account the actual condition of the real world as higher level plans are translated into short term plans and then into action.
- Control is too narrowly seen as measuring and taking corrective action, rather as a process of learning.

Koskela and Howell (2001) see that the weak interface between planning and execution is the cause for the first and second shortcomings. Of course, these shortcomings in management theory and their subsequent shortcomings in application have a great negative impact on the objectives of the project mentioned before with respect to cost, time, and quality. Therefore, most construction projects suffer from delays and cost overruns. However, the percentage of these time and cost overruns depend on the project type, management efficiency, and stakeholders.

The Indian construction industry is a good example here, where the problem of time- and cost overruns is very severe. The reports of the Ministry of Statistics and Program Implementation (MOSPI) clearly prove the infamous delays and cost overruns. However, time overrun not only upsets the planned targets but also causes cost overrun due to inflation, exchange rate fluctuation and higher

interest rates and administrative costs (Bahwan and Marg, 2012). Figure 4-12 ((a) left side) depicts the percentage of delayed projects between 1993 and 2011 where ((b) right side) depicts the trend of cost overrun between 1991 and 2011 in Indian construction industry based on MOSPI report.



(a) Percentage of delayed projects (b) Percentage of projects with cost overrun

Figure 4-12: Percentage of delayed projects in Indian construction projects (MOSPI Annual Report, 2011-2012)

Singh (2009) shows a powerful relation between the delays and cost overruns and many project management issues. He argues that improper planning and contractual failure are the main reasons for cost overruns.

A decrease in productivity is a significant problem of a construction industry that is based on the classic management approach. Wodalski et al. (2011) referred to this stating that the "construction industry has not improved productivity since the 1960s". On the contrary, they believe that it has witnessed recession "all non-farm U.S. industries have more than doubled productivity, but the construction industry's productivity has actually decreased". Figure 4-13 below shows the labour productivity from 1964 to 2000. They also refer to the low productivity as a consequence of improper project management.

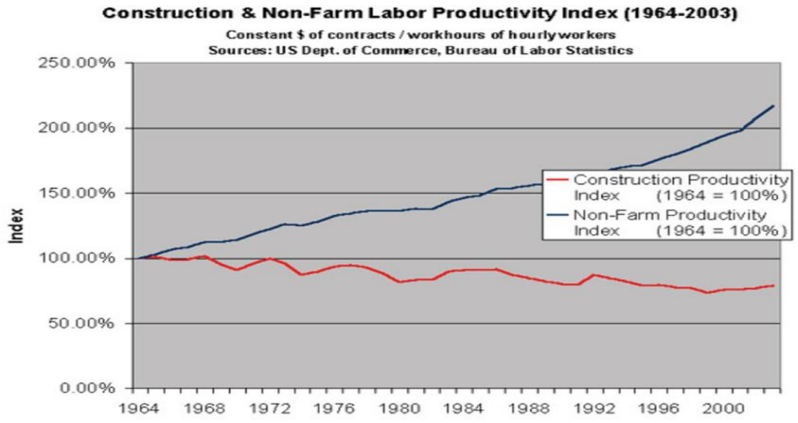


Figure 4-13: Construction and Non-Farm labour Productivity Index (Wodalski et al., 2011)

These problems accompanied construction management for a long time. Researchers and other people involved in the construction industry tried to solve them and to find a new methodology to overcome the existing shortcoming in construction management. At the beginning of the 1990s, the early features of success started to appear along the way, and a new concept of construction management was announced in 1993, called Lean Construction. This term has been coined by the International Group for Lean Construction (IGLC) at its first meeting in 1993, hosted by Professor Lauri Koskela in Finland (Alsehaimi, 2011).

The new concept of "Lean Construction" has relied on the success of the production industry compared to the retardation experienced by the construction industry. Therefore, it depended on the principles and concepts of "Lean Management". Gehbauer (2012) sees that "Lean Construction belongs to the same family as Lean Management, Lean Production, and Lean Thinking and it relates to the construction industry. It has the same approaches and methodologies that have been developed and introduced by Ohno, Womack, Jones, Goldralt, and many others".

In fact, the main efforts that seemed to form Lean Construction relied on two researches, the first was carried out by Koskela and the second was introduced by Howell and Ballard. Koskela (2000) reviewed the scientists' criticism of classical management. He found that "several scholars of construction have pointed out the lack of theoretical foundation in construction as a barrier to progress", therefore he introduced his new theory called "TFV Theory of Production" where TFV build a model consisting of three elements; Transformation (T), Flow (F) and Value generation (V).

On the other side, Ballard and Howell (1994) studied Koskela's essential model called "Conversion Model" which is the basic of the TFV model; they were looking after the best method to implement it in construction projects. First, they focused their implementation strategy on the element "Flow (F)" of the model because, in their opinion, the flow management is the most difficult task in construction management, especially in complex and fast track projects. In this regard, they carefully studied the traditional planning process in construction management and they developed the Last Planner System (LPS) as a production control tool. These two components, the new theory of Koskela (TFV Theory) and its application tool introduced by Ballard and Howell (LPS), form the core of Lean Construction.

However, when introducing and discussing their concepts, neither Koskela's theory (TFV) nor Ballard's tool (LPS) considered the corruption phenomenon in construction, thus, this important phenomenon was not discussed directly in Lean Construction. In this research, it is assumed that corruption is a major obstacle to the implementation of Koskela's theory and Ballard's tool. In other words, corruption is the main obstacle facing the movement towards Lean Construction and its implementation both in projects and on organization levels.

Here, it is fair to mention that despite the fact that both Koskela and Ballard did not mention corruption directly, they referred to "Transparency" as a basic principle, which is, in a way, related to corruption. Koskela (2000) sees that one of the fundamental sources of improvement is to "increase transparency". However, he mentioned that transparency is more or less a heuristic principle that has been observed to be useful in practice but is, as yet, less directly connected to theory. On the other hand, Ballard (2000) sees that LPS needs more transparent look-ahead processes, and he argues that transparency is an important issue for a better implementation of LPS. However, "Transparency" is not a new concept related only to Lean Construction. It is also an important principle in Lean Thinking; Womack and Jones (1996) made its importance clear as they describe transparency as the key principle in everything.

Therefore, this research aims to put the corruption phenomenon on the agenda of Lean Construction, assuming that its lack affects the successful implementation of Lean Construction. How can corruption affect Lean Construction and which opportunities within Lean construction help combat corruption in the construction industry? All these thoughts will be discussed in the next chapters along with the relation between Lean Construction and corruption in construction.

5 Lean Construction and Corruption in Construction

Undoubtedly, as discussed in chapter 3, corruption is a dangerous factor in the construction industry. Its bad impact transcends quality, time, and cost of any project, it affects directly or indirectly the environment, society, and the target values of project delivery, in addition to its negative effect on the construction companies and individuals involved in it which results in losing their reputation.

There are many examples of companies excluded and banned from entering tenders or new projects because of their corrupt behaviour. Examples are the sanctions applied by the World Bank when firms or individuals are found through an INT investigation to have engaged in corruption. The WB may impose a sanction such as debarment as discussed in section 2.4.2. Debarred entities are then ineligible to be awarded a WB financed contract, either permanently or for a designated period of time. On 29 July 2011, the WB announced the debarment of China Communications Construction Company Limited (CCCC). CCCC is mentioned above in the 100 top construction companies and ranks fifth as a global top construction company. The debarment was due to fraudulent practices under Phase I of the Philippines National Roads Improvement and Management Project. Thus sanctioned, CCCC is ineligible to engage in any road and bridge projects financed by the WB until January 12, 2017 (World Bank news, 2011). Another example, also from China, is the death sentence of the corrupt former railway minister, Mr. Liu Zhijun. The court has sentenced him to death, with a two-year reprieve, for bribery and abuse of power (The Guardian, 2013).

Meanwhile, Lean Construction came as a revolutionary corrective approach for the construction industry, not only on project level but also on the level of organizations and companies working in this vital sector. Lean Construction offers a new management framework and understanding based on value in its original sense.

"Corruption in Construction" and "Lean Construction" are two contradictory concepts. Neither of them can exist and flourish in the presence of the other. In other words, the existence of corruption results in reducing the effectiveness of Lean, and vice versa, the implementation of Lean leads to reducing corruption. This contradictory relationship is the basis of this research's hypothesis "There is a contradictory relation between "Corruption in Construction" and "Lean Construction". The existence of either of them is a barrier to the other and leads to a reduction in their effectiveness".

Following the contradictory effects of both concepts will be discussed in more detail.

5.1 Corruption as a Barrier to Lean Construction

Chapter 4 highlighted the importance of transparency in Lean Construction as define by Koskela and Ballard. In addition, Womack and Jones confirmed its importance as a key principle in Lean. As a matter of fact transparency is also a main principle in fighting corruption. Corrupt people always seek to obscure or decrease transparency in order to succeed in their corrupt actions.

Here, in the first stage, we can consider transparency as the link and the connection between corruption and Lean Construction. In the case of corruption, corruption is the enemy of transparency; in the case of Lean, Lean is the ally to transparency or, in other words, transparency helps in overcoming corruption. At the same time, transparency helps in implementing Lean Construction successfully. Both Koskela's theory (TFV) and Ballard's tool (LPS) will be discussed below in order to determine how corruption influences and obstructs Lean Construction.

5.1.1 Corruption and the Transformation-Flow-Value generation (TFV) Theory

Koskela (2000) introduced a new theoretical foundation for construction management with his theory (TFV). He was able to explain many problems of construction management in the current era, in addition to several ideas on improving efficiency and eliminating wastes, thus increasing the value for the customer. However, as mentioned before, Koskela did not consider the effect of corruption in his theory. The following paragraphs will discuss corruption in construction in the context of the TFV theory.

Corruption and Transformation Concept

The transformation concept is the first concept of Koskela's model of production (or TFV theory). By transformation, Koskela includes all operations producing goods, services, or a mixture of the two, using their resources to change the state or condition of something to produce outputs. According to Koskela, "all operations conform to the general input - transformation - output model" shown in Figure 5-1 (Koskela, 2000).

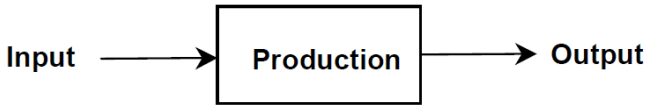


Figure 5-1: General input-transformation-output model (Koskela, 2000)

Based on the above model, Koskela expanded the production process as a transformation process, as illustrated in Figure 5-2 below.

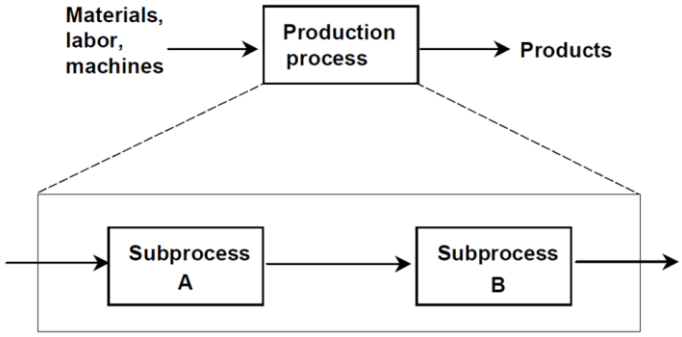


Figure 5-2: Production process as a transformation process (Koskela, 2000)

According to Koskela's model, the inputs of the transformation process are materials, labour, and machines, although they may not be limited to this. Anything classified under "resources", like energy and components, can be considered one of the inputs of the transformation process (Moavenzadeh and Koch-Rossow, 1975; and Koskela, 2000).

The hypothesis is that corruption negatively affects the inputs of the transformation process. Consequently, it will negatively affect the outputs of the process, i.e. the products. In the construction industry, corruption in all its types and forms has a big impact on construction materials, labours, and construction machines as discussed hereafter.

Input "Materials"

Paragraph 4.4.1 previously describes the important role of the construction industry in the economy. Construction is an important economic sector because of its strong link with other industries, the most important of which is the industry that supplies construction materials. Moavenzadeh and Koch-Rossow (1975) see that construction materials are important and provide basic input for the construction process. In addition, they argue that construction materials have the biggest impact on the cost of the construction project which could reach an average share of about 50 percent of the total construction cost.

Material, as a vital element in the construction process, can be considered an essential gateway through which corruption enters construction projects in many ways and forms. One of the cases presented by the Global Infrastructure Anti-Corruption Centre (GIACC, 2008) is a case of "supplying inferior materials": A concrete supplier is obliged to supply a specific concrete, however, deliberately delivers concrete of a cheaper and inferior specification and invoices the contractor for the specification he ordered. This is an example of the supplier's fraudulent activity. However, it would not have been possible without the participation of people in charge, whether the contractor or the supervisor who ignore the inferior quality in return of a bribe they may have received. The result of this corrupt practice (fraud) has a negative effect on the quality of the construction element in which this concrete will be used.

The second case is presented by Transparency International (TI, 2006) in which a group of material suppliers collude to fix the minimum price of their supply. Even when there is competitive tendering, prices will be kept higher than they would have been in the case of genuine competition. The negative impact of this corrupt practice (collusion) affects the cost of materials which will lead to increased construction project cost.

The third case in this context is from the Construction Sector Transparency Initiative report (CoST, 2010). It was part of the report of the Assurance Team (AT) who noticed in one of the Malawi Housing Corporation (MHC) projects the following: The Department of Building (DOB) provided professional advice to MHC which is suspected to have no legal foundation. Here, corruption may occur in one way or another. The DOB advised the MHC to expedite the construction program; therefore, the contractor would be given payment on an ex-gratia basis for materials on pro forma invoices with performance and advance payment bonds securing the payment. The performance bond had expired at the time of CoST's study. Furthermore, the contractor had re-paid the advance in full and therefore the advance payment bond had automatically elapsed. Consequently, it could not be used as security. This arrangement is unorthodox because it was solely done to expedite the works and it is not normal practice to make this kind of payment.

The last case is from the author's observation: During a specific project, there was only one concrete supplier for the whole project. A review of different monthly progress reports revealed that the main contractor suffered from a shortage of concrete delivery. In fact, the owner asked the main contractor to deal with one concrete supplier only. Project owners are allowed to nominate a specific subcontractor or supplier, at least according to FIDIC contracts. However, executing this right should only be done after careful consideration. Nominating a particular supplier is usually risky for the main contractor. When it happens, it should serve a technical purpose or be based on the requirement of a specific service, or know-how, or work quality owned by the nominated supplier. In such case, we may suspect the nominated supplier engages in corrupt practices. The observed result is always a decline in construction productivity due to a shortage of concrete supply. Consequently, this has a

major effect on workflow, productivity, and project time, in some cases; the workforce had to wait on site without work because of concrete shortage.

The above cases show clearly how corruption disrupts an important input of the production process. It negatively affects the quality of construction materials or its prices. These result in a lower output value than expected and higher production cost which directly damages the basic principle which Koskela explained as a transformation concept, i.e. "cost minimization". Koskela (2000) considered "cost minimization as the core principle of transformation concept". In addition, he considered "the value of the output of a process is associated with value (or costs) of inputs to that process" Therefore, it is important to protect this important input (materials) from corruption to ensure a clean input to the transformation process; consequently, an output compatible with the expected value.

Input "Labour"

Despite the big developments in the construction industry from heavy industries providing modern machinery and tools to be used in construction processes, this industry is still very much dependent on labour. This is confirmed by El-Gohary and Aziz (2014) when they argue that despite the development of construction machinery and equipment, the construction industry continues to be a labour-intensive industry, and the labour costs still remain an important part of the overall project's cost. Some researchers in the field of construction have revealed that the labour cost comprises 30% to 50% of the total project cost (Robles et.al, 2014).

In his explanation of the transformation concept in order to minimize cost, Koskela (2000) put great importance to labour and labour cost by relying on the hypothesis of Umble and Srileath. It states that the total cost of the production process equals the sum of the costs of each operation, and the cost of each operation (excluding material cost) is proportional to the cost of direct labour for that operation.

In his research, Koskela (2000) referred to two different schools for ways to reduce cost related to labour. The first school is the one Ford founded and depended on the "reduction of labour" through technology (reducing labour time). The second school was adopted by Ohno who, in addition to depending on technology, replaced "reducing labour" with "reducing the waste related to labour". Ohno, according to Koskela (2000), identified seven types of waste. Two of which are related to the work performed by people (labour), namely waste of waiting and waste of motion.

Lean construction, in relation to this important input of the production process, focuses on improving productivity or even increasing productivity. Figure 4-13 in chapter 4 showed how the productivity in the construction industry has decreased. Koskela started his research by speaking about problems in the construction industry and referred in his introduction to the idea that "construction productivity lags behind that of manufacturing". In fact, increasing productivity is a major factor and an important target anticipated by all organizations and construction companies, even if they do not know or implement Lean Construction. For this reason, increasing numbers of research works and scientific papers about improving productivity in the construction industry, especially productivity of labour, are available (Robels, 2014).

Researchers have concluded that it is difficult to obtain a standard method to measure labour productivity because of project complexity and the unique characteristics of construction projects (Oglesby, 1989). However, there exists a consensus among researchers to define productivity as "the ratio of output to input" (input and output of production process based on Koskela). Consequently, construction productivity can be regarded as a measure of outputs which are obtained by a combination of inputs. In review of this, two measures of construction productivity emerge (Talhouni, 1990).

1. The first one is the total factor productivity (TFP), which is defined as the ratio of outputs to the amount of all inputs. Based on TFP, the measure of productivity is as follows:

$$\text{TFP} = \frac{\text{total output}}{\Sigma \text{ of all input resources}} = \frac{\text{total output}}{\text{material} + \text{labour} + \text{machine} + \text{etc.}}$$

2. The second one is the particular factor productivity (PFP), where outputs and single selected inputs are considered. Based on PFP, the measure of labour productivity is as follows:

$$\text{Labour productivity} = \frac{\text{output quantity}}{\text{labour hour}}$$

The TFP shows the importance of labour and other input factors in improving the productivity. Further, PFP gives a closer look about an important factor of productivity related to labour (labour productivity).

At the time, Ford aimed to reduce labour time, i.e. to reduce the denominator in the PFP equation to increase the output. Opposed to this, Lean focuses on reducing the waste associated with the production process, including waste associated with labour as mentioned above (waiting and motion) which reduces hours of work and increases output quantity and therefore productivity.

In Lean Construction, Koskela gives labour productivity highly important and a key element in increasing the total productivity of a production process. He considered productivity as the major measure of improvement since the improvement of production is a goal of Lean (Koskela, 2000). In this context, Koskela provides a link between the concepts of productivity and transformation when he states “it is also instructive to note that the model is directly associated with the notion of productivity, e.g. the ratio of output to the input (or particular parts of it) in a given time period” (Koskela, 2000) and this reflects clearly TFP and PFP in his transformation concept.

Koskela (2000) tries to improve productivity, including labour productivity, by looking for concepts implemented in the production industry, like “Just-in-Time” and other concepts introduced in his research. However, he didn’t consider corruption associated with labour although this affects the labour productivity as well as other factors, as will be discussed in the following.

In general, corruption in the construction industry is complex. When considering corruption associated with labour as a major input of the transformation process, it is one of the most complex forms of corruption. Here, two cases of corruption can be distinguished: (1) corruption in the labour-environment and (2) corruption committed by labours. The two cases are interrelated and cannot be separated from one another, since the risk of becoming a corrupt labour when working in corrupt surroundings is high.

Koskela (2000) found that the Transformation Concept has been commonly presented in textbooks and articles on production and operation management. PMI (2013) defines operation management as "an area of management concerned with ongoing production of goods and/or services. It involves ensuring that business operations continue efficiently by using the optimum resources needed and meeting customer demands. It is concerned with managing processes that transform inputs (e.g. materials, components, energy, and labour) into outputs (e.g. products, goods, and / or services)". Project management in Lean is a project-based production management, which makes the two terms interchangeable: production management and operation management.

Referring to the above mentioned first case of corruption (corruption in labour-environment); corruption is associated with individuals (senior staff and senior management) in charge of the operation (or production) management which is responsible for overseeing, directing, and controlling day-to-day business operations. When at least one person of the operation management team is corrupt, this person can significantly affect the production process by manipulating inputs, the most important of which is labour. The same approach as above (case of materials) will be used to validate this statement.

One of GIACC cases (GIACC, 2008) is concerned with the "submission of false supporting documents in contract claim, or dispute resolution proceeding": A claimant submits false time sheets for specific work that was never realized or for longer hours that have not been worked. Consequently, this will influence cost records which incorrectly state the cost of labour. This corrupt practice (fraud) linked to labour and done by a person in charge in operation management will corruptly increase the cost of the project (or product). Such fraud, as seen before in chapter 3, is most likely accompanied by a bribe paid to those involved in reviewing and approving the claim.

Similar cases were recorded in this thesis' case study and in previous work in construction projects can be included under corruption in labour-environment. One of these cases here is when companies rely on (or hire) inefficient labour to perform the work. In one project executed by an international company (oversea contractors), the company had more than 6,000 labourers on site. It was reported that a big number of those workers were prisoners in their countries of origin. Since the company was owned by the government of that country, the labourers were sent to work on construction sites and thus spend the periods of their sentences. Meanwhile, the state rehabilitates them in the field of construction industry which is a developing sector in their country of origin. This can be considered a corrupt practice by the construction company which has a big impact on construction processes when assigning less efficient and lower quality labourers.

Other cases included many corrupt practices from senior management staff, e.g. labourers were employed not for their experience but for their relation with the senior staffs. This activity can be considered a form of corruption (nepotism) as explained before in chapter 3.

Another case is when senior staff uses labourers to do special private work e.g. renovating his house at the time when they are being assigned on the construction site (abuse of power and fraud).

Another corrupt practice (theft) was committed by an area manager, using a large number of labourers in his area to order tea, coffee, sugar, and detergent. Then he used them for private work or would even sell them for a good sum of money because they were so large in numbers.

All these cases of corruption, whether fraud, bribe, nepotism, theft and abuse of power, are linked in a way to labour and use this input of production processes to be settled. They have a big impact on the outputs of production processes, either directly or indirectly on the cost of production which Koskela's theory aims to reduce to the minimum.

In fact, corruption linked to labour in the construction industry is much more complex than just the issue of corrupt practices related to operation management and its impacts on project cost and product quality; it goes beyond that, taking on economic, social, and humanistic dimensions. Non-governmental organizations such as Transparency International (TI), International Labour Organization (ILO), Verité and others took an interest in corruption related to construction labour. Verité (2013) published a white paper "Corruption and Labour Trafficking in Global Supply Chains" where it detailed how corruption, fraud, bribery and other illegal practices were common features of the international recruitment of migrant workers. In 2016, The Freedom Fund and Verité (2016)

extended the white paper and conducted an exploratory study on the role of corruption in international labour migration. In this study, they focused on the construction industry. The study showed, in one of its aspects, the corrupt practice in recruitment processes. "A worker is paying an illegal "kickback" commission for a manpower agent in order to secure "demand letters or a job order". When extending the view of the Transformation concept and realizing how the recruitment process has been undertaken, the negative impact of corruption in choice of non-qualified workforce becomes obvious.

Transparency International (2010) shows how corruption has a negative effect on human rights and labour practices. The existence of corruption results in neglected health and safety standards at the workplace and in the environment surrounding the workers, which in turn significantly affects their productivity. Consequently, the total productivity of the project is affected, too. According to Koskela (2000), "another waste factor is the lack of safety" and "it is one of the chronic problems in construction". However, corruption is the main factor in restricting safety in the construction industry. The bribery paid to the Health and Safety Executives (HSE) to ignore many safety procedures in construction projects to save money at the expense of workers' safety is just one example, the purchasing of low quality safety equipment such as personal protective equipment is another. In this context, a case reported by CoST in its report about Afdera-Abala Road Project in Ethiopia is of relevance. An accident was reported where a pickup overturned and dropped over 15 metres deep. According to a consultant's investigation, the vehicle was overloaded with 43 labourers; four were found dead and most of them were injured. The investigation results revealed that the vehicle was very old and the break was not functioning properly which caused the driver to lose control of the car. To make matters worse, it was discovered that the driver did not have a driving license (CoST, 2015). This CoST case cannot be separated from corruption since it includes all factors that are inherently part of corrupt actions; i.e. disregard of procedures, omission to perform proper and timely maintenance, manipulating documents, and hiring a person who is not suited as driver without a driving license. All these are corrupt practices that did not only negatively affect the project value (increase the cost of the project) but, even worse so, caused fatalities and injuries to others who might not be able to work again in this sector or at all in the future.

The second case of corruption linked with labour (2) is corruption committed by labourer themselves, regardless of the general reasons of corruption, as they mentioned in chapter 2 and 3, e.g. low salary. Here are some examples of corrupt practices by labourers in the construction projects. Often, many labourers disappeared from the site, not only normal workers but also senior staff, despite the existence of an electronic fingerprint system for recording attendance in the morning (when work starts) and in the evening (when all workers depart). Many senior staff logged in in the morning and came in the evening to log out to give the impression that their work hours were always complete. Other labourers established a "good relationship" (using corrupt practices) to the IT person in charge of controlling and reviewing the fingerprint system to fill their hours manually in case of absence.

Another example from former projects is the bribing of the workers from subcontractor "geotechnical soil investigation lab") in charge of conducting soil tests at the site to count higher standard penetration test results (i.e. better SPT results). This might sound simple, but it has major impact when foundations are constructed on insufficiently compacted soil; consequently resulting in future building collapses or differential settlement which causes significant problems and damages to a building and its functionality.

Other examples include falsified certificates confirming specific experience to get the job opportunity, or senior staff manipulated scientific testimonies. They were hired as civil engineers and assigned technical and operational tasks outside their expertise. In Middle East, this is common procedure that finds its way into the news and newspapers daily. In 2006, the Ministry of Labour in the United Arab

Emirates (UAE) discovered forgery of 421 scientific testimonies in different disciplines; among them certificates of Bachelor of Civil Engineering Sciences, one of the forged certificates belonged to a "civil engineer" who works as a director of a big construction company in the UAE and another forged certificate belonged to a "civil engineer" who works as a safety coordinator (Al-Ittihad newspaper, June 21; 2006). Similar cases were reported in 2013 from the Saudi Council of Engineers which revealed 1,270 forged engineering degrees in the Kingdom, representing 36 countries headed by the Philippines, India, Pakistan and the Arab countries (Al-Arabiya net, November 23, 2013). Such corrupt practices (manipulation of certificates) damage the construction process as a major process input, labourers (including their skills and components), are not qualified for the job assigned to them.

Input "Machines"

There is no doubt that construction machines and equipment also play a big role in the success of a construction process. This was especially true in recent years when the heavy industry experienced a dramatic development, making the construction industry a target and a major client for them.

Corruption can find its way in this field, too. It starts with the procurement of machines. In some cases, machines are bought in larger quantities than required to speed up transactions and business deals, e.g. a, based on manipulated business plan, a corrupt senior manager of a construction company advised, his company to purchase a large quantity of drilling machines to create a new business unit within the company. The transaction was only executed with one manufacturer and shortly after the deal the senior manager attends the same manufacturer as a highly paid sales manager.

Other examples of corrupt activities include the purchasing of lower quality machines and equipment. In many cases, unqualified or inexperienced labourers are hired to operate machines.

Another example for corruption in this input of the production process is theft of equipment and tools from the construction site. In the case study, the author recorded the stealing of a pump used by a subcontractor in charge of installation the piezometer. The piezometer is typically installed in a borehole, therefore, drilling and cleaning of the borehole is required. By stealing the pump, the installation was interrupted, which considerably affected the work, it delayed the drilling for several days until a new suitable pump was bought and consequently increased the project cost. Moreover, the project was delayed and labourers were left waiting with no work for several days (zero productivity).

During another incident computers were stolen on site from engineers' offices. As a result, not only new computers and software had to be purchased, but also the locally stored information was lost which considerably decreased the efficiency and productivity of the site engineers and labourers.

These incidents of theft are included under corruption even if they appear minor; however, they greatly influence productivity and consequently the outputs of production processes.

Based on the above, corruption has a negative effect on the Transformation Concept. It is mainly caused by the corrupt operation management which runs and manages the inputs of the process, or if very important elements of the input process itself, namely labourers, are corrupt, too.

Both cases have a negative impact on the outputs of the production process and consequently decrease the expected value of the product.

Corruption and Flow Concept

Womack proposed "Flow" as the third principle of Lean Thinking. Koskela also considered the Flow Concept an essential part of his theory (TFV). In his opinion, construction management generally

ignores this principle or is unable to deal with it because the production process is being misunderstood. He relied on Shingo to explain the idea. Shingo believed that production is a network formed by axes of process and operation. Also, makes a distinction where the process refers to the flow of products from one worker to another and operation refers to the stage at which a worker may work on different products. Here, Koskela (2000) argues that the classical management approach had either confused these two concepts or forgotten the process altogether. Therefore, attention was always on improving the operation instead of improving the process (Koskela, 2000).

Koskela found that the fundamental source of improvement is to reduce (or eliminate) none-value-adding activities or waste (waste is unnecessary in production). This principle forms the basis of Koskela's Flow Concept from which he developed the concept of "Flow Management in Construction". At a later point, Ballard and Howell (1994) claimed that "Lean Construction focuses on managing flows" which is the cornerstone of the "Last Planner System" (Ballard, 2000) as discussed further below.

Koskela (2000) specified flow in construction (including design) as follows: information flow, material flow, location flow, and assembly flow. He stated that the "management of the flow is a major part in a production manager's job" The flow describes how materials and information are being processed.

Here, specially, when we connect flow with an individual, a group or an organization which has a tendency for corruption, the flow process will not be conducted correctly and the corruptive actions will prove to be real obstacles to the flow.

In chapter 2, Fjeldstadand (1999) interpreted corruption based on his P-A-C model. Agent (A) manipulates the flow of information to gain private benefit from client (C). This means that the flow process may be accompanied by a kind of corruption, e.g. manipulation and fraud to achieve a benefit. Therefore, the risk of corruption should be taken into account within the production process. This refers specifically to corrupt people who oversee flow processes, since their corrupt actions may hinder the flow, interrupt it or delay it at any point of the production process. Therefore, corruption forms a serious barrier to Koskela's flow concept, especially since he defines "the term flow actually refers to continuous flow" (Koskela, 2000).

Below, some examples on how corruption impacts the flow will be discussed. The first example relates to corruption in design, where Koskela presents design as flow. He found that "things are made through the flow of information" (Koskela, 2000).

GIACC (2008) presented a case about "manipulation of design": A project owner appoint an architect to design a project. One of the competing contractors who is tendering for the project bribes the architect to provide a design with which only the contractor can fully comply. The contractor bribes the architect with the promise of significant future work. The architect provides an appropriate design. The contractor submits a price that is higher than it would have been had there been a genuine competitive tender, and higher than several of the other tenders. The architect informs the project owner that the relevant design was in the project owner's best interests and that the compliant contractor should be appointed, even though his tender is not the cheapest, as only it fully complies with the tender design. The project owner follows the architect's advice and awards the contract to the compliant contractor.

Here, the architect deceived the project owner by manipulating the information given to him to develop a design based on the contractor's interest who is his partner in this corrupt action. Such a

case of information flow in design can also be called a diversion of flow; from its correct course to a corrupt premeditated action.

Another example from GIACC (2008) is a case of a design and build contract with an overly sophisticated design. A project owner and a contractor are negotiating a design and build contract. There is no competitive tender and the project owner relies on the contactor to put forward a reasonable proposal. In his written proposal, the contractor deliberately specifies an overly sophisticated design. The contractor is aware that an alternative cheaper design would be adequate for the project owner's purpose but does not inform the project owner of this possibility.

The contractor's intention is that the project owner will accept the sophisticated design as it will result in a higher profit for the contractor. The project owner places the contract with the contractor.

Here, also, the contractor deceived the owner by withholding information about an adequate design at a certain time (design phase). This case of withholding partial information or other alternatives of information flow at a certain time in order to gain a premeditated benefit.

In some of its reports, the Construction Sector Transparency Initiative (CoST), believes that bureaucracy (classified by researchers as a type of corruption as discussed in chapter 2) is an obstacle to the material flow resulting in the shortage of material on the construction site, due to the bureaucracy associated with the purchasing process. In addition, the theft of materials from the site is considered a corrupt action resulting in an interrupted material flow process.

From the results of the case study further below, several corrupt actions have negative effects and obstruct the material flow as well as the location and assembly flow. For example:

- The material flow was affected by corrupt logistic managers who changed more than once during the project's execution phase.
- Obtaining permission to enter the site was a big obstacle to the flow of either machines or labourers. Entrance permission could be sped up by bribing officials in charge.
- The location and assembly flow was affected by an area manager who would not give approval to commence work unless he was paid a sum, otherwise the manager would not let the subcontractor start work. Hence, labourers of the subcontractor assigned to this job stayed out of work.
- Some area managers became partners with subcontractors with specific percentage of contract values to gain access to work in their areas (sub-sourcing) which delayed flow in certain areas and sped it up in another regardless of quality.

All this confirms the negative impact of corruption on the important element flow as to Koskela's theory, which will be discussed again further below in the section "Last Planner System".

When Koskela introduced the Flow Concept, he specified with it three important flow concept related principles. The first, as mentioned previously, is part of the theoretical and conceptual foundation which is to reduce the share of non-value-adding activities (waste). Secondly, principles that can be derived from the theory i.e. reduce lead time and reduce variability. Thirdly, there are heuristic principles which have been observed to be useful in practice but according to Koskela; they are yet less directly connected to the theory. They are simplifying principles to minimize the number of steps, parts and linkages, increasing flexibility and transparency.

Despite the fact that transparency was not directly connected to theory (Koskela, 2000); but, there is no doubt that all engaged scholars (including Koskela) and stakeholders in the field of Lean Construction agree that transparency is the key factor for the implementation of Lean and for the delivery of successful projects (Stifi; Gehbauer and Gentes, 2014). Currently Lean Construction focuses on how to make the process transparent without taking in consideration the corruption of the

class that runs this process; i.e. the corruption of operation staff, managers, key staff or corruption of labours.

Corruption and Value Generation Concept

The Value forms the first basic principle in Lean Thinking according to Womack. Koskela added his theory to make it (value) an essential principle that both the first principle (transformation) and the second principle (flow) aim at.

In fact, scholars working in the field of Lean confirm that value is the heart of Lean, and it is an attracting factor to all efforts and actions to do the best to increase it or to eliminate anything decreasing it. On the other hand, all scholars working in the field of anti-corruption confirm the negative effect of corruption on value, describing it as an epidemic consuming it.

Meanwhile, Womack (1996) argues that what determines the value is "the ultimate consumer based on his requirement in terms of what specific good or services he needs at a specific price and time". In addition Koskela (2000) made the value generation concept depend on the relation between the supplier and customer as shown in Figure 5-3.

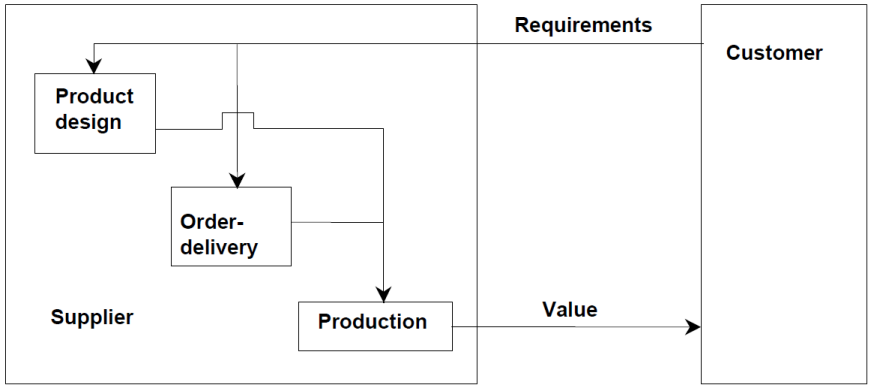


Figure 5-3: Value concept based on supplier – customer pair (Koskela, 2000)

Moreover, he made value an essential element when he introduced the simple definition of Lean Construction as "Lean Construction is a way to design production systems to minimize waste of material, time, and effort in order to generate the maximum possible amount of value." (Koskela et al., 2002).

Researchers in the field of corruption have proved that corruption leads to poor quality, cost and time overruns and consequently unsatisfied customers or clients, all this results in decreasing the value while Lean works to increase it.

The above introduced examples and cases about the effect of corruption on transformation and flow concepts are applicable here. The previous example about manipulation and specification of an overly sophisticated design shows how corruption occurs in the requirement of a customer (project owner) through a supplier (contractor). As shown in Figure 5-3 above, manipulating the product design will affect the production and consequently the expected value for the customer, of course in a negative way as presented in the cases of GIACC.

Other cases on the effect of corruption on value presented by GIACC (2008) are about "concealing defects". In the first example, a contractor accidently omits some structural steel from the foundation works. The contractor discovers the omission after the foundation has been completed. Neither the architect nor the project owner realized the omission. The contractor decides not to disclose the omission to the architect or project owner. The contractor invoices the project owner in full for the

foundation works (including the omitted structural steel). The project owner pays the contractor in full. This shows how corrupt action affects the value of the project in terms of cost and in terms of quality.

Corruption is not always an issue between main contractors (main supplier) and project owners (ultimate customer), the subcontractor may also be corrupt. Based on Lean philosophy, each element in the production process is referred to as a customer for the element that comes before, and this concept can also be applicable to the corruption of subcontractors. The second example of GIACC (2008) reflects this point: A roofing subcontractor installs a waterproof membrane. The membrane is accidently perforated during installation which means that it could leak. The membrane needs to be approved by the contractor's supervisor before it is replaced owing to the perforations. The subcontractor offers to make a payment to the supervisor if he certifies that the subcontractor's defective membrane is watertight. The supervisor accepts. The payment is made by the subcontractor to the supervisor and the supervisor issues the certificate. The subcontractor submits the certificate to the contractor, and obtains full payment for the defective membrane. Neither the subcontractor nor the supervisor discloses to the contractor that the membrane is defective.

This corrupt action shown here as fraud (hiding a defective part) and bribery (payment to the supervisor) will affect the value of the building, in terms of quality, additionally, it leads to lose the owner's trust in the main contractor after discovering the defect when it first rains.

Some examples introduced by Transparency International (2008) show the effect of corruption on value. The bribe included in the contract price is one of them: The cost of bribes paid by contractors to corrupt government officials is usually recouped by including the amount of the bribe in the contract price which is paid by public funds. This example shows how bribery will raise the cost of the project and consequently reduces the expected value for the owner (at least in terms of cost). In another example, Transparency International argues that corruption may have an immediate adverse effect on the cost and quality of the public and private sector. It may result in an increase in financing, capital operating, and maintenance cost of projects. So, such corruption decreases the value target for the customer.

The Construction Sector Transparency Initiative (CoST) states that its core objective is seeking to help participating countries improve the value for money spent on the construction of public infrastructure. The goal is to achieve the delivery of good quality infrastructure projects at lower cost, with increased predictability of outcomes. In a case from CoST in Malawi (water supply project), the contract with the consultant who was responsible for design and supervision was rewarded. The initial design contract was terminated due to failure of the consultant to provide adequate staffing for the assignment. Poor working relation between the consultant and the contractor was another reason for termination of the contract. Such a case shows again the effect on the value which goes beyond the project itself to affect the local community and even the nation as a whole because of the importance of such infrastructure project for the environment and community.

During a Project Management Professional (PMP) course, many participants (more than 40 persons from the construction industry) requested adding a sum as "cost of corruption" to the contingency reserves when the trainer introduced the paragraph "Determine Budget". So it is common practice in this field that this value is added to the original project budget to cover any payment for corruption practice in the future.

5.1.2 Corruption and the Last Planner System (LPS)

On the opposite side of Koskela's theory (TFV) is the Last Planner System (LPS) to form the second pillar of Lean Construction, despite the fact that LPS depends on the flow concept of Koskela's theory. However, it forms the flow management within construction management (Ballard, 2000).

Berthelsen (2004) noticed that most people, especially in the practice of the construction industry believe that the LPS are a synonym for Lean Construction - which of course it is not. Gebhauer (2012) clears this misconception when he explains that the LPS are the management tool to apply Lean Construction on-site.

According to most references, the LPS's story started in the early nineties by the effort exerted by both Howell and Ballard, Mossman (2013) claims that the beginning of LPS goes back to their work in the early eighties (Howell and Ballard). Anyway, 1992 will be considered the starting point of the LPS as explained by its developer Ballard, who states "The last planner has been in development by the author since 1992" (Ballard, 2000).

Ballard (2000) developed the framework for the LPS based on the conception of projects as temporary production systems. He describes it as a production control system which adds a production control component to the classical project management system. LPS is the mechanism for transforming what should be done (the main concept of classical management practice, see Figure 5-4 below) into what can be done.

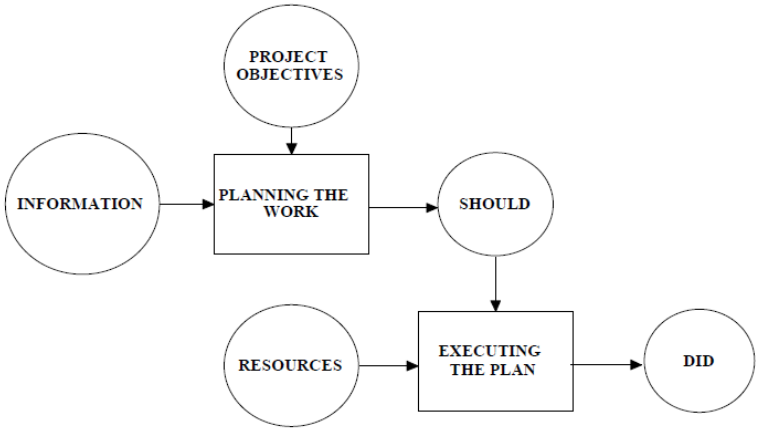


Figure 5-4: Traditional planning system (Ballard, 2000)

Ballard argues that this transforming from "should" into "can" forms an inventory of ready work, from which weekly work plan can be formed. Assignments on weekly work plans are a commitment by the last planners to what they will actually do (see Figure 5-5).

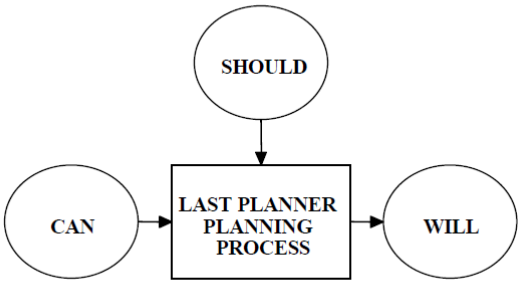


Figure 5-5: Last planner (Ballard, 2000)

According to Ballard and Howell (1994), the last planner is last in the chain, or the person or group that makes assignments to direct workers (Ballard, 2000). Figure 5-6 is a result from combining Figure 5-4 with Figure 5-5 and explains whole system, i.e. the Last Planner System.

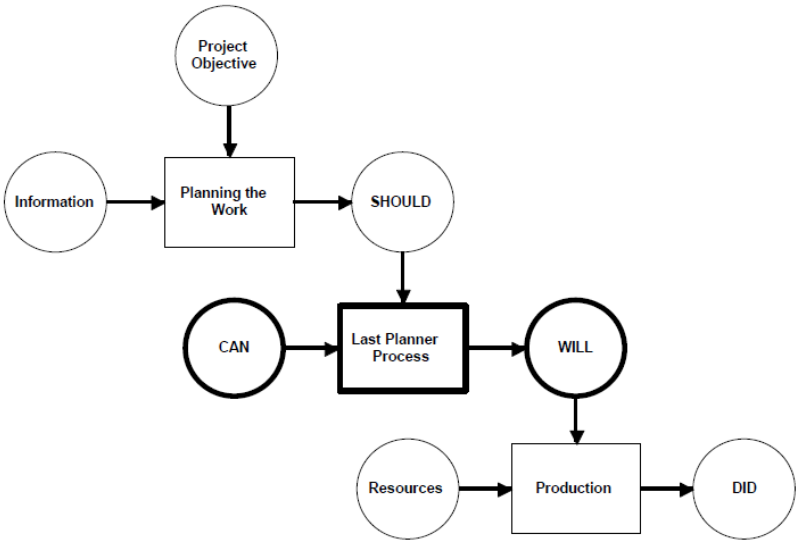


Figure 5-6: Last Planner System (Ballard, 2000)

Ballard explains that "Should" reflects the classical management concept and forms the push system in construction management. As detailed in chapter 4, some different planning techniques serve push system (see Table 4-2). Opposed to this philosophy, LPS replaces the push system with a pull system; an essential element of Lean Thinking.

However, how did Ballard use LPS to apply the pull system as a planning and control system? The principle is simple since LPS releases only workable plans and look ahead plans. It analyses the upcoming tasks for constraints and quality requirements. Since uncertainties exist, the system is structured to log plan failures to avoid similar failures in the future (Ballard, 2000).

The process of LPS consists of the following components (Ballard, 2000; Seppänen et al., 2010 and Alsehaimi, 2011):

Master Schedule

The master schedule is established at the beginning of the project as an initial complete plan with activity durations and total project durations based on quantities and scopes by using average productivity rates or historical information from previous projects. It aims to involve the major actors early rather than to involve the last planners themselves in this stage. The reason here is to identify the important milestones based on clients' or stakeholders' needs. The classical planning techniques mentioned before, e.g. CPM, can be used to develop a master schedule. However, the master schedule will be replaced by the phase schedules.

Phase Schedule

Developing the phase schedule is an integral part of the LPS. It is the basis for generating look-ahead plans and ultimately weekly work plans. Planning a phase schedule starts with the milestone (identified in the Master Schedule), from there, the process is followed backwards; so that each task releases the work required for the next task. Therefore, it can be called "reverse phase scheduling" or "pull scheduling", which starts from the lower end of the tree, i.e. the last planner, and moves towards the constraints at the higher end. It is developed by taking inputs from them to establish and define executable tasks and organize them according to the pull working plan by identifying the corresponding constraints. This is considered complete when all members agree on the criteria decided for execution of the tasks and are confident that all activities have adequate resources and time. What makes phase scheduling a better schedule tool are the last planners (contractors, subcontractors,

clients, consultants, and suppliers) who have power over resources and knowledge about their availability and capability.

Look-ahead Schedule

The Look-ahead schedule provides an exploded view of the phase schedule tasks, classifying them into assignments and defining their constraints. It is considered as a medium-term plan which prepares tasks so that they are ready and can be done when the right time comes or, in other words, the assignment is allowed to proceed in the look-ahead schedule only if it can be ready in time. This helps to focus the supervisor's attention on what work should be done in the near future. The look-ahead plan period can vary from 3-12 weeks depending on the design process and the project scale.

Weekly Work Plans

The weekly work plan (WWP) is the most detailed part of the LPS. The plan is prepared after taking inputs from the last planners and the person responsible for work execution. It is developed through a weekly meeting involving all last planners. The weekly work plan contains only the activities that are ready for execution without any pending constraints.

Based on Ballard (1994), the critical quality characteristics of weekly work plans are:

- The "right sequence" of work is selected: The sequence of the work is elaborated upon schedules, execution strategies and constructability.
- The "right amount" of work is selected: Last planners have the knowledge and right judgment about their crew capability and capacity.
- The "selected work can be done": This needs to examine the specific work to be done. This can only be successful when the first two quality characteristics are insured.

Moreover, Ballard (2000) set up rules for allowing scheduled activities to remain or to enter each of the three primary scheduling systems, i.e. master, phase, and look-ahead schedules.

- Rule 1: allow scheduled activities to remain in the master schedule unless positive knowledge exists that the activity should not or cannot be executed when scheduled.
- Rule 2: allow scheduled activities to remain in the look-ahead window only if the planner is confident that the activity can be made ready for execution when scheduled.
- Rule 3: allow scheduled activities to be released for selection into weekly work plan only if all constraints have been removed - i.e. only if the activity has in fact been made ready.

One of the most important rules above established by Ballard is the removal of all constraints which obstruct the execution of the work/activities as planned. This requires last planner's good understanding of the constraints facing the task or more accurately the constraints facing the production process. That's why the issue of constraints analysis has a special importance in the LPS.

Constraints Analysis

According to PMBOK (PMI, 2013), a constraint is "a limiting factor that affects the execution of a project or process" This factor can either be internal or external and it will affect the performance of the project or process. Ballard (2000) used a simple definition for constraints: "A constraint is something that stands in the way of a task being executable or sound."

By reviewing and studying constraints in construction, in addition to the case studies he conducted, Ballard has specified the most important constraints which may be encountered in construction projects. They include: contract, design, submittals, space, environment, prerequisite work, materials, labour, and equipment (Ballard, 2000). In fact, the last three constraints correspond to the inputs of Koskela's transformation process.

Like Koskela, Ballard has not mentioned corruption and its effects on the production process in the practice (implementation of the TVF theory). Therefore, the impact of corruption on the LPS needs to be addressed since corruption is a barrier impacting the efficiency and success of the Last Planner System. As Ballard explains, the Last Planner is responsible for releasing the tasks or making them ready by preparing the right assignments after removing all constraints preventing their execution. Experience has shown that corruption has a delaying effect on releasing the tasks because it also impacts the flow of information, materials, labour, equipment, and machines.

However, experience of many people working in the construction industry has shown that corruption may accelerate the production process through accelerating some processes e.g. permits, inspection or even approvals that were helped by bribes. This actually meets the idea of some researchers and many practitioners introduced in chapter 2 where the positive effect of corruption is explained. They expressed that corruption may be a “good thing", and they justify this opinion by saying that corruption can smooth rigid bureaucracy and help get things done.

This can be illustrated by a project where the supervisor was bribed by the contractor only to speed up an inspection process. In this case, the supervisor and the contractor are at fault because the supervisor is slowing down the process of inspection which will affect the overall progress of the project; consequently, this creates pressure for the contractor in term of time; therefore, the contractor feels himself forced to bribe the supervisor to speed up the inspection process.

This action is erroneous because at the end it creates a high risk of bribery, so the supervisor will get used to receive bribe in return for ever inspection. Moreover he will approve any poor quality due to the engagement in bribery. Bribing is wrong and breeds more bribing.

Actually, the negative effects of corruption on transformation, flow, and value concepts seen in the previous section are applied in the case of the Last Planner System because it is the practical application of the TFV Theory, specifically with respect to the flow concept. Therefore, the focus is now on the core philosophy of the LPS and Ballard’s new model “SHOULD-CAN-WILL”. This model moves construction management from push planning to pull planning as illustrated in Figure 5-6 above. Ballard (1994) explains the relation between the three elements (SHOULD-CAN-WILL) as “Last planners can be expected to make commitments “will” to do what “should” be done, only to the extent that it “can” be done”. Later on, in 2000, Ballard reformed this relation as “last planners say what “WILL” be done, and (hopefully) are the result of a planning process that best matches "WILL" with “SHOULD” within the constraints of “CAN””.

“SHOULD” represents the push system and both “CAN” and “WILL” represent the pull system; therefore, “CAN” and “WILL” represent the spirit of Lean Construction, therefore, the effect of corruption on both "CAN" and "WILL" will now be further analyzed. Figure 5-7 illustrates the concerns where corruption might affect the Last Planner Process.

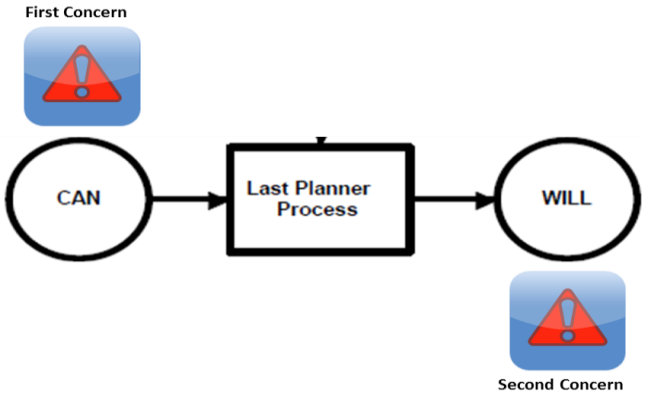


Figure 5-7: Research's concern on LPS

The first concern "CAN"

"CAN" is the basic key concept to move into pull planning. Ballard (2000) states "pulling allows material or information into a production process only if the process is capable of doing that work."

Discussing the effect of corruption on"CAN" refers to its effects on the constraints analysis. Corruption can be a hidden factor that delays the constraints removal process. Moreover, it could be in itself the main reason for the formation of these constraints.

Having discussed before the effects of corruption on TFV Theory, an earlier example illustrated how the shortage in concrete delivery had a big effect on delaying project execution. The reason, as observed, could be a corrupt practice between supplier and owner (senior officer) such practice would affect releasing the task and making it ready to work.

Another example of corruption in the labour-environment is when it is thought that the work can be done because labour is available. However, the labour available at that time may not be capable to do the planned work because they received their job through corruptive action (connections or nepotism). In the following, further corruption examples will be presented within the classification of constraints as to Ballard's specification:

Contract category: it refers to constraints related to contract types, parties, period of contract, changes in contract conditions, sub-contractors, clearance and approval from concerned authorities, etc.

An example on corruption in this category from GIACC (2008) is bribery during subcontract procurement. In this case, the procurement manager of a contractor is managing a competitive tender between subcontractors. One of the subcontractors offers a free holiday to the procurement manager if he awards the contract to the subcontractor. The procurement manager obliges and thus gives way for the corrupt practice (bribery) to negatively affect the project. Contract awarding has been conducted in a corrupt manner excluding the other subcontractors who could have been more suitable in terms of efficiency, experience, and competence in addition to the availability of proper machinery and equipment to perform the required work.

Another example from the case study is what may be called "sell-contract"; i.e. when the main contractor awards a contract to a subcontractor. The subcontractor awards the contract to another one, and in some cases the number reaches 3 or 4 subcontractors for the same task. This action can be considered corrupt because the contract signer (subcontractor) did declare his ability to complete the work; however, in reality, the subcontractor is not able to do that and he is selling the contract to another subcontractor and so on until the task reaches someone in a cheaper price compared to the original price.

Due to the low payment, the last subcontractor resorts to hire cheap and inefficient labours who execute the work in inferior quality. On other hand, regarding "can do the work", the big number of subcontractors involved in one task makes it difficult to provide accurate information about the possibility of executing the work because the information chain is too long.

Design and Engineering category: it refers to constraints related to design and technical issues such as design changes, certification and approvals of designs, measurement of work done, request for information (RFI), methods statements (MS), preparation of designs and design drawings, shop drawings, as-build drawings, etc.

This category is considered an important one and the work on-site highly depends on it because no work can normally be done without final design or/and design drawings approved by consultants or owner's representatives. In fact, this category is considered also a fertile area for corruptive action, be

it for both getting approvals and approbations for works which were not done correctly or for speeding up the general approval of work correctly executed.

A suitable example for this category comes from a project where a method statement (MS) was presented for facade work. As it turned out, the scaffolding work was not compliant to safety requirements. There were no nets to protect workers from falling or to prevent construction materials and equipment to fall on the construction site. After the method statement was rejected, it was observed after a short while that it was nonetheless approved and work resumed without the necessary safety precautions. It is assumed that the supervising engineer in charge received a bribe to release the method statement. An action like this obstructs knowing the "CAN" in the right time because it is originally “not ready to work” and with a corrupt practice it became “ready to work”. It may now be considered as "CAN" but wrongly so.

During an interview with a subcontractor who had to submit as-build drawings for executed works he carried out, he claimed that the main contractor’s engineer had asked him for money in return for signing the as-build drawings, saying that he would be responsible for the result and that he would like something in return for this responsibility, despite the fact that this was originally his job and within the scope of his work and duties.

Cases like these will undoubtedly influence the release of activities to become “ready to work”.

Environment category: this it is the most uncertain since it refers to the constraints related to climate and weather conditions. For instance, work remains incomplete inside a building on the pretext of the rain outside is not credible (false claim). Another opposite example by road construction is to consider a task “ready to work” or "CAN" be done despite the knowledge that the outside temperature and humidity may exceed the allowed limits. Often, there are no fixed rules either. For example, in Gulf Cooperation Council (GCC) countries, companies decide on the maximum temperature for their work. So, it is possible that workers leave the work site and stopped working during hot days despite the fact the work was planned to be executed and the management thought that work was in progressing on-site. Therefore, ambient factors in the workplace have to be considered when submitting information that a process step is “ready to work”. The International Labour Organization presents a set of codes that can be used when making the decision about work under specific environmental conditions, it states that the “code of practice should be considered as the basic for eliminating or controlling exposure to hazardous ambient factors at the workplace like vibrations, high and low temperature, and humidity” (ILO, 2001).

*Prerequisite work category***:** this category is very important. It refers to the constraints related to the conformance to plan, status of prerequisite work to be completed “complete kit” (Ballard, 2000), delays and failures, clearance of work area, reports and data. In Ballard’s opinion (2000), the prerequisites of upcoming assignments form the pull system "that is instrumental in ensuring that all the prerequisites are available for assignments".

The importance of this category is based on the complex relation resulting from the dependency on others for the possibility of accomplishing required work. In other words, to get one’s work done, the previous work should be done correctly to enable one to get his work done also correctly.

This category may include most types of corruption mentioned before. It is possible for the person in charge of the drawings approval to demand bribe for approving them before one start work based on them. Another example in this regard is the concealing of defects. GIACC (2008) sees the concealing of defects as an instance of fraud affecting one’s work when receiving an assignment as the previous work is not completed as required but this fact is disguised by corrupt actions. The concealed defects will obstruct an individual’s work to be done correctly as planned. The reason could be collusion between a previous subcontractor and the person in charge of supervising his works.

Material category: it refers to the constraints related to materials' availability, storage, inspection, maintenance, logistics, and conformity to design, delivery / lead times, requests for quotation (RFQ), and purchase orders (PO).

Labour category: it refers to constraints related to labour availability, health, safety, performance and skills, provision of benefits to labour, etc.

Equipment & machines category: it refers to the constraints related to equipment availability, acquisition, mobilization, inspection and maintenance, logistics, fuel consumption and availability, etc.

The impacts of corruption on the previous three categories (materials, labour and equipment/machines) were illustrated in the above paragraph about Koskela's Transformation Concept. These three categories provide the inputs of the production process as presented by Koskela.

The above shows how corruption hinders achieving "CAN" in its correct form. It is either blocks the achievement of "CAN" and delaying it, so that the planned assignments will be at risk, or it will push "CAN" to appear incorrectly due to corrupt actions resulting in unfavorable consequences in terms of quality or/and time & cost.

The second concern "WILL"

Before discussing the second concern "WILL", the final process of the LPS will be explained because it shares a strong connection with "WILL". The final process consists of "percent plan complete" and "analysis of reasons of plan failure":

Percent Plan Complete and Analysis of Reasons of Plan Failure

The Percent plan complete (PPC) is the measure for the reliability of the LPS (Ballard, 2000). It is used to measure the match of "WILL" and "DID". Therefore, it is the starting point for improving the planning process (Ballard, 1994). The PPC contains the number of planned activities completed, divided by the total number of planned activities, expressed as a percentage where the planned activities form the promised activities (reflecting the WILL). The next step after calculating the PPC is to identify the reasons why promised activities were not completed. This analysis of reasons for incomplete assignments can be called "reasons for plan failure". Ballard (2000) sees that the analysis of reasons for plan failure can help to avoid these reasons in the future which mean improving the PPC or plan. This would be more accurate if done by the last planner or the person responsible for performing the activity for a continuous and improved learning during project duration.

Ballard categorizes the reasons for plan failure in the same manner as the constraints categories introduced previously. Ballard (2000) considers (WILL) as an output of the last planner process in which "CAN" forms the essential input.

"WILL" forms the commitment of the last planner to do the task which is thought to be possible to be executed after studying the surrounding constraints and the ability to remove these constraints. It is possible that the last planner doesn't take this commitment seriously for corrupt reasons, the greatest obstacle in this "WILL stage" is the conflict of interest (CoI).

According to Ballard (2000) "should, can, will, did" form the concept upon which the last planner system is based, and the efficiency of this system lies in understanding these four words. He claims "a production management system must tell us what we should do and what we can do, so that we can decide what we will do, then compare with what we did to improve our planning". Focusing on the statement "we can decide what we will do", it forms a situation where conflict of interest can arise and dominate; consequently, it obstructs the good and effective implementation of the last planner system.

Conflict of Interest

Chapter 3 explained that scholars in the field of corruption had two points of view regarding conflict of interest (CoI). The first team did not consider it as a form of corruption but as a situation that led to corruption, whereas the second team considered CoI as a form of corruption. For this research, the second opinion is adopted because of the negative effects of CoI on the success of project delivery.

Bowen et al. (2012) see that attention must be paid to conflict of interest and it should be taken into consideration in the construction industry. In fact, Ballard (2000) mentioned the topic of "conflicting in engineering management". He considered conflicting as "an opposition between those who adopt the view of production (the design and making of physical artifacts) as transforming or converting inputs into outputs and those who add the flow and value views" Narrowing down the opposition between those who execute the project (last planners), he suggested the term "conflicting demands". He found in one of his case studies that conflicting demands along with prerequisite work and insufficient time form the most important reasons for plan failure. Furthermore, he stated that "unfortunately, such categories reveal little about root cause, so do not facilitate corrective action" and "regarding conflicting demands may need clarification". This research aims at clarifying this by introducing the concept of conflict of interest as a phenomenon which obstructs the successful implementation of the LPS and as a hidden action that limits the effectiveness of the LPS.

Based on the definition of conflict of interest presented by (FIDIC, 2015):

"Conflict of interest is the situation that may involve potential conflict between consulting activities with prior or current obligation to other clients, clients' staff, or procurement of goods, works or services". Similarly, cases of conflict of interest may arise between last planners themselves which may result in not working seriously to remove the constraints surrounding the task; consequently, the task is delayed and not shown in the weekly work plan.

Similar to the definition presented by FIDIC, CoI in LPS can be defined as "the situation that may involve potential conflict among last planners to serve their own interest". Here, the term "to optimize their won process" as commonly used in Lean Construction (Mossman, 2013) was avoided for two reasons: the first is that corruption and conflict of interest (as one of its forms) do not result in any optimization whatsoever. The second reason is that that conflict of interest may arise between last planners and their companies; consequently, last planners will do their best not only against the other partners but also against their companies. For example from the case study, some employees are keen on delaying work assigned to them intentionally because they will be unemployed as soon as the project will be finished. Or they will have to move to another project far away from where they were living. Such actions are often a standard procedure of many companies after each completed project phase, thus rendering hundreds of engineers and labourers unemployed.

Such a case can be described as a conflict between top-down and bottom-up of an organization. Lambsdorff (2010) argues that the conflicts of top-down and bottom-up are standard in managerial science. He also found that this topic has only scarcely been explored for anti-corruption.

The second example from the case study is about a subcontractor who did not do the work assigned to him on time despite his commitment to do so because he was waiting for the opening of a new work area to move his labourers and equipment. He did not want to leave the site and come back again after a period of time because moving his labourers and equipment back and forth would cost him additional money and his labourers would be unoccupied until the new work area would open.

These two examples show how conflict of interest on an internal level (within one company) or on an external level (between several companies) will negatively affect the LPS by reasons that cannot only be justified by the known constraints introduced above, unless conflicts of interest is taken into consideration. However, the most dangerous result of CoI in the LPS is destroying trust among the last planners.

Researchers in Lean Construction have devoted substantial attention to the concept of trust and trust building. For example, Smith et al. (2014) found that high levels of trust between project participants increases productivity and enhances team performance. Opposed to this, researchers of the anti-corruption field, like Salter (2010), see that "a conflict of interest can involve violation of people's trust in professionals such as engineers and architects". Reed (2008) argues that a conflict of interest undermines trust, whereas Marris and Klesner (2010) see that the lack of trust is nourished by corruption.

Bowen et.al (2012) found in their study "corruption in the South African construction industry" which was a web-based online questionnaire survey including 500 responses from different participants (e.g. clients, professional consultants, construction managers from the South Africa construction industry) that "conflict of interest is reportedly the form of corruption most experienced by all respondents (69%)".

Unfortunately, most references confirm the difficulty of avoiding conflicts of interest in the first place. Salter (2010) believes that speaking about avoiding conflicts is not sufficient and action is required. However, people tend to be unable to recognize conflict of interest. Therefore, all scholars resort to preventing the conflict of interest with a "prevention concept" as an approach to overcome it (TI, 2006; Passas, 2007, and Lambsdorff, 2010). However, Reed (2008) believes that "it is not possible to simply prevent or prohibit all conflicts of interest".

5.2 Solving the Problem of Corruption with the Lean Approach

The previous section detailed the first part of this work's hypothesis, i.e. the contradictory relation between "Corruption in Construction" and "Lean Construction". The existence of any of them is a barrier to the other and reduces its respective effectiveness.

Based on the many examples and cases presented by Global Infrastructure Anti-Corruption Centre (GIACC), Transparency International (TI), and the Construction Sector Transparency Initiative (CoST) and observations recorded in the civil engineering practice, it is evident and well proven that corruption poses an obstacle to the elements of Koskela's theory (Transformation, Flow, and Value), and also to effectively implementing the LPS. Therefore, it is an obstacle to Lean Construction.

In this section, another aspect of the hypothesis will be discussed in order to reveal how Lean Construction presents a solution to the phenomenon of corruption in the construction industry.

Lean Construction, with all its theories, ideas, the recently developed concepts and tools, has the potential power to contribute to fighting corruption in the construction industry. However, until now, corruption was not included in Lean Construction's dictionary.

It is the aim of this research to draw the attention of the "Lean Construction community" and all engaged researchers to this phenomenon and the risks involved in successfully implementing Lean Construction. Furthermore, this study will provide insight about Lean Construction's powerful tools which can help all stakeholders in the construction industry to prevent and finally rid themselves of corruption.

Linking the concept of Lean Construction to the issue of corruption in construction and adopting the idea of combating corruption with the philosophy of Lean will extend the Lean concept and give the construction industry a viable tool to reduce the negative and retroactive impact corrupt actions have on the industry.

The concept of problem solving is an essential and important concept in Lean methodology; therefore, corruption is characterized as a problem. Womack and Jones (1996) argue that problem solving is the

first critical management task of any business, followed by information management, and physical transformation tasks. Furthermore, they see that the problem solving is required throughout the entire process; from the concept through detailed design and engineering to production launch. Equally, corruption "as a problem" can also occur throughout the entire project cycle.

Whelton and Ballard (2002) distinguish between well-defined and ill-defined (or ill-structured) problems. They found, that ill-structured problems are problems whose structure lacks definition in some respect. "The problem has unknowns associated with the ends (set of project goals) and means (set of processes, actions and decision rules) of the solution at the outset of the problem-solving process". Compared to this, the well-defined problems are "those for which the end or goal is already prescribed or apparent and their solutions require the provision of appropriate means". The ill-defined and complex problems are also called wicked problems (Whelton and Ballard, 2002).

One of the difficulties of fighting corruption in different industries and especially in the construction is to see it as a complex problem and the attempt to ignore it, be it intentionally or unintentionally. This view is shared by Sohail when he argues that especially construction companies' stakeholders try to ignore the subject of corruption due to its sensitivity.

This research does not aim at making corruption a wicked problem, rather working to simplify it and moving it away from complexities since simplification is one of Lean's core concepts. The next step is to systematically and continuously reduce corruption with the help of the Lean philosophy

Whelton and Ballard (2002) see that the systematic step by step approaches to the problem solving provide structure and direction to a decision problem. The research's Lean based approach to solve the corruption problem includes the following four steps as presented in Figure 5-8.

1. Characterizing the corruption phenomenon as a problem that needs to be solved.
2. Identifying corruption itself as waste which should be eliminated.
3. Determining the root cause of corruption
4. Applying effective countermeasures

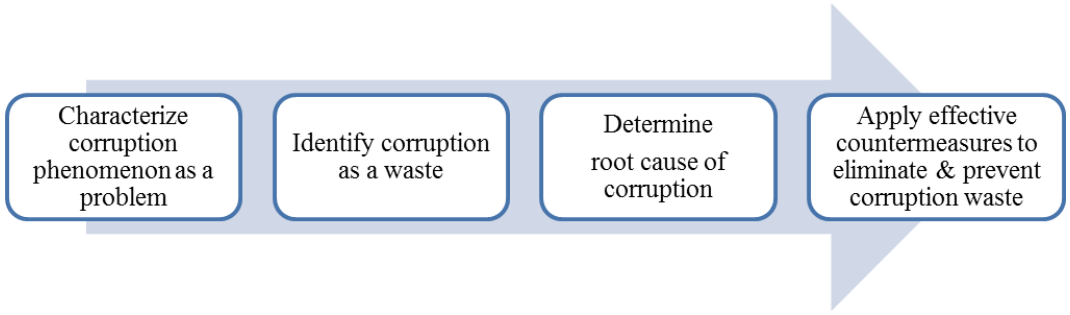


Figure 5-8: Lean Construction approach to solve the corruption problem

5.2.1 Corruption as Waste

The "concept of waste" forms an important and essential concept in Lean. At the beginning of Lean Construction formation, Koskela (2000) depended on his theory (TFV) of seven wastes identified by Ohno: (1) overproduction, (2) correction, (3) material movement, (4) processing and (5) inventory (these five wastes refer to the material flow) in addition to (6) waiting and (7) motion (these two refer to the workforce). However, Koskela (2013) argues that the seven wastes introduced by Ohno from mass production industry do not cover wastes found in the construction industry. Therefore, Koskela (2013) calls for searching and discovering new "wastes" within the construction industry, which were

initially not included in the traditional list. He also emphasizes that his call "will propel the next stage of research towards producing a list of wastes specifically for construction".

Based on this research so far, corruption can be considered as a kind of "waste" when considering its negative effects on the goals of construction projects (cost, time and quality), as discussed in chapter 3, its effects on the TFV theory and the LPS in section 5.1, and the obstacles corruption produces to the implementation and success of Lean Construction. Consequently, corruption in construction can be added to the list of wastes developed by Koskela (2013) with the aim to create awareness of the corruption phenomenon and mobilizing actions to stemming, reducing and eliminating it.

Moreover, as mentioned in chapter 3, there is a relationship between different corrupt offences and actions, where one action often results in more than one offence; this is where the corruption phenomenon can be linked to Koskela's "chain of waste". An example from a project is the collusion between two geotechnical investigation companies leading to higher prices. The main reason for this is the bribing of the construction manager who approved only these two companies from a long list of suppliers (vendor-list). From this example, the main results of this corruption waste were:

- Increase of investigation cost (they mutually agreed on a higher price which neither of them will undercut).
- Delay, since these two companies are overloaded with work (they are the only contractors and did not have sufficient cone penetration test (CPT) trucks available).

Such shortage in equipment (CPT trucks) leads to delays onsite. Koskela (2013) calls it a “lead waste” that was caused by a “core waste”, i.e. corruption.

Koskela introduced the two terms “core waste” and “lead waste”. The causes and consequences of corruption are interchangeable and hard to separate (Andvig et al., 2000), corruption as a waste can be considered a "core waste". According to Koskela (2013), a core waste is “a phenomenon that is both a waste in itself and at the same time the cause of other wastes”.

The knowledge obtained from literature review, the evidences from examples and results of studies clearly show that considering corruption as a "waste" is correct. Additionally, this view was validated by interviews with several specialists in this field of corruption in construction and Lean Construction. The interviewees were asked the question: What do you think of considering corruption as a "waste"? Reponses were as follows:

Sohail, a scholar in anti-corruption field and professor of sustainable infrastructure at Loughborough University, sees that “you can define anything in different ways; however what you need to think about is; what is the benefit of defining it in that way?” In his opinion, the important point is to know whether one is getting deeper inside into something by defining it. He thinks that “defining corruption as a waste is a simplification of the term corruption”. However he believes that a person needs to support his definition with evidences to clarify it and to make it well understood.

Christine Pasquire, a professor of Lean project management in the center for Lean projects at Nottingham Trent University, believes that “considering corruption as a waste in Lean is really an interesting point”. She argues that corruption is related to the “cost of the work” and simulant to the “area of behaviour” because not making payment, changes the behaviour or making someone or team acting badly. Therefore it is a waste of value or a “value loss”. Pasquire argues that “in Lean system it is expected that everyone is contributing to value, in that way if corruption takes outside of this idea (contributing to value), then it must be some sort of waste or value loss”.

John Hawkins, the programme manager of CoST said that "corruption is a too much waste". He also suggests that one should be looking inside the whole project phases to identify the biggest corruption wastes. He also believes that considering corruption as a waste would open the discussion; how to measure such waste, which is still in his opinion a "difficult task" due to the lack of knowledge and capacities in this field.

Vassilis Christakis, a principal officer (Procurement & Corporate Governance) at the Black Sea Trade & Development Bank (BSTDB); agrees with the definition "corruption as a waste". He stated "I agree that corruption is a waste because, regardless of all legal and law implication, the resources are wasted as they don't go to any productive purpose". Evgeny Smirnov, a senior procurement specialist working at the Procurement Policy Department of the European Bank for Reconstruction and Development (EBRD), shared Christakis his opinion. Smirnov said "I do believe that corruption is a form of resources waste because resources are not used to the purpose intended". He added that money is equivalent of value and with corruption, money is not spent for intended purpose".

Prof. Stephan Grüninger, the scientific director of the Konstanz Institute for Corporate Governance (KICG) and director of the Forum Compliance & Integrity (FCI) in Germany, agrees with the research consideration "corruption is a waste", he said "I would absolutely share with you the view that corruption is a waste, specially waste of money". However he believes that it would be difficult for many companies in construction sector to accept such view, especially when corruption is used by them to obtain contracts, not because they are not qualified or not able to deliver project cost-effectively on time and in the highest quality, but because their competitors are corrupt and in some cases they find corruption is the only way to get contracts. Despite all this Grüninger believes that corruption is always bad and can be consider as a waste.

In addition to the above, the subject of corruption was brought to the attention of the "Lean Construction community" in early 2014 in Oslo (IGLC 22) and late 2016 in Boston (IGLC 24) during a Lean Committee Most scholars in Lean agree with our research approach in considering corruption in Lean Construction as a waste.

In order to reduce the waste of corruption while applying the Lean approach, it is necessary to determine its root cause and then to apply effective countermeasures. The study of corruption in general in chapter 2 and corruption in the construction industry in chapter 3 results in the definition of three main reasons for corruption in construction from the Lean Construction point of view:

1. Lack of Transparency
2. Lack of Accountability
3. Lack of Integrity

The above main three causes for corruption are shown in the form of an Ishikawa diagram (fishbone diagram) in Figure 5-9 below.

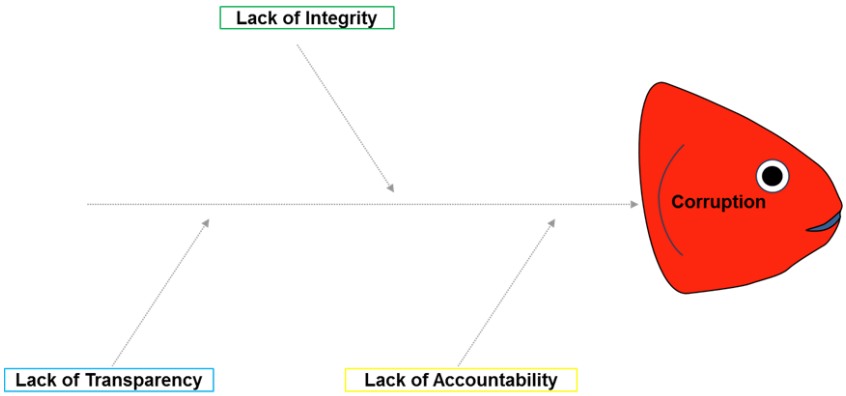


Figure 5-9: Causes of corruption in Lean Construction

In this context, Lean construction can eliminate the waste of corruption by increasing the transparency and accountability and by enhancing a person's and organization's integrity.

Since this research methodology includes real world research or as Robson (2002) calls it "the real life situation", the opinions of others in the real world about these conclusions are relevant. Therefore, an interview with a focus group was conducted. The interviewees were asked to explain their perspective on the importance of the previously mentioned reasons leading to corruption.

The interview took place at an international conference in the Middle East on engineering contracts. Corruption was a special topic in this meeting. As a preface to this interview, the risks of corruption, its forms and the role of integrity, transparency and accountability in reducing it were explained. The five interviewees all possessed a good knowledge of the construction industry. Two of them had engineering background (civil- and architect engineer), and the other three had legal backgrounds (three lawyers working in the field of construction law). The five interviewees were from different nationalities (Egypt, United Arab Emirates, Saud Arabia, Pakistan and Algeria).

The interview consisted of four prepared questions for all interviewees. The participants were asked to answer the questions using a voting system to keep their responses confidential; however, they preferred to discuss the questions and their answers with the others.

Question 1: Did you encounter any corruption practice in the past?

Although the question was clear, most of the participants asked whether it meant corruption in life in general or at work (in construction industry). It was agreed to consider this question about corruption in the professional life. Surprisingly, only one of the five participants, an engineer, reported to have encountered corruption throughout his professional life. The other four, also engineers and lawyers, denied this question.

Question 2: Do you think that corruption has a serious negative impact on the project objectives, namely cost, time, and quality?

All five participants confirmed that corruption undoubtedly has a big negative impact on the project objectives. They even referred to its negative impacts on society and environmental.

Question 3: Based on the second question, would you consider corruption as a waste in the construction and engineering industry?

This was an attempt to convey the idea of corruption in Lean and at the same time to suggest the new concept about corruption from a Lean point of view. However, the participants were not familiar with

the concept of Lean Construction and therefore not with the idea of "waste" according to Lean. After a short introduction into Lean Construction, four of the participants agreed with the idea of considering corruption as a waste. However, the fifth, a lawyer, did not see corruption as a waste in itself, but rather as a cause of waste. He stated "based on the introduction about Lean Construction I didn't see the corruption as waste, I think it is a cause of waste". Actually, his answer confirms the importance of Koskela's idea that the awareness of the concept of "waste" needs to be expanded and a deeper analysis would be required to understand what "core waste" is and that it can be considered both a "waste" and at the same time a source of "wastes".

Question 4: In your opinion, what is the most important element to eliminate corruption? (1) integrity, (2) transparency or (3) accountability

Transparency and integrity received both two votes each whereas accountability gained only one vote.

The research identifies corruption as a waste and it determines its root causes as a lack of transparency, accountability, and integrity. The Lean roadmap suggests to solving problems by implementing effective countermeasures to eliminate the waste. Countermeasures are related tools and techniques which should be developed and implemented or as a best practice benchmarked and applied (Womack, 1996). According to Koskela, Lean Construction itself has evolved and developed based on concepts and practices that origin from the Toyota Production System (Biton and Howell, 2013). According to Gehbauer (2012), Lean Construction includes several principles and tools that were taken from the automotive industry and were further developed to suit the construction industry. Gehbauer sees that many other principles and tools can be developed and added to it depending on the need or problem stakeholders in construction industry might encounter. Therefore, before looking for effective countermeasures, the three factors that were determined as the main reasons for corruption need to be further studied in order to understand them profoundly: This will help in searching and developing effective countermeasures to eliminate these reasons causing this kind of waste, i.e. the "waste of corruption". This subject will be further discussed in the following paragraphs.

5.2.2 The Stem Cells of Lean

Looking at the corruption phenomenon from a Lean Construction's point of view has evolved in to a new definition of corruption: "waste" which derives from the following three reasons: lack of transparency, lack of accountability, and lack of integrity.

The fact that these three reasons share a "lack of", means that the cause of corruption goes back to a "deficiency in something", i.e. deficiency in transparency, accountability, and integrity. Therefore, transparency, accountability, and integrity will be considered to form the "immune system" required to fight corruption. Each one of them represents a "stem cell" for Lean Construction, providing it with the ability to resist and reduce corruption.

Stem 1 Transparency:

Undoubtedly, the term transparency is related to anti-corruption and can be found in the respective organisations and projects. One of the largest organizations currently involved in fighting corruption around the world is Transparency International (TI) derived its name from transparency. An initiative within the construction industry to fight corruption even includes "transparency" in its title; the Construction Sector Transparency Initiative (CoST).

In fact, understanding the relation between transparency and corruption can be aided by the statement of Transparency International that "corruption is concealed. The greater the transparency, the more

difficult it will be to conceal corruption" (TI, 2006). Several scholars also have proven that increasing transparency is a very important factor in reducing corruption (Sohail and Cavill, 2006; Kolstad and Wiig, 2008; Sohail and Cavill, 2008; and Takim et al., 2013). Others expressed the same idea contrary when they considered the lack of transparency as the main reason for spreading corruption (Arumugam, 2002; and Desta, 2004).

The main reason for the lack of transparency in the construction industry is related to its project management approach that ignores this principle. The same applies to classic project management following the PMI approach and the PMBOK5/ PMI Guide for project management. However in Lean, Womack (1996) states "Transparency is the key principle in everything" and Koskela (2000) considers the principle of transparency as an important one especially in Lean Construction practice. For this reason, Koskela's theory always demands to increase transparency.

TI defines transparency as "the characteristic of governments, companies, organizations and individuals for being open in the clear disclosure of information, rules, plans, processes, and actions."

Koskela (200) considered the theoretical meaning of transparency depending on the definition introduced by Greif in 1991 which is "in a theoretical sense, transparency means a separation of the network of information and the hierarchical structure of order giving, which in classical organization theory are identical."

According to Koskela, classical project management, or "task management", offers transparency by introducing a work breakdown structure (WBS) as mentioned in chapter 4. However, this is not sufficient and the lack of transparency has disturbing effects on the industry, i.e. this deficiency increases the propensity to err, reduce the visibility of errors and diminish motivation for improvement (Koskela, 2000).

Takim et al. (2013) give a general simple definition of transparency as "transparency is generally defined as the open flow of information" Therefore, the lack of transparency or the spread of corruption leads to, as seen in the previous section 5.1, limitations and manipulations of the flow of information which is an essential part of Koskela's theory.

Moreover, Koskela also argues that a lack of transparency will diminish the motivation for improvement. Improvement, especially continuous improvement, forms a basic principle of Lean. This caused Koskela (2000) to search for practical approaches to enhance transparency with the following results:

- Establishing basic housekeeping to eliminate clutter. Here, he referred to the Method of 5S
- Making the process directly observable through appropriate layout and signage
- Standardization
- Rendering invisible attributes of the process visible through measurement
- Embodying process information in work areas, tools, containers, material and information system
- Utilizing visual controls to enable any person to immediately recognize standards and deviations from them
- Reducing the interdependence of production units (focused factories)

Based on these ideas and the requirement of increased transparency, Lean Construction scholars are developing tools and principles to translate the above-mentioned approaches.

Since 1993, i.e. since the foundation of IGLC and the organization of its annual conference to exchange ideas and researches within Lean Construction, this concept has evolved and established eight basic areas of interest: (1) cost management, (2) contract management, (3) value management, (4) supply chain management, (5) design management, (6) information technology, (7) people and culture, and (8) sustainable management with all its different principles and tools. These areas do not contradict the content of the PMI approach but are rather an improvement and a new way of looking at current project management (Gehbauer, 2012)

In this context, information technology (IT) in Lean Construction plays a major role in increasing transparency. Rischmoller and Alarcon (2005) define IT in Lean Construction as "the body of knowledge that deals with production, distribution, storage, recovering, but mainly utilization of information in the implementation of Lean construction by the use of various concepts and tools to allow information integration and flow efficiently".

In fact, technology (including Information Technology "IT") presents one of the three important aspects from Lean perspective. The other two aspects are people and process. Actually, the main purpose which scholars in Lean sought by applying IT in Lean is increasing productivity by improving the process which can be achieved by increasing transparency maintained by applying IT (Dave et.al, 2008).

On the other hand, scholars and international institutes against corruption (e.g. the World Bank and Transparency International) admit the important role of IT in increasing transparency and in lowering corruption therefore they call for applying IT as a tool to combat corruption, (Shah, 2007; and Wickberg, 2013). Wickberg argue that "there is a broad consensus that information and communications technology (ICTs) have the potential to make a significant contribution to the fight against corruption". She sees that the new technologies can promote transparency and accountability (Wickberg, 2013).

In this context, both scholars in Lean Construction and in the corruption field are agree that resorted to one tool, IT, to achieve two different goals (each according to his perspective and interest) based on the same principle of transparency. Therefore, both parties can benefit from other. The stakeholders interested in fighting corruption in construction should think about adopting Lean Construction as a method to develop and manage their construction projects. Similarly, stakeholders of the Lean Construction should recognize and pay attention to its potential power (with all its principles, concepts and tools) in contributing to fight corruption in the construction industry, and above all to protect Lean Construction against corruption which would be a major barrier to its success.

Several scholars in Lean Construction proved the important role of many other IT tools in increasing transparency which can now be applied to eliminate corruption in the construction industry. These include, but are not limited to, the following:

Virtual Design and Construction (VDC): according to Kunz and Fischer (2012), VDC is the use of integrated multidisciplinary performance models of design-construction projects to support explicit and public business objectives. It includes several major components, engineering modelling methods, model-based analysis methods, visualization methods, business metrics and methods and economic impact. VDC helps in achieving improvement of reliability and visibility through accurate model-based quality take-offs and through 3D/4D visual models (Cho and Fischer, 2010).

Building Information Modeling (BIM): BIM is a virtual representation of a building, potentially containing all the information required to construct the building, using computer and software. BIM may include also 2D, 3D, 4D (time element scheduling), 5D (cost information) or even nD (other

elements like energy, sustainability and other information) (Haron et.al, 2009). Lean scholars are interested in studying and linking BIM with Lean. Currently, construction companies have the tendency to adopt BIM and use it in design, construction, and operation phases. BIM has many advantages that can be used in combating corruption through its features in increasing transparency. Al Hattab and Hamzeh (2013) see that BIM offers interaction in flexible ways thus aggregating and transparently sharing information among all participants. Taboada and Garrido-Lecca (2014) found that BIM obtains reliable quantity estimates and in less time and cost; i.e. 64% of time required by excel spreadsheets and CAD drawings. Khan and Tzortzopoulos (2014) proved that BIM increases collaboration and commitment among team members.

Web Service & Web-Based Information System: they are software systems designed to support interaction and transfer of information among participants (Dave et.al, 2010). Such software improves connectivity among key participants and provides the right information at the right moment (Dave et.al, 2010). Chin (2010) proved that web based information systems reduce processing time and increase RFI transparency among all the team members.

In addition to what has been mentioned above, the use of tablets and mobiles on-site support getting real time information (Nakagawa, 2006) and provides easier monitoring and controlling of the construction progress as well as reducing deviation from planned output (Barbosa et.al, 2013). On–site vision tracking and GPS support systems offer affective information about positioning of personnel as well as equipment and machine (Moser and Santos, 2003; Simonsson and Carlsward, 2005).

In addition to the role of IT to increase transparency, it can automatically lead to the elimination of corruption. The value management, which is one of the important areas of interest in Lean Construction, can significantly contribute to achieving transparency and eliminating corruption.

As seen before, value is a basic principle in Lean Thinking as well as in Koskela's TFV theory. The purpose of the other two principles, transformation and flow, is to achieve the best value a customer expects (Koskela, 2000). Scholars in Lean searched many principles and different methods for value creation. Some of which are:

Value Stream Mapping (VSM): VSM is a graphical tool or method used to display all actions and activities involved in the production process from raw material to the customers including information exchange between tasks (Lima et.al, 2010). In their case study, Pasqualini and Zawislak (2005) proved that VSM helps in systematic visualization identifying reasons for wastes and problems. Lima et.al (2010) sees VSM as a tool to visualize processes and increase their transparency for all participants. VSM helps to identify the people in charge of each activity of the production process, so it can be used as corruption detection tool.

Root Cause Analysis (RCA): RCA is a method of solving problems by identifying the root causes of problems/faults, which, when removed from the problem, prevents the undesirable event from recurring (Chin, 2009). In most cases, this way is applied after the problem occurred. Nevertheless, it is still an effective way to avoid the problem recurrence in the future, as the cause is apparent. One of the most important methods used in this concept is the "5-Whys" and the Fish Bone Diagram. RCA adopts five major steps (Chin, 2009): (1) Identify the problem, (2) collect data, (3) identify possible casual factor, (4) identify root cause, and (5) implement solution. Using this method in identifying the underlying cause for corruption helps a lot to prevent recurrence of such causes.

A3 Reports: The Lean Construction Institute introduced the A3 report which is a one-page report prepared on a single 29.7 x 42 cm sheet of paper. The information given on that report adheres to the principle of PDCA (plan-do-check-act). The name "A3" is derived from the German standard DIN 476

for paper sizes (Gehbauer, 2012). This report includes the background, problem, statement, analysis, proposed action and expected results. The A3 report is an opportunity to mentor, to learn, and to communicate and can be used in all project phases. According to Gupta et.al (2009) A3 allows extensive communication to take place quickly and effectively, and creates transparency in the decision making process.

For the area of interest "people and culture" in Lean Construction several principles and tools can help to increase transparency to eliminate corruption. Some of them, for example, are:

Trust building: makes participants more open to each other and enhances commitment towards the project (Smith et.al, 2014). Collaboration among project team allows open access to sharing information and knowledge (Schottle et.al, 2014).

Training and Learning: Lean Construction facilitates learning on all organizational level. The training and learning concepts help in knowledge sharing and in making organization competent towards the changing needs and demands allowing them to learn new concepts (Christensen, 2010).

However, Proper application of LPS is the basic tool that includes several previously mentioned concepts and principles. Fauchier and Alves (2013) believe that LPS, in addition to having a basic role as seen before in planning and controlling, includes most of the principles mentioned before. Fauchier and Alves state "Teams undergoing LPS implementation usually have some degree of coaching or leadership that emerges during the process." They also add "collaboration and trust also emerge from LPS implementation." Therefore, they believe that "behaviours are further fostered by a clear and visual workplace which promotes transparency and information sharing among team members."

All the above shows the positive and effective role of some Lean Construction principles and tools in increasing transparency which can support the eliminating corruption. However, is transparency enough to achieve this difficult task? It can either protect Lean from corruption (an important factor for Lean scholars to achieve a successful implementation of Lean Construction which reflects the first part of this work's hypothesis), or reduce corruption (an important factor for scholars in the anti-corruption field with Lean as a problem-solving approach which reflects the second part of this work's hypothesis). In a simple sentence, is transparency sufficient to protect Lean from corruption and, as a consequence to combat corruption?

To answer this question, the experience of scholars in the field of corruption in construction and in Lean Construction will be discussed below.

The first point of view is presented by Lambsdorff (2010) when he discusses the "problem" of what is called "increased transparency". He says "there are, however, also some problems with transparency". According to Lambsdorff, one concern is that transparency may support the monitoring of corrupt reciprocity. He argues that bribers may prefer a transparent environment if this allows them to avoid opportunism among public servants. Furthermore, he sees non-transparent bureaucracies may at times prevent corruption. He supports his opinion by the fact that bribers will face difficulty in (1) finding the right person to bribe and (2) observing whether the bribe reciprocates honestly. In this context, Lambsdorff presents the following example from construction industry (Lambsdorff, 2010):

"It is a standard practice that public procurement requires some limits on transparency: Bidders are not supposed to know the incoming bids of their competitors. Some secrecy must prevail until all bids are jointly opened. The reason is that bid-rigging would be facilitated if transparency is introduced at the wrong stage." Therefore, he believes that "the principle of transparency will undergo a more fine-tuned interpretation."

Kolstad and Wiig (2008) follow the same way when they admit the role of transparency in reducing corruption. "There is also empirical evidence suggesting that transparency is associated with less

corruption." Nevertheless, they confirm that at the same time transparency is necessary to reduce corruption; however, it can not achieve this task alone. They say "several studies argue, however, that the effect of transparency on corruption is not unconditional. In other words, transparency is necessary, but not a sufficient condition to reduce corruption". They introduce the same example suggested by Lambsdorff that transparency shows directly (with no effort) the right person to be bribed. In this case, they believe that transparency may increase corruption. "In certain cases of small improvements in transparency, the identification effect may dominate the detection effort, and transparency may thus actually increase corruption."

On the Lean's side, Gehbauer expresses his concern about some parties involved in the construction process using the transparency offered by other parties to serve their special interests. The situation or action here is a kind of conflict of interest. Conflict of interest can be a hidden corrupt action in the LPS. The research defines it in Lean as "the state or quality that can be attributed to a person, group or organization involved in Lean project in which transparency provided by Lean to this person, group or organization is used without working on the same principle of transparency", in other words, it is the misuse of the transparency principle. It is an intentional exploitation of Lean's important concept "win-win". Conflict of interest is a genuine threat to the successful implementation of Lean construction.

Based on deconstruction of the transparency concept provided by Kolstad and Wiig (2008) and the observations gained from the case study, the shapes and ways that people misuse transparency can be identified as following

- Secrecy and withholding of information
- Opacity the information
- Offering wrong information
- Biased information
- Spin
- Incomplete information
- Inaccessible information
- Unequal access to information
- Information overload
- Irrelevant information

For this reason, transparency is necessary, but not enough to reduce corruption. Meanwhile, their concerns about "increased transparency" are not shared because transparency is an important and essential principle of Lean Construction and it should be so. The solution to this dilemma is to support Lean with other principles that work to limit the exploitation and misuse of transparency. These principles are accountability and integrity, further discussed separately in the next paragraphs.

Stem 2: Accountability:

Accountability is the second element in the "immune system" that will protect Lean from corruption. As mentioned in the previous paragraph about the importance of transparency for those who are concerned with fighting corruption, accountability has also attracted similar attention. Literature review has shown that the lack of transparency and accountability are often mentioned together as reasons for corruption, in the same manner, some references called for increasing transparency and accountability in order to decrease corruption (Desta, 2004; Del Rosaio and Starr, 2011; Cavill and Sohail, 2007).

As mentioned in chapter 2, Kiltgaard (1988) defined corruption as monopoly power (M) plus discretion (D) minus accountability (A) as per his model "basic ingredient of corruption":

$$C = M + D – A$$

This means that "if someone has monopoly power over a good or service and has discretion to decide whether someone gets the good or service or how much a person receives, and there is no accountability whereby others can see what that person is deciding, then we will tend to find corruption." (Cavill and Sohail, 2007)

This model introduced by Kiltgaard shows clearly the importance of accountability in combating corruption. Looking at his formula mathematically, reveals the indirect proportion between corruption (C) and accountability (A), whenever (A) increases, (C) decreases and vice-versa.

However, studying accountability in construction industry is also seldom as studying corruption in this field (Nordin et al., 2011), they believes that the importance of accountability in the construction industry goes back to the nature of this industry itself. They state "since a construction project is unique in nature, the concept of accountability to prevent corruption in construction is inevitable".

The subject of accountability was analysed by Kenny (2010), in his "World Bank Policy Research Paper" and in data from the World Bank's financed road contracts in 28 countries. He found that countries with an average accountability pay $30 per square metre for the rehabilitation of a two-lane highway, compared to $37 per square metre in countries with low accountability. Further, he presents a relationship between cost overruns and accountability based on data from 130 World Bank financed road projects in 24 countries. The data suggests that countries with an accountability score below the global average suffer from average cost overruns of 46%, whereas the cost overruns in countries with an above-average score amount to only 18%.

This means that the existence of accountability not only decreases the rate of cost overruns but also decreases the cost of project execution. From a Lean Construction point of view, this in itself contributes to increasing value if considering this effect of accountability.

Such evidence, based on data and information from several projects and studies provided by reliable institutions like the World Bank, confirm the effort of Sohail and Cavill (2007) in studying accountability in construction and seeing it as an essential factor to fight corruption in the construction industry. Sohail and Cavill (2007) discuss how accountability improves infrastructure service and how accountability can be operationalized. Logically, their study started by defining accountability. They found that the term means different things to different people depending on the context and the purpose for which accountability is sought. (Sohail and Cavill, 2007)

The Merriam Webster Dictionary states: "Accountability is the quality or state of being accountable, especially an obligation or willingness to accept responsibility or to account for one's action."

In its Anti-Corruption Glossary, Transparency International defines accountability as "the concept that individuals, agencies and organizations (public, private and civil society) are held responsible for reporting their activities and executing their powers properly. It also includes the responsibility for money or other entrusted property."

In simpler words, Sohail and Cavill present a definition for accountability as "a relationship between people, between service providers and those affected by their actions". They explain their definition based on the following example which is a general definition of the concept of accountability: "A is accountable to B when A is obliged to inform B about A's (past or future) actions and decisions, to justify them and to suffer punishment in the case of eventual misconduct." Based on this, they found that accountability has two elements:

1. Answerability (making power holders explain their actions)
2. Enforceability (punishing poor performance); in Lean philosophy correcting poor performance

Sohail and Cavill also explained the difference between accountability and responsibility. They depended on a research by Oliver and Drewry in 1996 who explained that the distinction between accountability and responsibility is blame. Responsibility is having a job to do and taking the blame

when things go wrong, while accountability is having the duty to explain and making amends without accepting blame.

Sohail and Cavill (2007) proved the positive influence of accountability in the infrastructure sector (the infrastructure sector is a vital and important part of the construction industry). They found major reasons for applying accountability to the delivery of infrastructure services; those are (Sohail and Cavill, 2007):

- Improved service delivery
- Reduce discretion
- Improve information flows
- Create demand for better services
- Induce greater monitoring by service users
- Protect the socially and economically disadvantaged
- Improve public sector provision
- Improve cost recovery

If all these points are considered from a Lean Construction point of view, it becomes cleasr that they refer to value and help increasing the value for a customer or user, especially when reviewing the definition of accountability mentioned above, as it refers to the relationship between people, service providers, and those affected by their actions. This is important with respect to Lean Construction where people form the base of its philosophy. However, the phrase "service provider" refers to the meaning of production. Therefore, this concept requires its fair share of attention in Lean Construction.

In the next paragraph, the analysis of the concept of accountability move away from the viewpoint of "corruption in construction" to "Lean Construction".

In fact, accountability is neither mentioned nor implemented in Lean Construction as to the degree that transparency is. To date, responsibility is much more mentioned than accountability in Lean Construction. Even Koskela (2000) believes that "construction is the responsibility of a general contractor under contract to the client". He also found that there is a lack of leadership and responsibility for the total project. Ballard (2000) followed the same trend as Koskela when he explained that "the last planner system has previously been successively applied by firms with direct responsibility for production management; e.g. specialty contractors."

The general approach of the LPS is to "allocate responsibility" by asking the following question: "Who had responsibility for what?" However, this does not mean the absence of the concept of accountability in Lean Construction, even if it was not treated directly; Koskela mentioned it in his research introducing his theory TFV and in one of his case studies (T40 Project in Australia). Here, he presented the measures proposed for project time reduction of 40%. The first feature of the proposed concept was "single point accountability for the client by a "solution team" - a collaboration group of up to nine organizations". Ballard (2000) also mentioned accountability in one of his case studies about applying the LPS: "The project superintendent continued to use the Last Planner System and reported that eventually all foremen were participating and that they began to hold each other accountable for keeping their weekly work plan commitments".

Later on, Fauchier and Alves (2013) paid attention to the importance of the LPS in promoting transparency and accountability week after week (in a continuous manner). McConaughy and Shirkey (2013) argue that the proper implementation of the LPS requests trust and accountability amongst all project team members including owner, construction manager, main and subcontractors. In their opinion, the implementation of the LPS remains inefficient when accountability is being missed, they state "when accountability is not present, teams go through the motions, data becomes irrelevant and collaborators become followers".

However, the LPS is not the only tool that shows the importance of accountability in Lean Construction, other principles and tools in Lean Construction deal with accountability directly or indirectly. For example: the steering model presented by Pennanen et al. (2014) in which they presented the theory of workplace planning and a steering model to support the management of the facility planning process. They found a link between workplace planning to production, not only to construction production, but also to the organization's general strategy. This link between workplace planning and organization strategy underlines accountability between decisions and outcomes. They depended on the following principle "The purpose of the organization is determined by the organization strategy. The strategy is realized by the operations". They found that accountability is an important element in the organization during the dialogue between strategic and operational management when they generate value.

Tillmann et al. (2012) believes that the role of accountability lies in expanding consciousness to understand the project. They argue that "the project should be understood as a means of achieving agreed goals rather than the simple delivery of outputs." This understanding makes project delivery in Lean Construction not limited to operation levels, but also goes beyond that to include an organization's strategy as referred to by Pennanen above. In this context, Tillmann believes that it is important to maintain "capability of understanding the project holistically and going beyond the physical facility to generate benefits that are aligned with strategic intent". They studied benefits' relations and their contribution to achieving a project outcome by applying the BeReal Model which was developed by the British University of Salford. The most important results achieved by applying the BeReal Model are:

- Enabling a holistic understanding of value
- Enabling a dialogue about stakeholders' expected outcomes
- Providing means and methods for accountability

A link between a decision-making process and methods for accountability is established with the creation of a specific workforce to help defining and measuring the achievements. The workforce focuses on project accountability. However, they argue that the effort of workforce could be improved if the rest of the team was better engaged in achieving project accountability (Tillmann et al., 2012).

Cho and Fischer (2010) focused their interest on supply chain management (SCM) and IT in Lean, especially virtual design and construction (VDC). With the help of a pilot project about an integrated supply chain management system they realized that many tools and principles of Lean contribute positively to the increase of accountability. They developed their integrated supply chain management system including VDC, Lean (model-based Last Planner), and real-time data capturing tools. They found that the integrated system caused positive cultural impact for the supply chain members. Furthermore, the project members were able to add a high level of accountability to them and to every aspect of the supply chain management.

In addition to the positive role of the LPS, the steering model, BeReal model, IT in Lean, and supply chain management increase accountability in Lean. It is highly advisable to refer to other Lean tools and principles for the same purpose (increasing accountability):

Performance measurement: it is an important element in the production process through which necessary required information can be provided for controlling processes. Moreover, it is an important factor in making the production process transparent to all stakeholders, especially for the employees, so that they see their performance and assess it (Lantelme and Formoso, 2000). The process of measuring the performance is an essential and important condition in the improvement process. As a logical consequence, when improving anything, measure it first. Schieman and Lingle (1999) shared the same idea when their survey with more than two hundred executives revealed that measurement-managed companies exhibit better performances compared to non-measurement-managed counterparts.

"Enforceability", is the second aspect of accountability as defined by Sohial and Cavill (2007) above. This means punishing and correcting poor performance. This aspect leads to the importance of performance measurement in increasing accountability to avoid any kind of punishment.

Integrated Project Delivery (IPD): the American Institute of Architects AIA (2007) provides a comprehensive definition for IPD. It is "a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phrases of design, fabrication, and construction."

We believe that it is necessary and recommended that Lean construction committee should pay attention to the phrase introduced by AIA's guide emphasizes that "collaboration is not a substitute for accountability." (AIA, 2007), a realization that the Lean Construction committee would better pay heed to.

Suite (2013) argues that the IPD process positively influences employee behaviour. It helps in increasing the understanding and knowledge of professional work, encourages continuous improvement, and communication and collaboration among project participants. All of this pertains to increasing accountability. Therefore, IPD is well suited to support accountability and should be considered as a powerful process.

Poka–Yoke: It is a tool applied to the Lean concept that aims at eliminating defects by preventing, correcting, and drawing attention to human errors (Santos and Powell, 1999). Tommelein (2008) argues that Poka-Yoke helps to immediately address, identify and correct the mistakes that occur in the process and eliminate the need of quality control by making it right from the first time. The implementation of such a tool in Lean concept guarantees 100% inspection of a process. Poka-Yoke is Japanese for "mistake proofing". Paying attention to mistakes and working to eliminate them is the core of accountability.

Other principles and tools introduced by Lean Construction may play an important role in promoting accountability. Some of them are: Trust Building (Smith, 2014) and Leadership Model (Bettler and Lightner, 2013) in addition to principles and tools that promote transparency. Researchers in the area of corruption in construction emphasize the fact that increasing transparency leads to increasing accountability. Since the Lean principle always aims at increasing transparency, it also increases accountability at the same time.

Answering the following three basic questions from the Lean Construction's perspective will provide a more profound understanding of accountability (based on the concept of Koskela's supplier-customer pair which is the base for a value-generation concept) (Koskela, 2000; and Sohail and Cavill, 2007):

- Question 1: Who is accountable?
- Question 2: To whom is the supplier (service provider) accountable?
- Question 3: What is the supplier (service provide) accountable for?

Question 1: Who is accountable?

Sohail and Cavill (2007) see that assigning accountability for the performance of services is difficult because a variety of factors are involved in service delivery. However, applying their findings to Lean Construction, accountability can be found in:

- Lean organization (or Supplier) → corporate accountability.
- The executive/ managing director of a company → personal accountability.
- Every member of the Lean organization (or supplier) is equally liable for the conduct of the organization → collective accountability.

- Individuals are accountable to the extent that their actions have contributed to the organization's conduct → individual accountability.

Question 2: To whom is the supplier (service provider) accountable?

Sohial and Cavill (2007) argue that the front-line service providers are accountable through line management structures within the organization for which they work. In addition, the service providers are accountable to service users. Moreover, service providers are accountable to their peers and fellow professionals in terms of meeting shared values and standards. Applying this principle to Lean it results in:

- Suppliers are accountable to customers.
- In a production process, every member is accountable to the person that comes after her. In other words, each preceding person is accountable to the person afterwards until the end of production process.

Question 3: What is the supplier (service provide) accountable for?

After specifying who is accountable and to whom, we should specify accountability about what. Sohail and Cavill (2007) believe that there are changes in the concept of accountability. . Accountability in Lean should go beyond conventional concern which includes:

- Legal accountability: the suppliers are accountable through legislation and regulation.
- Financial accountability: ensuring value for money, cost recovery, and financial and accounting.

The term "Accountability" in Lean should be extended to:

- Accountability for technical processes of service delivery
- Accountability for outcomes of service delivery which creates a new form of accountability, i.e. professional accountability. Professional accountability requires professional competence in the preparation of design, construction works, operation and maintenance of facilities, in addition to personal management and organizational planning (Sohail and Cavill, 2007).

Understanding the importance of accountability can help solving the problem of lack of skilled labour, lack of experienced staff, lack of training programs, choice of wrong construction method and other factors linked directly or indirectly to corruption in construction.

Another important point is the fact that if Lean Construction would give more room to the accountability concept, this would contribute to strengthening the relationship and promoting trust between the people involved in the top-down and bottom-up processes, which are the two sides of the path to Lean Enterprise (Gehbauer, 2008) especially when there is mutual accountability in each side toward the other.

Arming Lean Construction with both principles; transparency and accountability will not render its desired effect in protecting itself from corruption and eliminate corruption waste unless the important concept of moral and ethics is also considered. First and foremost, corruption is a personal moral failure (Sohail and Cavill, 2007). Therefore, the "immune system" in Lean Construction should be well prepared to face any ethical misconduct and offences to moral behaviour. This is exactly the function of the third stem, i.e. integrity, within this "immune system" which will be studied in detail in the next paragraph.

Stem 3: Integrity

Integrity is the third and most important element in the "immune system" we proposed to protect and at the same time help Lean Construction to eliminate corruption waste. Literature review on Lean

Construction showed that Lean indeed mentions both the transparency and accountability concept. However, the concept of integrity was not directly mentioned before. There are many reasons for ignoring the concept of integrity in Lean Thinking. The most important is probably ignoring the discussions about corruption in the first place. Other reasons are related to discussing topics that overlap with integrity, e.g. morality and truth. Erhard and Jensen (2013) argue that there are overlapping, confusing, and confounding factors amongst the concept of integrity, morality, ethics and legality which are commonly understood to provide directions for correct behaviour.

This overlap should be understood very well because of the importance of integrity as an essential factor in the occurrence of corruption (when there is a lack of it) and as an essential factor in reducing corruption (when it increases). Doig (2012) argues that promoting integrity is a strong measure to prevent and combat corruption.

With respect to the construction industry, Nordin et.al (2011) see integrity concept as a critical factor contributing to corruption in the construction industry where integrity is an important quality which prevents individuals to perform corrupt acts. Transparency International and scholars in corruption field confirm this opinion.

Since integrity is neither a widely discussed subject in the construction industry nor in Lean Construction in particular, this concept will be discussed in this paragraph to establish how Lean Construction could deal with it and add it to its "immune system" which will protect Lean against corruption and furthermore help Lean in reducing corruption in the construction industry.

We will start by looking at the meaning of term "integrity". The Merriam Webster dictionary defines integrity as "the quality of being honest and fair, and the state of being complete or whole". Cox et al. (2005) see integrity as one of the most important and often-cited term for virtues; used in this respect, it refers to the quality of a person's character, or when used to describe objects, it refers to their wholeness.

In its Anti-corruption Glossary, Transparency International defines integrity as "behaviour and action with a set of moral or ethical principles and standards, embraced by individuals as well as institutions that create a barrier to corruption."

The FIDIC defines it as "the total set of values, attitudes and attributes of a firm that may enable a rigid adherence to a code of conduct and behaviour."

In fact, the concept of integrity is more complex than the above definitions. Working to promote integrity requires a deeper understanding of this concept which Cox et.al (2005) describe it as the most puzzling virtue term. While, Baxter et.al (2012) argue that the concept of integrity is complex and subject to disagreement. They state that "attempts to define integrity commonly involve appeals to other specific values or virtues, such as honesty, objectivity, conscientiousness, etc. to the extent that it is tempting to define it as a "cluster concept" amounting to no more than a vague agglomeration of other principles or character traits."

Based on that, the most important ideas introduced by scholars about integrity will be chosen to apply the most suitable ones to serve the purpose of reducing corruption waste within the context and ideas of Lean Construction.

It would not suffice to search for an integrity concept within management or the field of construction management only. Most scholars in this topic studied the philosophical literature which discussed the concept of "integrity". Cox et.al (2005) and Baxter et.al (2012) did a philosophical literature review which focused on integrity based on research by Harry Frankfurt in 1971, Bernard Williams in 1973, Lynne McFall in 1987 and Cheshire Calhoun in 1995.

Cox and Baxter found similar results. Both explained the concept of integrity according to philosophers' point of view, looking at integrity from different aspects. They specified the following aspects for integrity (Cox et.al, 2005; and Baxter et.al, 2012):

1. Integrity as self-integration
2. The identity view of integrity
3. Integrity as standing for something
4. Integrity as moral purpose

Integrity as self-integration:

According to Cox et.al (2005) on the self-integrating view of integrity, integrity is a matter of persons integrating various parts of their personality into a harmonious, intact whole. Baxter et.al (2012) refers to this as a wholeness of character.

According to Harry Frankfurt, acts of will are desires and volitions which are arranged in a hierarchy (first, second... order desires and volitions), self-integration is achieved through coherence and harmony within the hierarchy of desires' and volitions' order (Cox et.al, 2005; and Baxter et.al, 2012). It means, persons with integrity are able to harmonize these various levels of desires and volitions and to fully identify with them at the highest level. Cox et.al (2005) claim that such identification appears to involve knowing them (desires and volitions) and not deceiving oneself about them

According to Cox et al. (2005) there are various measures to fully identify with higher-level desires and volitions, such as deliberating and distinguishing between various levels of desires and volitions. Since one is subjected to many conflicting desires, one has to distinguish between those, in this case a person acts with integrity and is a self-integrated person; otherwise, he is a non-integrated self (act without integrity) and Frankfurt calls such person a "wanton" (Cox et.al., 2005)

Cox et al. (2005) argue that fully integrated persons will not fall victim to conflict, they will avoid it altogether (if they can) or resolve the conflict in some way.

Frankfurt introduced a concept as an important way of developing the integrated self or to fight the self-conflict. He calls it "wholeheartedness". To explain this concept, he presents this example: When agents, in making decision, constitute themselves without ambivalence (unresolved desire for a thing and against it) or inconsistency (unresolved desire for incompatible things), then the agent has wholeheartedness. Cox et.al (2005) see wholeheartedness in this context equated with integrity.

An important point here is that self-conflict is not limited to desire. Cox et.al (2005) emphasized that conflict ranges over commitment principles, values and wishes; all of them being in flux. Achieving the wholeheartedness is a never-ending process. Cox et al. (2005) see that self-knowledge is crucial to this process, where one must know what one's values are especially if one needs to put them in order.

Understanding this aspect of integrity and its relation with integration should be clear in Lean construction especially when discussing integrated project delivery and integrated teams. This requires a high level of integrity, so they should rearrange their desires based on the expected goals and values of the project by reducing any kind of conflict.

The identity view of integrity:

Cox et al. (2005) and Baxter et.al (2012) studied the work of Bernard Williams who links integrity to identity in such a way that integrity here is not really a virtue. The identity view of integrity is to act in a way that accurately reflects your sense of who you are, to act from motives, interest and commitments that are most deeply your own (Cox et.al, 2005).

This opinion of integrity links integrity and utilitarianism (Cox, 2005; Baxter, 2012). Therefore, it should be taken into consideration that a person could do an in his/her opinion honest action; however,

it may not be so if measured against other standards. For example, in a construction project, a project manager may replace big amounts of excavated soil with imported soil although the excavated soil is suitable for backfill and can be used again on the site. But he wants to raise his companies' profits through additional activities such as removing the excavated soil and purchasing new soil from outside the project to increase his companies' and consequently his profit. However, such action causes the owner (customer) to lose time and money.

Cox et al. (2005) express this idea by saying "people of integrity can do horrific things and maintain their integrity so long they are acting in accordance with their core commitments."

In this view of integrity, the important thing is holding steadfastly true to personal commitment, rather than rearranging and endorsing desires. Here, Lean Construction should understand how to deal with this view to maintain integrity especially when commitment, according to Cox et al. (2005) is used as a broad umbrella term covering promises, and relationships of trust and expectation. This is exactly the case in Lean approach particularly in the LPS. Integrity in this context is a matter of commitments we expect a person of integrity to remain true to (Cox, 2005). The important point here is this commitment should be in the right framework without corruption (including all its forms). According to Cox, there are many factors leading to the lack of integrity in this context, e.g. self-deception, weakness of will, cowardice, ignorance, and cop-out.

Integrity as standing for something:

In this view of integrity, Cox and Baxter studied the point of view of Cheshire Calhaun, who went beyond linking integrity to self-integration and identity and to to see integrity as a relationship among people with others. "Integrity is defined by a person's relations to others" This gives integrity a new dimension called the social character of integrity (Cox et.al, 2005; and Baxter et.al, 2012).

Persons of integrity, according to Calhaun, do not just act consistently with their endorsements, they stand for something: they stand up for their best judgment within a community of people trying to discover what in life is worth doing. Calhaun's sees "integrity as matter of having proper regard for one's role in a community process of deliberation over what is valuable and what is worth doing" (Cox et.al, 2005).

This other view of integrity shows the importance of its coming role in Lean Construction especially in the value generation phase. It will contribute to promoting the discussion and dialogue between the different parties and eventually will be a requirement from each party in both design and construction stages for the best interest of the community (whole production team) who should seek the best value.

In this context, Cox et al. (2005) explain that it is important to respect the deliberations of others in order to successfully implement this view of integrity. Unfortunately, the lack of proper respect for the deliberations of others exists in construction projects. The idea of "proper respect" is very important and must be promoted in Lean Construction, especially when considering the high diversity in professions between people of the production process. It is important to always respect peers and employees. The lack in proper respect causes situations of fear of raising a discussion which may add value to the project, or may ignore the interaction and communication with these people who do not show proper respect for the deliberations of others. Lean Construction should promote the culture of proper respect especially among Last planners.

Integrity as a Moral Purpose:

Cox et.al (2005) and Baxter et.al (2012) studied the research of McFall who added the moral constraint upon the above aspects of integrity. This means that the moral purpose of integrity places moral constraints upon the kind of commitment to which a person of integrity must remain true (Cox et.al, 2005).

McFall divides people, according to their point of view, into two categories: seekers of pleasure and seekers of approval. She describes the person of integrity as a seeker of approval; while the seeker of pleasure is described as a person of principle. She explains this classification of the two people: "A person who is only a principle seeker for pleasure is not a candidate for integrity because there is no possibility of conflict between pleasure and principle in which integrity could be lost. Where there is no possibility of its loss, integrity cannot exist". In the case of approval, she claims that "pursuit of approval is inconsistent with integrity (possibility for conflict)". According to McFall "A person of integrity is willing to bear the consequences of her/his convictions, even when it is difficult."

How is it possible to distinguish these two kinds of persons classified by McFall. The answer is by depending on the distinction between principles and commitments. McFall depended in her judgment on the following criteria: "we judge people to be of integrity only if they have commitment which a reasonable person could accept as important" and this turns out to be a morally substantive constraint. Cox et.al (2005) see according to McFall's conception that "judgment of another's integrity depends on our conception of what is important, moral, and good, and implies substantive constraints on what a person may do and still be judged to have integrity". This issue led McFall to distinguish between two kinds of integrity: personal integrity and moral integrity. On her view, "a person who, in action on some morally deficient principle, does morally abhorrent things may have personal integrity even if not moral integrity". Cox et.al (2005) found that McFall appears to draw the distinction between moral integrity and personal integrity in terms of the reasonableness of a person's moral beliefs.

It is not easy here to distinguish between the two kinds. For example: a project manager asked labourers to work on-site during a phase of high temperature. From the project manager's point of view, he sincerely believed to act rightly based on the project plan (personal integrity exhibits). However, he lacks moral integrity and moral judgment considering the set of codes available when deciding about work under specific environmental condition introduced by ILO as mentioned before.

Cox et al. (2005) recommend a distinction between personal and moral integrity, suggesting distinguishing between the kinds of commitments and the kinds of activities and in which context they occur. They argue that personal integrity would then refer to non-moral aspects (if applicable) of personal life and moral integrity would refer to aspects of a person's life with clear moral significance. Cox et.al (2005) find that the positive side of this aspect "integrity as moral purpose" is to link and discuss moral in integrity; however, they see the approach appears too narrow.

Therefore, it is important to understand the moral dimension of integrity and to focus on it. However, morality and ethics are defined and shaped by society in general and the surrounding community in particular. Such understanding helps Lean in finding the right ways in promoting integrity within communities. A good example from the case study is nepotism. Senior managers employ many engineers and labourers based on family and social relationships and not on expertise and qualifications. Businesswise, this is a corrupt action (nepotism is a form of corruption). However, this might be a social and moral requirement within their community to help relatives and friends and employ them in their projects. For them, this is "moral integrity". This is what should be worked on to improve and change.

Both Cox et.al (2005) and Baxter et.al (2012) who studied the four previously mentioned aspects of integrity as introduced by philosophers emphasize that the concept of integrity is a "cluster concept" tying together different overlapping qualities of character under the one term "integrity".

In his profound study, Cox added a new and fifth aspect expressing comprehensive integrity: "integrity as a virtue".

Integrity as a Virtue:

Cox et al. (2005) state "we take integrity to be a complex and thick virtue term", according to them, a person of integrity lives in a fragile balance of human traits. These traits include arrogance, dogmatism, fanaticism, monomania, sanctimoniousness and rigidity. All these traits can defeat integrity. On the other side, they found that there are different sets of characteristics undermine integrity such as capriciousness, wantonness, triviality, disintegration, weakness of will, self-deception, self-ignorance, mendacity, hypocrisy and indifference. However, the defeaters of integrity are person-relative and situation relative (Cox et.al, 2005). This particular point is important to understand that integrity is firstly related to a person and secondly to the surrounding situations. Therefore, in order to promoting integrity, the effort should be directed at the person (workers in the production process) and the surrounding situation (the production process itself). Actually, this duality of "people-process" is the core of Lean Thinking (Gehbauer, 2012).

Even though Cox tried to summarize all four aspects introduced by philosophers who studied integrity into the one aspect of "integrity as a virtue", he admitted that "it appears that integrity is much more difficult to achieve than is often thought".

Despite the fact that achieving integrity is difficult it is still important to pursue it because the lack of integrity is the main reason for the spread of corruption. Therefore, maintaining and promoting integrity is the main firewall against corruption. FIDIC as an active organization in the field of the construction industry presents many essential reasons for the importance of integrity (to its members) which can be reflected in the construction industry in general, they are introduced in section 3.5.5 and repeated hereunder:

- Integrity is financially good for business
- Integrity represents the morally and ethically correct framework for providing consulting services; it preserves the respect and reputation for the industry of those interested in using its services.
- Integrity protects the firm and its staff from external influences that may lead to corruption
- Integrity is important for the long-term sustainability of a firm as it grows, adds staff and provides services to existing and new clients.
- Integrity enhances revenue and growth.
- Integrity in business builds client loyalty.

In addition to these factors presented by FIDIC which can be considered as strategic reasons for the importance of integrity to the enterprise, we are going to move forward and search within an important factor for Lean Construction, namely performance, to see its relationship with integrity.

Improving performance forms the main target in Lean Construction; actually low performance in construction industry was the spark which ignited the Lean Construction revolution. Koskela (2000) in the introduction of his PhD, he confirmed that the purpose of his new theory in the construction industry is to improve performance; "Does such a theory add to our understanding and lead to improved performance when applied to construction?"

Linking production (including performance) with integrity will open the path for developing not only the strategic dimension of integrity but also its operational one. Besides, it will support the identification of integrity from a Lean Construction's point of view.

Integrity as Honouring One's Word:

Further literature reviews on integrity revealed that Erhard et al. (2013) connect integrity and production. Initially, they considered integrity as a production factor. Erhard et.al (2013) claim that the role of integrity in productivity and performance has been largely hidden or unnoticed, or even ignored

by economists and others. It is a fact that integrity plays an important role which has not been given the right attention in the construction industry, even in Lean Construction which has always fervently sought to improve this industry.

Erhard et.al (2013) found that integrity is not understood to be a factor of production. People are looking for reasons for why things do not work and almost never consider out-of-integrity behaviour as a cause. Instead, they supply explanations, rationalizations, justifications, and excuses that masquerade as a cause for messes created by out-of-integrity behaviour. Erhard et.al (2013) argues that "this masquerade hides the role played by the out-of-integrity behaviour's impact on performance."

In addition, they see that people in the production often use sincerity and good intentions to further excuse and cover up their lack of integrity. This behaviour prevents people and organizations from realizing that integrity has an impact on performance, while paradoxically being committed to performance. This is an important recognition with respect to Lean Construction and should be considered for implementation. Lean and its scholars consider transparency as the important factor in production, but unfortunately they ignored integrity. While Lean sees transparency as the key principle of everything, Erhard et al. (2013) believe that without integrity nothing works.

Takim et.al (2013) see a relationship between transparency and integrity as they state "transparency is directly linked to integrity; a person with integrity open themselves up for scrutiny of others and is transparent with regards to their actions". Hence, in order to achieve a higher degree of transparency, integrity should exist and be promoted. Ergo, integrity is the key to transparency. However, a suitable model for integrity that suits the core of Lean is still to be found. Or, differently put, what is integrity from the Lean perspective?

The challenge in front of us here is looking for a suitable model for integrity which suits the core of Lean. The most important criterion in the search for a model or a concept for integrity that suits Lean is "simplicity". Simplicity is considered as an important principle in Lean and a base for considering matters and discussing them. For this reason, the new concept for integrity suits the Lean approach, is easy to implement, fits with Lean's production theory, and supports the improvement of performance.

As seen, Erhard et.al (2013) argue that there are overlapping, confusing, and confounding amongst the concept phenomena of integrity, morality, ethics, and legality which are commonly understood to provide directions for "correct behaviour". In their research paper "Integrity: A Positive Model that incorporates the normative phenomena of morality, ethics and legality" they presented a model for integrity.

Erhard et.al (2013) introduced a model for integrity as "honoring one's word" where it means "you either keep your word (do what you said you would do and by the time you said you would do it); or, as soon as you know that you will not, you say that you will not and clean up any mess caused for those who were counting on your word"

Erhard argues that the integrity of a group or organization is a matter of the group's or organization's word, whereas the word of a group is the word of an appointed spokesperson, in the same manner is the word of an organization is the word of its authorized persons, e.g. their board of directors and management. According to Erhard et.al (2013) "honoring one's word" is the route to creating whole and complete social and working relationships. Moreover, honoring one's word provides an actionable pathway to earning the trust of others (Erhard et.al, 2013).

Erhard et.al (2013) linked between integrity, production and consequently performance. Their new model of integrity explains the relationship between integrity and performance. They state "integrity is a precondition (that is, a necessary condition) for maximum performance. When integrity is broken, the opportunity for a person, group or entity to perform is broken". They proved their hypothesis "integrity is a precondition for maximum performance" through connecting integrity with workability.

These two are interrelated, any changes, minor or major, to objects, systems, etc. would result in a decrease of the workability. So they assume as integrity (whole and complete) declines, workability declines, whether for an object, system, individual, group or organization, and as workability declines, the opportunity for performance declines. Their logical argument goes as follows (Erhard et.al, 2013):

- Because maximum workability is a necessary (although not sufficient) condition for maximum performance, and
- because integrity as they distinguish and define it is a necessary and sufficient condition for maximum workability
- It follows integrity is a necessary (although not sufficient) condition for maximum performance, and
- it follows that as integrity declines, the opportunity for performance declines

Through this profile, Erhard et al (2013) see integrity as the platform for successful performance. They emphasize that "when people or entities are out of integrity, we cannot rely on what they say. We do not know at any given time what of their word they will deliver on time (and if not on time, by when they will), or what of their word they will not deliver at all. Consequently, there is no platform on which maximum performance can be sustained". Therefore, they emphasize that integrity by itself is not a guarantee for successful performance (that is, not a sufficient condition), integrity is the platform on which to build successful performance, and in the presence of integrity, the other factors required for building successful performance can be added (Erhard et.al, 2013).

It is important to explain the point, in honoring ones' word, this "word" should be far away from corruption, it should be a word based on moral, ethics and legality, for example the briber's word given to the bribe receiver. The briber's word here is his commitment to the bribe receiver and honoring his word here reflects only the identity view of integrity (aspect 2) mentioned above where Cox confirms that people of such integrity can do terrible things. This important issue was not ignored by Erhard et al (2013); rather their whole research was based on the distinction between the four phenomena: integrity, morality, ethics, and legality. They distinguish them in two separate realms. Integrity exists in a positive realm devoid of normative content (integrity is thus not about good or bad, or right or wrong, or what should or should not be) while morality, ethics and legality exist in the normative realm of virtues (they are about good and bad, right and wrong, or what should or should not be). According to Erhard et al (2013), the model of integrity incorporates morality, ethics, and legality. Figure 5-10 shows the relationship between integrity with morality, ethics, and legality based on Erhard's model.

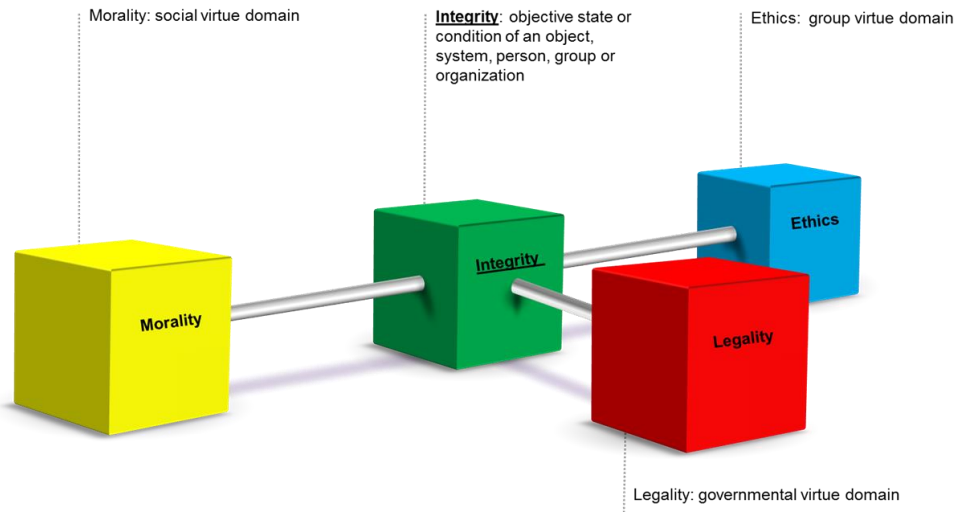


Figure 5-10: Integrity model incorporating morality, ethics and legality based on Erhard et al. (2013)

Within the new model of integrity, Erhard et al. (2013) define the three virtues as:

Morality: (social virtue domain) "In a given society, in a given era of that society, morality is the generally accepted standards of what is desirable and undesirable; of right and wrong conduct, and what is considered bad behaviour of a person, group, or entity."

Ethics: (group virtue domain) "In given group (the benefits of inclusion in which group, a person sub-group, or entity enjoys), ethics is the agreed-on standard of what is desirable and undesirable; of right and wrong conduct; of what is considered by the group as a good and bad behaviour of a person, sub-group, or entity that is a member of the group, and may include defined bases for discipline, including exclusion."

Legality: (government virtue domain) "The system of laws and regulations of right and wrong behaviour that are enforceable by the state (federal state, or local governmental body) through the exercise of its policing powers and judicial process with the heart and use of penalties, including its monopoly on the right to use physical violence."

In the new model of integrity "Honoring one's word"; Erhard et al. (2013) define person word as consisting of each of the following words listed in Table 5-1. Word 6 for example explains how the new model of integrity incorporates morality, ethics, and legality.

Word No.	**The Word**	**Clarification**
Word 1	What You Said	Whatever you have said you will do or will not do, and in the case of do, by when you said you would do it
Word 2	What You Know	Whatever you know to do or know not to do, and in the case of do, doing it as you know it is meant to be done and doing it on time, unless you have explicitly said to the contrary
Word 3	What is Expected	Whatever you are expected to do or not do (even when not explicitly expressed), and in the case of do, doing it on time, unless you have explicitly said to the contrary
Word 4	What You Say Is So	Whenever you have given your word to others as to the existence of some thing or some state of the world, your word includes being willing to be held accountable that the others would find your evidence for what you have asserted also makes what you have asserted valid for themselves
Word 5	What You Say You Stand For	What you stand for, whether expressed in the form of a declaration made to one or more people, or even to yourself, as well as what you hold yourself out to others as standing for (formally declared or not), is a part of your word
Word 6	Moral, Ethics and Legal Standards	The social moral standards, the group ethical standards and the governmental legal standards of right and wrong, good and bad behaviour, in the society, groups and state in which one enjoys the benefits of membership are also part of one's word (what one is expected to do) unless

		a) One has explicitly and publicly expressed an intention to not keep one or more of these standards, and b) One is willing to bear the costs of refusing to conform to these standards (the rules of the game one is in).

Table 5-1: Words form the one's word in new integrity model

Based on the above discussions on the six different views on integrity (model or aspects) presented by Cox et.al (2005); Baxter et.al (2012) and Erhard et.al (2013):

1. Integrity as self-integration
2. The identity view of integrity
3. Integrity as standing for something
4. Integrity as moral purpose
5. Integrity as a virtue
6. Integrity as "honoring one's word"

As a result, it is recommended that Lean Construction adopts Erhard's model and implements within it the new model of integrity "honoring one's word" because Erhard's model is the most comprehensive one which includes all the other aspects of integrity (the other five), especially the aspects of morality, ethics and legality as shown in Table 5-1 above.

One of the most important results of this adoption is supporting to make reliable promises, especially when "one's word" considered as "promise" in the Last Planner System. According to Fauchier et al. (2013) reliable promising is an inherent characteristic of the LPS.

This link between "one's word" as introduced by Erhard's model and "promise" is the entrance to linking integrity with the Last Planner System, in addition to transparency and accountability, in order to make it a platform for promoting integrity. In this way, the LPS will not only be the main Lean Construction tool in terms of planning and controlling but furthermore it will be the main platform to enhance and promote the integrity, transparency and accountability in Lean Construction. Consequently, the high level of integrity, transparency and accountability (or the decrease of the three reasons of corruption; lack of integrity, lack of transparency and lack of accountability) leads to eliminate corruption waste.

In a previous research related to an extent to this one in collaboration between Karlsruhe Institute of Technology - KIT and Polytechnic University of Valencia, a study was conducted of the factors influencing the labour productivity in the construction industry, especially in Spain. Spain, as seen before, is considered one of the leading countries in the construction industry worldwide and is only second to China as to the size of their construction companies (see Figure 3-13). In addition, the world's top construction company "ACS" (see Table 3-12) is a Spanish company. Therefore, the construction industry plays an important role in the Spanish economy (Robles et.al, 2014).

In a research paper based on previous research published in the field of labour productivity in the construction industry by scholars from different countries, variations and differences in factors influencing labour productivity according to the nature of the country were detected. The factors ranged from 13 according to Horner et.al (1989) in the UK to 83 according to Dai et.al (2009) in the USA. The paper was called "Labour Productivity in the Construction Industry - Factors Influencing the Spanish Construction Labour Productivity" and was published at the International Conference on Human Factors and Sustainable Infrastructure ICHFSI 2014 in Barcelona.

What is important here is that the integrity concept was never mentioned as a factor influencing labour productivity in the previous researches. Therefore, we considered the integrity of labourers as a new

factor influencing their productivity in our survey "It considers the adherence to moral, ethical, and legal principles, Moreover, it intends to highlight the importance for increasing performance in the way people honor their words" (Robles et.al, 2014).

The following Table 5-2 shows the set of 35 factors which were selected for the above mentioned research. The factors were classified in five different categories. The proposed categories were:

I. Project category (4 factors, 11%) which grouped factors related to the project itself
II. Human category (6 factors, 17%) involving the factors affecting the labourers (the integrity factor belongs to this group)
III. Management or organizational category (14 factors, 40%) for those factors referring to planning, scheduling and supervising issues
IV. Material and Tool category (3 factors, 9%) grouping factors related to supply or shortage of material, tools and equipment or machinery and finally
V. Environmental factors category (8 factors, 23%) encompassing factors which cannot be managed.

Code	Factor influcing labour productivity	Category
F1	Construction method	Project
F2	Complexity of the design	
F3	Clarity of the drawings and project documents	
F4	Project scale	
F5	Level of ^skill and experience	Human
F6	Ability to adapt to changes and new environments	
F7	Labour motivation	
F8	Working overtime	
F9	Number of breaks and duration	
F10	*Worker´s integrity*	
F11	Incentive policies	Management or organizational
F12	Clear and daily task assignment	
F13	Insufficient supervision of subcontractors	
F14	Improper coordination of subcontractors	
F15	Inadequate planning	
F16	High congestion	
F17	Delays in payments to workers	
F18	Delays in payments to suppliers	
F19	Unrealistic scheduling	
F20	Communication problems	
F21	Reallocation of labourers	
F22	Coordination between crews	
F23	Lack or delay in supervision	
F24	Rework	
F25	Shortage or late supply of materials	Materials and tools
F26	Unsuitability of materials storage location	
F27	Tools or equipment shortages	
F28	Performing work at night	Environmental
F29	Influence of working at height	
F30	Motion's limitation in the jobsite	
F31	Air humidity	
F32	High/low temperatures	
F33	Rain	

F34	High winds	
F35	Distance between construction sites and cities	

Table 5-2: Worker's Integrity (F10) as a new factor influencing labour productivity

The research methodology was a structured-questionnaire survey to collect data from Spanish construction companies. The questionnaire was comprised of statements generated based on the factors listed above.

A total of 1.450 participants were selected randomly from a combination of contractors registered in the official register of classified companies of Spain. The number of responses obtained were 376 (> 367 participants were necessary to the representativeness of the size). For analyzing data, the relative importance index (RII) technique was used.

With a relative importance index of 75% (60% average effect (A) and 80% high effect (H)) the workers' integrity was ranked fourth among the factors belonging to the human category and 17th among the 35 factors surveyed. As mentioned, this factor has been barely studied before as a factor that could affect labour productivity. However, the data obtained through the questionnaire reflects it has high effect as a factor influencing labourers' productivity and their performance in the construction industry.

The above mentioned research, it aims at emphasizing Erhard's contribution to the importance of integrity on productivity and performance in general, and (through the survey) on the construction industry in particular.

Looking back at integrity in Lean Construction, we can emphasize that adopting Erhard's model and working to transplant it into the LPS is an advanced and important step that serves in increasing transparency and consequently (and logically) reducing corruption on the "bottom level". Of course, it is not enough because corruption should be simultaneously reduced on the other side, i.e. the "top level", too. Therefore, Lean organization should depend on other tools such as integrity management system (IMS) or similar anti-corruption systems as a new tool within Lean's tool pool. However, with LPS which takes the issue of "integrity" into consideration, it makes it possible to move integrity from the strategic level to the operational level. Through LPS, attention can be paid to integrity continuously on weekly bases and LPS can promote integrity week after week. Through these Lean Construction treats corruption not only, as traditionally known, combating corruption is a task of the top as referred to by most scholars like Doig (2012) who argues that "corruption prevention is a management function", rather Lean extends it as a task of the bottom, where the role of bottom (last planners) has been always strengthen by Lean.

The theory of Gehbauer (2008) to extend the potential of the Last Planner System is confirmed with this thesis' idea of extending it to a platform for the promotion of integrity and considering integrity management systems as an additional tool in Lean Construction. Integrity management systems work as top-down systems; the last planner system with its integrity power serves as a bottom-up system against corruption.

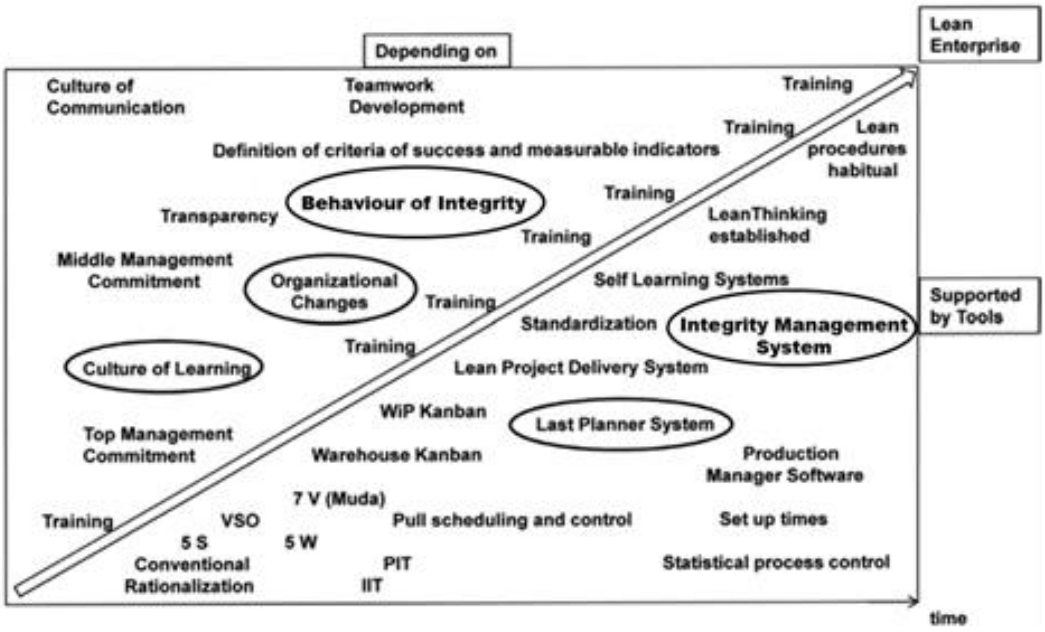


Figure 5-11: The road map to a Lean Enterprise including integrity concept based on Gehbauer (2008)

Of course, the solution is not limited to the Last Planner System. When Lean adopts integrity, many of its principles, concepts, and tools can be developed or adjusted to integrate integrity as many others already have the potential to promote integrity and reduce corruption. As mentioned before, it starts with paying attention to integrity, then working on exploring the potential that serves enhancing integrity.

For example, Lean Construction contains a sustainability concept, which is one of the eight areas of interest in Lean Construction. Scholars in this area developed many models and tools such as the First and Last Value model introduced by Salvatierra-Garrido and Pasquire (2011) which links the value of a project to the environment and society. It aims to enhance client and social values by earlier implementation of sustainability management in construction projects. The model focuses on making design and construction projects sustainable by ensuring reduced environment degradation, thereby creating healthy and quality built environment, at the same time ensuring continuous movement from economical perspective to social perspectives (Salvatierra-Garrido and Pasquire, 2011).

The Subsidy Allocation Mechanism for green performance contracting introduced by Sharma and Cui (2012), the Zero-Net Energy Retrofit for energy saving introduced by Ladhad and Perrish (2013) and the Green-Lean Simulation model for the relationship between green and Lean introduced by Golzarpoor and Gonzalez (2013) show the important of the sustainability in Lean Construction.

In an interview with Diaz Padilla, who is an expert in the field of corruption, he argues that there is no sustainability in the presence of corruption. He said “integrity is the door to sustainability".

Trust building: Trust plays a major role in Lean Construction. Smith et al. (2014) argue that a high level of trust between project participants increases productivity and enhances team performance. Similarly, Erhard, who developed the new model of integrity, states that "trust is incredibly important to efficient and effective human interaction across a spectrum from work environments to close personal relations. Trust adds value and reduces costs in many ways". However, he moves away from the traditional way to gain trust between people which is mostly based on making acquaintances and by being likeable or knowledgeable. Erhard et al. (2013) consider individuals in relation to their words and actions. Therefore, he believes that "if I want the trust of others I must earn it and the way I earn it is by honoring my word". Based on the new model of integrity, Erhard believes that "the path to trust for a person, group and organization is integrity-honoring one's word" (Erhard et al., 2013).

Incentive System: Garcia et.al (2006) see incentive systems as a tool to motivate individuals or a group of participants for the work concerned and to perform it with high performance aiming to produce value to the customer and contribute success to the organization. Alarcon and Seguel (2002) argue that such systems help in reducing waste. However, incentive systems can not work effectively and correctly in the absence of integrity. An example from the case study showed that the process of granting bonuses to engineers and labourers depended on the personal relations with the managers because they recommended to their superiors who should receive a bonus. Therefore, bonus was not based on performance or the effort exerted by the worker. On the contrary, this caused hatred and jealousy among colleagues. Most of those receiving a bonus did not earn it. In one instance, this company decided to move some workers to another site and dismiss others, based on the bonus recommendations. This decision caused disturbance in the project as the workers to be dismissed actually were the productive ones.

The presence of integrity in projects contributes to the correct implementation of incentive systems. Therefore, Lean should reward behaviour with integrity as a part of its incentive system. Such steps help promoting integrity in projects as well as in companies (Passas, 2007; Del Rosaio and Star, 2011; and Baxter et.al, 2012).

There are many other concepts and tools in Lean which should be considered from this perspective, so integrity can be promoted and applied in them at the same time. If we continue to give examples in this context in addition to the above, Lean can integrate the concept of integrity in the Leadership model introduced by Bettler and Lightner (2013). The model defines the leadership, purpose of leadership, components of leadership and interaction of those components. Bettler and Lightner include a mechanism for applying plan–do–check–act (PDCA) to capture and propagate lessons learned during the application of leadership. Leadership plays an important role to promote integrity and must demonstrate their full commitment to integrity in a clear and visible way (FIDIC, 2012). Baxter et al. (2012) argue that the leadership of any organization should set the tone for integrity: "tone from the top".

One of the most important Lean domains to which the concept of integrity should be added is Lean's contract. Contract management forms an important area of interest in Lean Construction. It deals with developing and creating a new form of contract aiming to maximize performance and minimize risks. This can be achieved by adopting contracts with both transitional and relational contract properties. Such a contract in Lean Construction is an innovative contract form like Integrated Project Delivery (IPD), Integrated Form of Agreement (IFoA) and Allianz contract (Howell et.al, 1996; Matthew et.al, 2007; Heidemann et.al, 2011; and Sadal et.al, 2014).

The innovative contracts in Lean Construction should be formed including clauses that refer to corruption and combating it during the whole period of work. Furthermore, Lean contracts should point out the importance of integrity and work to promote it among all stakeholders and through all production processes.

Transparency International developed the Integrity Pact (IP) which is considered one of the anti-corruption tools by that can be applied in construction industry especially in bidding and execution phases (Nordin et.al, 2011 and Sohail and Cavill, 2006). The Integrity Pact is a formal written contract between customer and bidders in which they agree to create fair and transparent bidding. The IP is introduced in the pre-tender phase and its principles are transparency, fair business conduct, and no corruption. Based on the IP, an independent monitor is appointed to oversee compliance with the pact, should violations be detected sanctions would apply (Del Rosaio and Starr, 2011). Sohail and Cavill (2006) confirm that the integrity pact has already been successful in reducing corruption and cutting the costs of dozens of procurement procedures around the world. An example they refer to is the Karachi Greater Water Supply Scheme (KWSB) where integrity pact anticipated to save $3.1 million and has led to transparency in public procurement procedures to be implemented in the project. Integrity pacts are also used in the development of the Berlin-Brandenburg International Airport in

Germany, where the project has an anti-corruption officer and anti-corruption task force (Sohail and Cavill, 2006).

In addition to the Integrity Pact, FIDIC expertise in the field of contracts and integrity management introduced in chapter three can also be adopted in Lean, developing Lean contracts with integrity and anti-corruption clauses.

On the other hand, the Lean concept puts an emphasis on people and culture. Lean Construction considers this field one of its important areas of interest. This attribute makes promoting integrity within Lean easier compared to classical management which to an extent ignores this concept in construction management.

Lean Construction tools like training and learning can also be used to promote integrity. Christensen et.al (2010) finds that learning is a prerequisite for development in construction processes and for adding value to a project. It supports the sharing of knowledge and experience and helps solving problems.

Lantelme and Formoso (2000) see learning as a tool that helps organizations to develop towards the changing needs and demands allowing them to learn new concepts, e.g. the new concept for integrity.

Alwi et al. (2004) argue that the quality of field personnel can be improved by formal, informal, or even on-site training. According to him, training helps labourers and field personnel to improve their moral and skills. Kpamma et.al (2014) introduced a Lean Competency-Based Training (CBT) system described as an inherent Lean training tool that enhances stakeholder involvement, collaboration, transparency and customer/client satisfaction or, generally, teaches lean construction principles.

At the same time, all scholars and expertise in the field of corruption call for training to promote awareness of corruption. Training is always considered as the base for promoting a culture of integrity. As described further above, training forms the fifth concept of the FIDIC Integrity Management System (see Figure 3-20). The FIDIC sees the awareness training for staff and advanced training for senior staff and project managers as key issues for the success of an integrity management system. The same idea was pointed out by Del Rosaio and Starr (2011) when they called for "conducting employee training on integrity and accountability". Baxter et al. (2012) see that training if done properly can have an important role to play in teaching people skills and understanding ethical issue.

In an interview with Diaz Padilla, chair of the FIDIC Integrity Management Committee, he was asked about the next steps after developing FIMS I and FIMS II. He replied “The next steps in promoting integrity will be training, training, and again training”. Although Lean Construction already offers an advanced training platform which can be used to perform awareness trainings to promote integrity, it should also include the integrity principle.

Based on the three principles; transparency & accountability (already included in Lean Construction) and Integrity (introduced into Lean in this research) a Lean immune system is being suggested to protect Lean from corruption and to support Lean in eliminating corruption waste.

6 Integrity Stem Cell Transplantation into Last Planner System: "The Case Study"

A case study using action research was designed to "transplant" the model of integrity introduced by Erhard et al. (2013) as "honoring one's word" into LPS. The research strategy depends on LPS as platform to promote transparency, accountability and integrity which should lead logically to reduce corruption as the lack of them is the main reason for corruption as defined above.

LPS works already on promoting transparency and accountability. The missing principle is integrity. The case study proves the ability of implementation of integrity principle into LPS which is the main tool of Lean Construction. Of course, other Lean Construction tools could also be adapted to include and promote integrity in addition to their initial role. Actually this concept "integrity transplantation into LPS" forms an important component of the Lean Anti-Corruption Toolkit introduced in this research in chapter 7.

The case study was carried out in a country ranked by Corruption Perceptions Index as a corrupt one. What distinguishes the culture of people there is that they do not respect their commitments due to different conflict of interest. Many examples about corrupt practices from the case study were mentioned in chapters 3, 4 and 5. As examples, the corrupt case in which location and assembly flow of one subcontractor was negatively impacted by an area manager who would not give approval to commence work unless he was paid a sum; otherwise the manager would not let the subcontractor start work as promised. Another example was about obtaining permission to enter the site which forms an obstacle to flow of either machine or labour, where possibility of bribing person in charge of giving entrance permission was recorded. Moreover, and in general, the author observed that most of the people in the project easily give a promise without even meaning it.

Due to its size, the project was divided into several areas. The case study was performed in one of the areas which was about to be finished (the LPS was implemented at a late stage).The work in the area is "finishing work" where the executed work included but was not limited to: block work, plaster, painting, screed, flooring, mechanical-electrical-plumbing (MEP) installation.

The strategy to implement the LPS included four main consecutive phases as presented in Figure 6-1 .

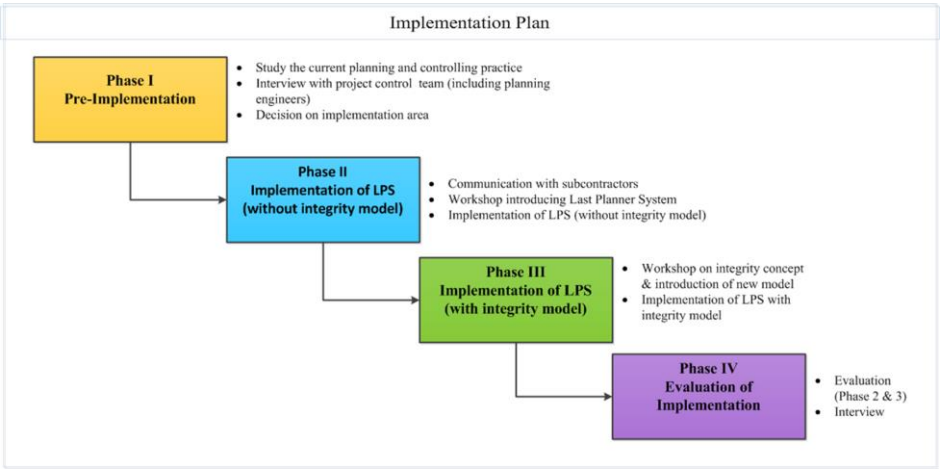


Figure 6-1: Case study - Implementation Strategy

In phase I, the goal was to identify the current practice of planning followed in the project and to decide in which area to implement the LPS. Phase II is the implementation phase of the LPS without referring to the integrity concept in this stage. This phase continued for five months and included 20 LPS sessions. Then, the third phase started in which the concept of integrity based on Erhard's model "honoring one's word" was Introduced. Phase III continued with the implementation of the LPS for another five months. In the fourth and final phase, an evaluation of the results collected from phases II and III was conducted to see the impact of integrity on the LPS. In addition, an interviewed with the project coordinator was conducted to learn his opinion about LPS.

In the next paragraphs, the implementation phases as shown in Figure 6-1 above will be explained.

Phase 1: Pre-Implementation

This phase includes the following three steps:

1. Studying the current planning and controlling practice
2. Interviewing the project control team including the planning team
3. Deciding on the implementation area

In this phase, information was obtained through observations, interviews, and surveys. In addition, the project control office (PCO) supported this work by collecting data and information in addition to studying several documents, the most important of which were the weekly and monthly progress reports, master plans besides attending progress meetings.

The project depended on "Primavera" as a planning and controlling tool, which is based on a CPM technique, a classical project management approach.

The main contractor hired an external project management company to run the project control office (PCO) which was taking the planning and controlling responsibility. He was hoping that this step would help him since this company had extensive experience in managing complex projects in addition to their skilled staff in project management. However, it turned out that the planning team (team of external company) and the teams of the main contractor (engineers and labourers) who are in charge of executing the work on site were not well integrated. The most important indicators of disintegration were the lack of communication and coordination among them.

For the existing planning and controlling process, the CPM technique was adopted in the master plan and the planning team prepared a three week look-ahead plan was distributed among the area managers. Each area has an area manager who belongs to the main contractor, and an area planner who belongs to the project management company (one planner can be involved on more than an area). The area planners visit the site on Sunday and compare the completed (actual) work with the planned work (as shown on the three week look-ahead plan). Then they send the results to the project control office which in turn modifies the three week look-ahead plan on Monday. Then, the PCO sends the plan to the area managers to record their notes or any modifications, PCO has them sending these modifications (if any) on the next day (Tuesday). Afterwards, the PCO, in turn, issues the final copy of the modified three weeks' look-ahead plan on Wednesday again to all area managers, area planners, the owner, and the owner representative. The area planners use the final copy again on Sunday during their site visit and update the plan. These activities are repeated weekly.

According to the planning process, the three week look-ahead plan should have been discussed by the area managers and the subcontractors on a weekly basis. This was not done regularly, and when it was done, it was done verbally (most of the time through a phone call) without involving the planning team or the people in charge performing the work.

Despite taking a long time (from Sunday to Wednesday), this process did not deliver the expected results. During an interview with the project control manager, he said that "one of the biggest issues is the lack of a meeting where the three week look-ahead is discussed". Another reason he mentioned was the inefficient coordination and communication between the area managers and area planners: "There are some area managers that have designated an area coordinator to meet with the planning team. However, we are not aware that any information that is discussed or requires action from area managers is being properly addressed". He also believes, especially in this critical phase of the project, that "there is a need for more cooperation from the area managers".

To have a clear idea about the current planning process and implementation of the three week look-ahead plan, a survey questionnaire was conducted with the area planners. They were asked the following questions:

i. Is the three week look-ahead plan being issued to area managers and subcontractors by planning team?
ii. Is the three week look-ahead plan reviewed and discussed? Do area managers and subcontractors contribute to any revision?
iii. Are there weekly site progress meetings regarding your areas with the area managers and subcontractors?
iv. Are minutes kept and distributed and by whom?

The participants' answers and their comments are shown in the Appendix 2. Figure 6-2 summarizes the analyzed results of the survey.

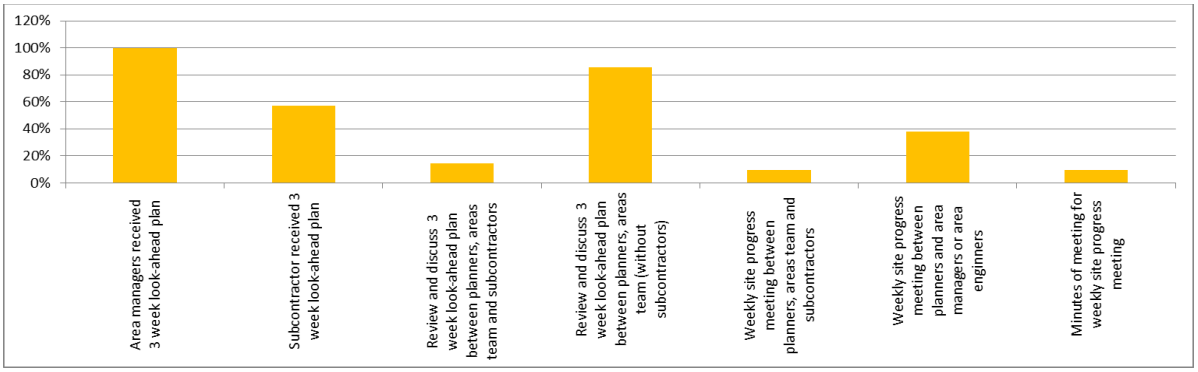


Figure 6-2: Result of the survey

Each area manager gets the three week look-ahead plan by e-mail on Monday and they are requested to answer (or at least comment on it) by Tuesday. Out of 21 areas, only in 12 areas are the subcontractors provided with three week look-ahead plans, i.e. 57%. In general, there are only three areas, i.e. 14%, where the three week look-ahead plan is discussed between the three parties of the planning process: the planners, area managers and subcontractors (from project control office's point of view), whereas most discussion meetings (which are considered internal despite the fact that the project management company is an external company) are conducted between area planners and area managers without the subcontractors. This applies to 18 areas, i.e. 86%.

The above analysis referred to the three week look-ahead plan. However, taking a closer look at the weekly meeting, it clearly reveals the weakness of this process. Only in two areas, i.e. 10%, the weekly progress meeting is conducted in the presence of the three parties together: planners, area managers and subcontractors, whereas in only eight areas, i.e. 38%, the planners and area managers conduct a weekly meeting which, as mentioned before, can be considered an internal one without the presence of subcontractors. In these weekly meetings, despite being few, the absence of minutes of meetings for most of them was noted. Only in two of the 21 areas the minutes of meetings were taken by the planners' team.

The analysis of the current planning process practice, the project control team, and the survey results has revealed that the project management company, which is well aware of Lean Construction, did not implement the LPS in the project. However, they did implement some of its important elements: the master schedule, the phase schedule and the look-ahead schedule, as well as the weekly meeting. However, the result of the survey shows clearly that only 10%, i.e. two areas comprise of such meetings including planners, area managers, and subcontractors. Even so, these meetings do not involve the actual last planners of the LPS principle.

This fact is considered a good starting point to depend on because the LPS implementation will start from the existing three weeks look-ahead which is already well-known to most of the project teams despite the difficulties during implementation, the lack of communication and coordination among the teams in particular.

Based on the collected data about the planning process, especially the result of the survey above, the author found that areas three, ten and eleven are the most suitable areas to implement the LPS because the three week look-ahead plan reaches both area managers and subcontractors. Furthermore, the three parties, i.e. planners, area managers, and subcontractors engage in on-going reviews and discussions about the look-ahead plan. Even weekly progress meetings exist, however, only between the area managers and planners which indicates presence of integration and cooperation among them more than in other areas. Another important fact to be considered is that the planner for these three areas is the same person, who gave the impression to be an efficient, professional, hardworking person who follows up his work seriously. Therefore, as a first step, the success of this matter can partially be contributed to the area planner, his cooperative personality and persistence to make his work as successful as possible.

Based on the above, on-site visits to the areas three, ten, and eleven and their respective area managers were paid to establish the area which will be the most suitable for the implementation of the LPS. The area manager of area three was the most cooperative and interested one, believing "that right management is the way for a successful project". In addition to these important factors, the work in area three was "finishing work" whereas the work in areas ten and eleven contained infrastructure works including excavations. Since a large data basis is highly advantageous for the resulting analysis process, the area with the most activities was selected for the implementation of the LPS.

Consequently, area three was chosen and a meeting was conducted with the area manager and the area coordinator in charge of communication and coordination with the subcontractors in this area. The area coordinator was also very cooperative and interested in successfully implementing the LPS in his area. In this research, the area coordinator played the role of facilitator in LPS implementation (it was the request of the area manager, since the area coordinator is officially in charge with respect to the subcontractors). Finally, it was decided to implement the LPS in area three.

This way, the path was open to move into the second phase of the implementation strategy.

Phase 2: Implementation of the LPS (without the integrity model)

This phase includes the following three steps:

1. Communication with subcontractors
2. Workshop "introducing LPS"
3. Implementation of LPS for five months

At the beginning of this phase, the author accompanied both the area coordinator and area planner during a tour on site to get an idea about their work. There, the subcontractors were met, and the area coordinator agreed with them to set up a meeting to discuss the next three week look-ahead plan. Unfortunately, only two out of five subcontractors attended the meeting. This pointed towards a trend as to the willingness of the subcontractors to meet the area coordinator. Consequently, the area manager was asked to invite the subcontractors formally.

The subcontractors were invited by e-mail to attend the first meeting. The meeting was attended by the author, the area coordinator, the area planner and four subcontractors out of five.. However, this did not have an impact because the missing subcontractor's work was about to finish. Later, he joined only the first last planner meeting; which was ignored for two reasons that will be explained later.

In this meeting, the author introduced Lean Construction as a way to improve the current planning practice through improving the communication and coordination between all parties. The focus was on the LPS as a main Lean Construction tool to achieve the target improvement.

The results of the previous phase (phase I) were discussed which revealed the inefficient use of the three week look-ahead plan and the lack of information. The improvement of these shortcomings would help all parties to achieve their work with the least waste and the best efficiency possible.

During the meeting, some issues were observed reflecting the relationship between parties:

- First, two subcontractors met for the first time in this meeting despite working together in one area. Until then, their contact was through telephone or e-mail only.
- Second, one of the subcontractors pointed out that there was already a weekly meeting conducted by the construction manager (i.e., the progress meeting), therefore he saw no need to meet again every week, in his opinion; "this is a waste of time".
- Third, one of the subcontractors, after seeing the weekly work plan form of the LPS, asked where to sign the weekly plan that was agreed on. He compared the weekly plan meeting of the Last Planner process with normal minutes of meetings which are usually signed by the participants.

These three observations showed the prevailing condition within this team and their cooperation. The first indicates the lack of communication between the parties, after working together in a project for a long time; some people in charge only meet in person when invited to a meeting. The second indicates

the lack of ability to bear responsibility on the part of subcontractor's area manager. The third indicates a lack of trust when one asks for the signature of all parties on the weekly work plan in LP meetings.

Here, the author explained the importance of weekly meetings and how they are the base for building trust and enhance communication and cooperation between the parties. It is not a tool to use against them, blame them or to increase pressure on them. On the contrary, it is a way to improve the planning process between them and raise the work efficiency to work together on solving mutual problems.

A work team was formed comprising the area coordinator, planner, area coordinator of subcontractors, and they agreed to attend the workshop in which the author would introduce the LPS. The workshop was to be conducted in a week from this meeting.

The workshop lasted for three hours in which the author introduced the LPS. Based on the team's knowledge of the three week look-ahead plan, the author presented a prepared form and its application by studying the constraints surrounding each activity and working to remove them for releasing the activity "Can do". Seven constraints categories were agreed on: (1) contract (2) engineering (3) equipment (4) environment (5) labour (6) materials (7) prerequisite work in addition to (8) for others.

At the end of the workshop, the teams agreed to use a spreadsheet as a weekly work plan (WWP) to include the assignments taken from the 3WLA plan. The weekly plan included also the name of the responsible last planner and the reasons for plan failure where the percent plan complete (PPC) value can be directly calculated. The weekly work plan is the essential working tool of the last planners for their meeting (last planner session) at the end of a week.

The first last planner meeting was conducted in the following week (after the workshop) and was repeated for 20 weeks in this phase (week 1 to week 20).

The author didn't consider the result of week 1 in the study due to the following reasons: (1) in this week there were five subcontractors, one additional to the four key subcontractors mentioned above. The fifth subcontractor had only assignments in this week and disappeared in the next weeks. (2) During phase III (week 21 to week 40), week 36 was a national holiday (non-working week). In order to achieve a similar implementation period and an identified team in both phases II and III, week 1 was only considered as a trial week for LPS implementation. Appendix 3 includes all weekly work plans for both phases. Data collected from the weekly work plans (from week 2 to 20) were studied and reasons for non-complete assignments were analyzed as presented in Figure 6-3 below

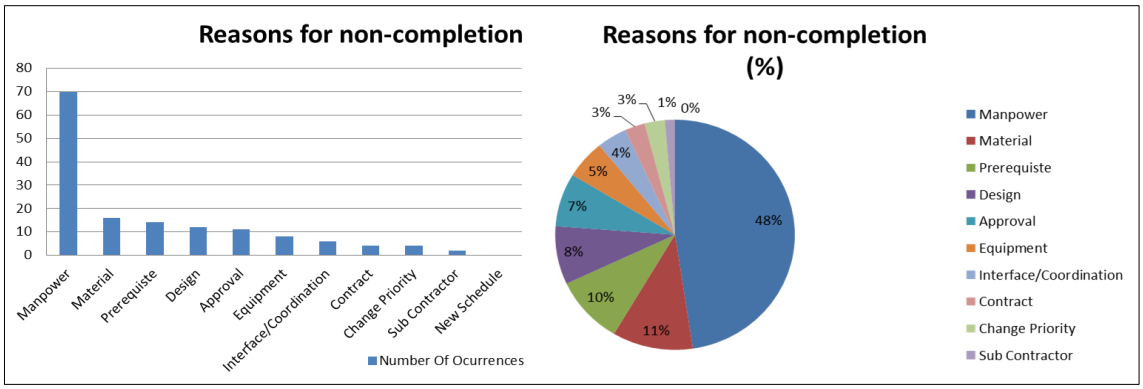


Figure 6-3: Reason for plan failure (Phase II)

The shortage of labour ranked first with 48% as the top reason for plan failure whereas material ranked second with 11%. These two factors are directly related to the subcontractor who is in charge of planning his resources in terms of manpower and material. What is more, these two factors form the important inputs of the transformation process, as seen before according to Koskela. The third factor for plan failure is prerequisite work which reflects the responsibility of others to the subcontractor by delivering him the work in such a way that he can accomplish his work. This factor is rated with 10%; all other factors are rated between 1% to 8%.

Table 6-1 shows the number of assignments per week and the number of uncompleted assignments. Also, Figure 6-4 shows the weekly PPC for week 2 to week 20.

Week	Assignment	Failure
Week 2	50	12
Week 3	23	9
Week 4	33	6
Week 5	28	9
Week 6	34	7
Week 7	39	10
Week 8	37	10
Week 9	30	10
Week 10	29	13
Week 11	20	4
Week 12	24	6
Week 13	27	6
Week 14	25	8
Week 15	22	5
Week 16	21	5
Week 17	22	8
Week 18	22	8
Week 19	19	6
Week 20	20	5

Table 6-1: Number of assignments and plan failure (Phase II)

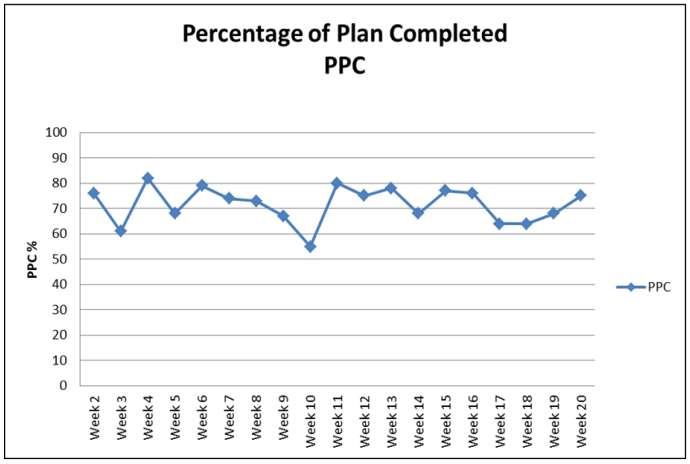


Figure 6-4: Weekly PPC values (Phase II)

PPC started with a good value 76% in week 2. It reached an average value during the period between week 2 and week 20 with about 72%. The smallest value was in week 10 with only 55%, whereas the highest value was produced in week 4 with 82%. When comparing several case studies about LPS implementation around the world, the LPS principle in this case study showed high acceptance at the beginning because of several reasons behind it. The most important of these reasons is the fact that the planning process in this project was somehow advanced. It already had a tendency towards the LPS and discontinued the look-ahead planning; however, it lacked effective weekly meetings. The second important reason is the big pressure on the contractors, especially with the official project deadline approaching fast and the project being a vital infrastructure project with the demand to be completed in the shortest possible time.

In week 10 the PPC value was 55%, the smallest value in this phase. The underlying reasons are shown in Figure 6-5.

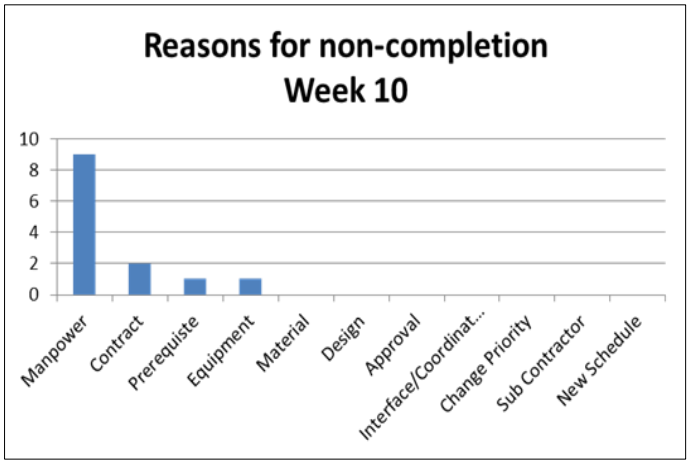


Figure 6-5: Reasons for plan failure in week 10

The shortage of labour has a significant impact on plan failure. In this week, there were 29 assignments of which only 16 were completed, and 13 were not. Nine of these 13 were caused by the shortage of labour. In this research, this is perceived not only as a failure in planning resources but also as a lack of integrity. This lack is visible in the non-compliance with the commitment to the contract signed between the main contractor and the subcontractor where the subcontractor confirmed that he has sufficient manpower and equipment (in general "resources") to accomplish the job assigned to him on time. As a matter of fact, the subcontractor did not calculate his resources well and many subcontractors depended on other subcontractors to solve this problem. However, most of the time and according to the analysis of reasons for failure it showed that most of the subcontractors were not able to keep their words to accomplish the job by providing the required labour.

As a result, the changes in PPC at this phase show a downward curve with an average value of PPC = 71.58% as shown in Figure 6-6 below where the trendline shows a slight decrease in PPC values.

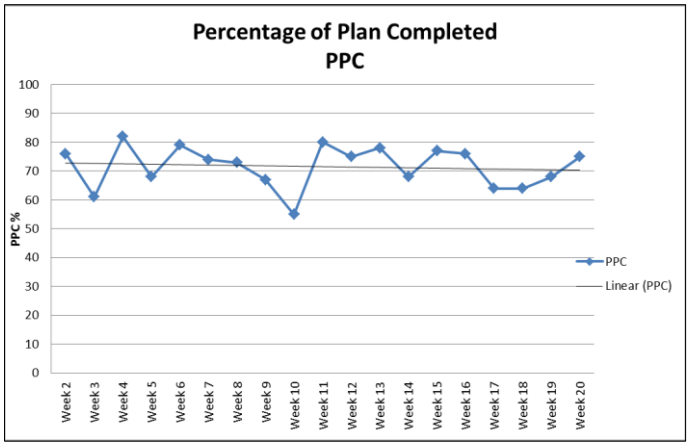


Figure 6-6: Trendline of PPC (Phase II)

Phase 3: Implementation of LPS (with the integrity model)

This phase includes the following two steps:

1. A workshop on the concept of integrity and an introduction of the new model
2. Implementation of LPS with integrity model

The author met with the work team at the end of week 20 and introduced the analysis and evaluation of the previous period from week 2 to week 20. The following points were discussed as a first introduction to the concept of integrity:

- Showing the value of PPC and its changes from one week to another focusing on how the trendline was decreasing (trending to a negative value) which is, in Lean Construction language, an evidence of no improvement in planning.
- The main reasons for plan failures were discussed which consist of:
  - Shortage in manpower
  - Shortage in materials
  - Prerequisite
- Each subcontractor could have calculated and planned his resources in a more efficient way when committing to do the work.
- The concept of prerequisite was also discussed; however, it caused an argument between the subcontractors at this point. Each party tried to put the blame on the other or on the main contractor. Since this problem can always occur, it would be a good idea to inform others in time about possible delays, so that they not need to prepare for work that cannot be started in the first place.
- It was recorded that all subcontractors intervened against the main contractor to mention the plan failures due to design and approval issues. This was discussed and it turned out that the owner representative (approval party) was not participating in the LPS.
- During the workshop, reasons for non-completion and PPC values were determined per subcontractor. The smallest value pertained to subcontractor four and the highest to subcontractor three as illustrated in Figure 6-7 below.

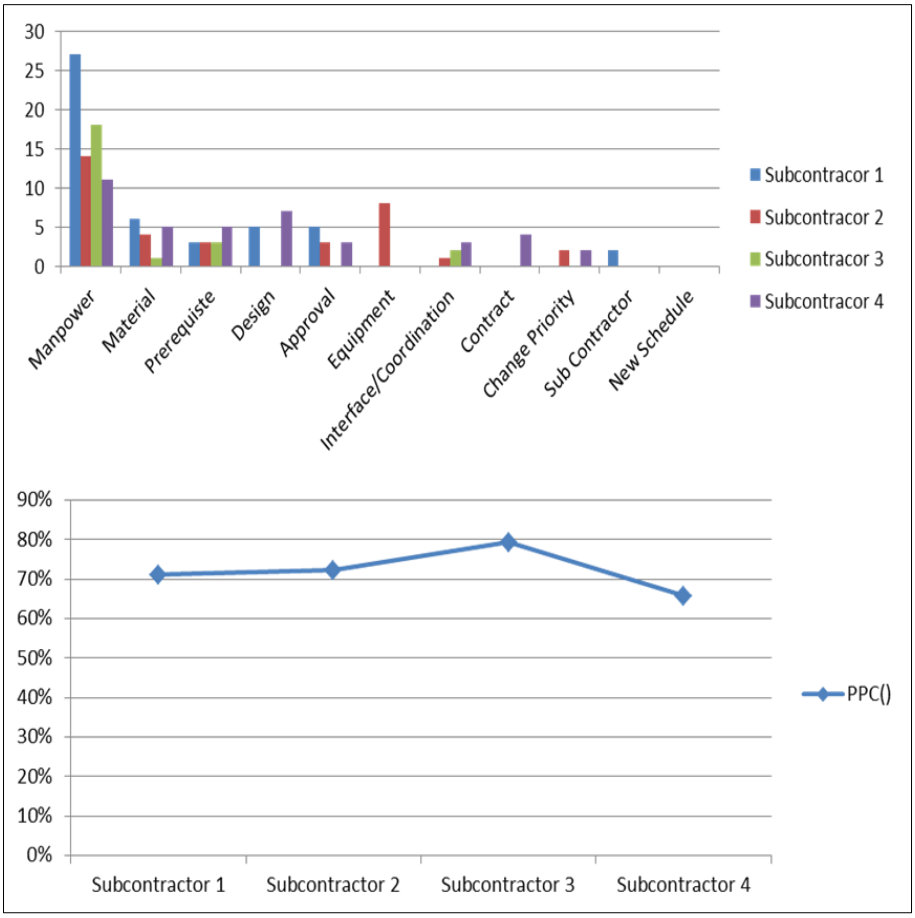


Figure 6-7: Reasons for plan failure and PPC values per subcontractor (Phase II)

After a clarifying discussion, integrity was introduced by suggesting the concept of "honoring one's word". "Your word" can be used interchangeably to the "promise" of the LPS. Therefore, before "committing" or "promising" to do anything, one should weigh the decision on the integrity scale which is defined here as "honoring your word". In this sense, you either keep your word (do what you said you would do and by the time you said you would do it); or, as soon as you know that you will not, you say that you will not and clean up any mess caused for those who were counting on your word".

To attain a better comprehension of this concept, a simple example was provided during in the workshop of how "one's word" affects the performance and work of others and consequently the work target. The four key subcontractors were divided into the two groups "A" and "B". It was assumed that crew A and crew B belong to two different subcontractors. The simulation work was "casting a pile for a bridge". Crew A was assigned to the installation of the formworks. Crew B was assigned to the installation of the bars for the concrete reinforced pile. The logical sequence of work was as follows: formwork installation, installation of bars, then pouring the concrete.

The person in charge of crew A gave his word to have their task completed in three days. They started on Monday and would finish on Wednesday. On Tuesday, during the installation of the formworks, crew A found a mistake in some elements delivered by the supplier. Consequently, they could not complete the work on Tuesday and they requested new suitable elements from their supplier. As a result, crew A was not able to continue its work on Tuesday. At the same time, they did not inform crew B of the delay, assuming that they could still complete the work the third day faster and get it done in two days instead of three. The three days were over, and crew B came to the site to start

working. However, they were surprised because the formworks were not completed. Therefore, they could not commence the installation of bars. Crew B stayed on-site without work. Considering the fact that crew B consisted of four labourers, one can easily calculate the loss the subcontractor of crew B suffered.

This could have been avoided or solved if information about the problem had been shared by crew A on the second day (on time). Other different scenarios were discussed in the workshop. For example, if there would have been a crew C assigned for concrete pouring, and in case they would not have been informed on time by crew A or crew B, the concrete might have been supplied to the construction site on the specified time in vain.

The author explained to the parties that similar problems apply with late supply of manpower, materials, tools, and equipment or machinery. Construction projects have many intertwined activities where one activity can only start upon final or partial completion of the previous one. This means that construction staff should be aware that failing their word would not only affect them but also other activities with the consequent loss of productivity and performance, as well as the loss of trust among the team.

To avoid problems like these, one should be a person of integrity by "honoring one's word".

Honoring one's word means the following (together):

1. Keeping your word (and on time), and whenever you will not be keeping your word:
2. Just as soon as you become aware that you will not be keeping your word (including not keeping your word on time) saying to everyone impacted:
    a) that you will not be keeping your word, and
    b) that you will keep that word in the future, and by when or that you won't be keeping that word at all, and
    c) what you will do to deal with the impact on others of the failure to keep you word (or to keep it on time).

To be a person of integrity, all you have to do is "honor you word", which means you keep your word (1 above), and when you will not, then you say you will not and clean up any consequences (2, a, b, and c above) (Erhard, 2013).

This new concept introduced requires all parties to better analyze their resources and work conditions (including constraints) when they consider the work (can do). Also, it evokes patience when they promise to do the work (will do). I in addition, the new concept turns the work team into internal observers or overseers by following the flow of the resources and information needed to honor their words. This alone contributes to raising and increasing transparency and accountability within the same organization which consequently leads to a decrease of corruption.

Working with this group, it was agreed to consider this concept and continue the implementation of the LPS in the following weeks along with the concept of "honoring one's word".

Similar to the results presented in the phase II, during this phase III, data was collected from the weekly work plan (from week 21 to 40, week 36 was a national holiday). An analysis of the reasons for non-completed assignments was conducted as presented in Figure 6-8 below.

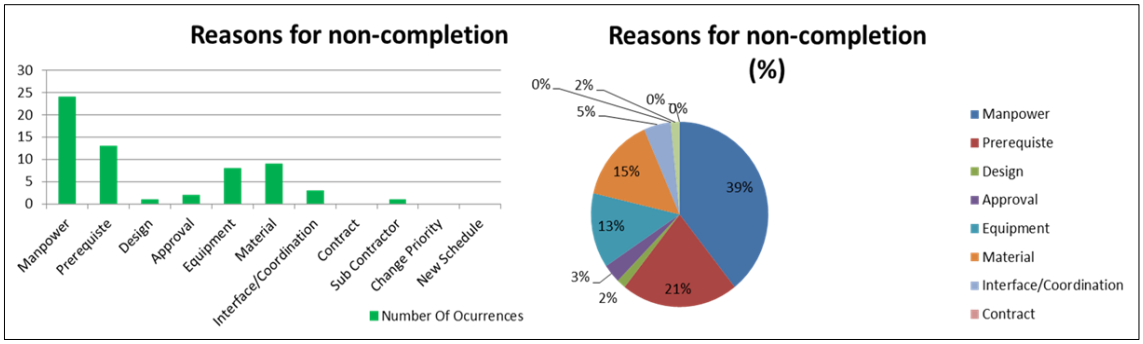


Figure 6-8: Reasons for plan failure (Phase III)

The shortage of manpower ranked first as the main reason for plan failure with 39%, whereas prerequisite ranked second with 21%, and material with 15% came third. Equipment ranked fourth with 13% and other factors were between 5% and 0%.

Table 6-2 shows the number of assignments per week and the number of uncompleted assignments. Also, Figure 6-9 shows the weekly PPC from week 21 to 40.

Week	Assignment	Failure
Week 21	20	6
Week 22	22	7
Week 23	19	3
Week 24	19	4
Week 25	15	1
Week 26	15	3
Week 27	20	4
Week 28	22	9
Week 29	21	9
Week 30	17	4
Week 31	15	1
Week 32	15	2
Week 33	15	1
Week 34	12	1
Week 35	11	0
Week 37	10	1
Week 38	11	2
Week 39	14	1
Week 40	17	2

Table 6-2: Number of assignments and plan failure (Phase III)

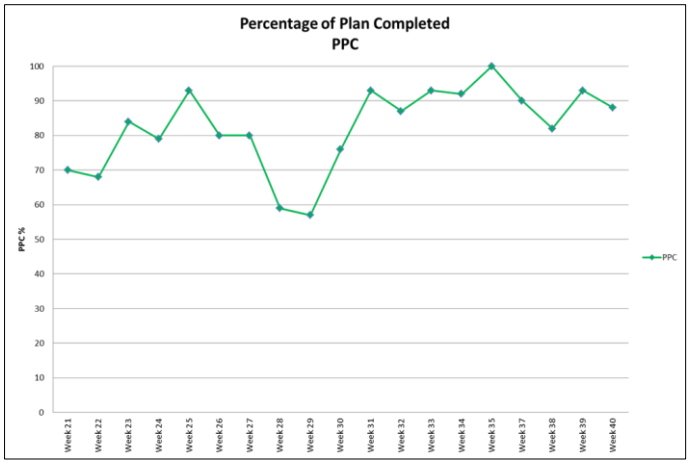


Figure 6-9: Weekly PPC values (Phase III)

The average PPC in this period reached 82.3%. The lowest value of 57% was in week 29 whereas the highest value of 100% was reached in week 35. As a result, the change of PPC in this phase (week 21 to week 40) shows an increased trendline with an average of PPC=82.3% as shown in Figure 6-10 below.

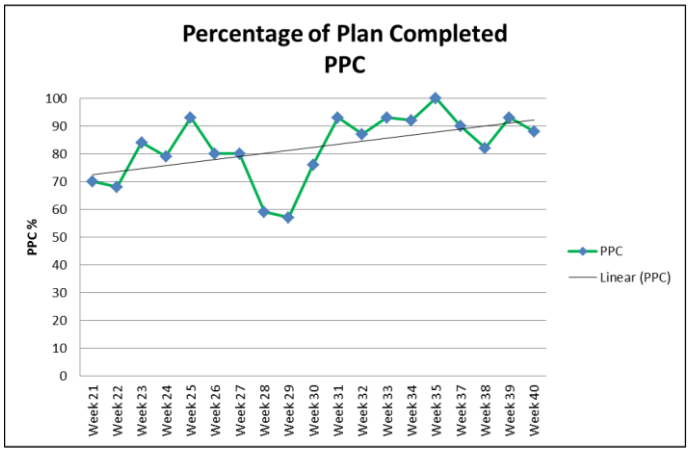


Figure 6-10: Trendline of PPC (Phase III)

The results of this phase show the increase in the PPC value (average 82.3%) in the period between week 21 to week 40 compared to the results of PPC (average 71.58%) in the period between week 2 to week 20. Evaluating and comparing the results of these two phases will be done in detail in phase IV of the implementation strategy in the next paragraph

Phase 4: Evaluation of Implementation

This phase includes the following two steps:

1. Evaluation of phase II and phase III results
2. Interview with the area coordinator

In this phase, the results of the LPS implementation in phase II (without the integrity concept) and those of phase III (after introducing the integrity concept) were studied. The PPC's from phase III are indicated as PPC (i) for integrity) in green color and in blue color for phase II.

Figure 6-11 shows the average PPC values of both phases. Phase II (week 2 and week 20) yields 71.58%, and phase III (week 21 to week 40) yields 82.32%, i.e. the introduction of the integrity concept to the LPS resulted in an increase of the PPC value since it made the promise more reliable. This increase of the PPC value from 71.58% to 81.32% corresponds to a 15% raise or is about 11 percentage points.

$$\text{Improvement of PPC} = \frac{ppc(III) - ppc(II)}{ppc(II)} \times 100 = \frac{82.32 - 71.58}{71.58} = 15\%$$

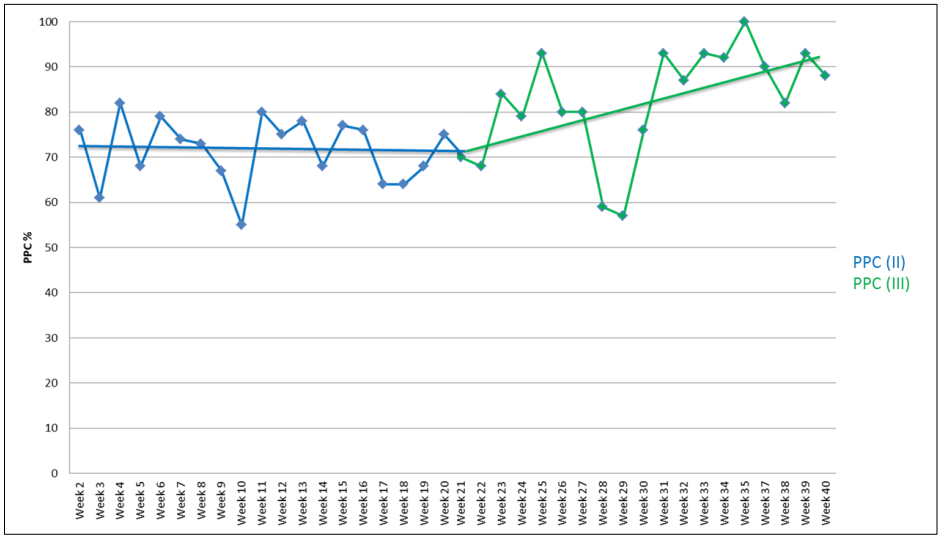


Figure 6-11: PPC values of Phase II and Phase III

However, the improvement of the PPC value in the case study cannot be attributed to the introduction of the integrity model alone. Here, the increase in the PPC value is also a result of the continuous LPS implementation because the work team, by time, got used to the concepts of the LPS. Therefore, other improvement factors also applied. Several past studies about the LPS proved this point.

The introduction of the integrity model in to the LPS ensures an accurate and efficient study of resources and constraints when considering (can do), and at the same time, promoting work accomplishments as promised (will do).

The difference in the number of reasons for plan failures between the two phases becomes obvious when comparing Figure 6-8 above with Figure 6-3. Figure 6-12 below compares those two figures showing reasons for non-completion in general during the whole period (week 2 to week 40) and in each phase (week 2 to week 20, and week 21 to week 40). This depicts the significant improvement in controlling the constraints leading to plan failure, especially those under subcontractors' direct control, i.e. manpower and materials.

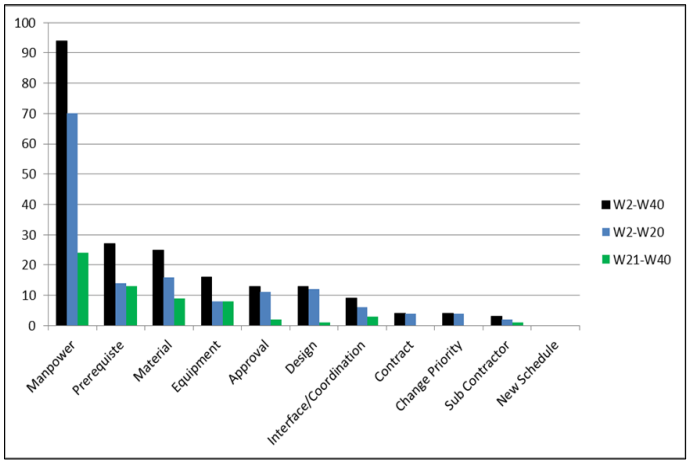


Figure 6-12: Reasons for plan failure (General view)

Figure 6-13 below shows the difference in each subcontractor's ability to control the reasons of plan failure per subcontractor. Therefore, each case (each subcontractor) will be assessed separately.

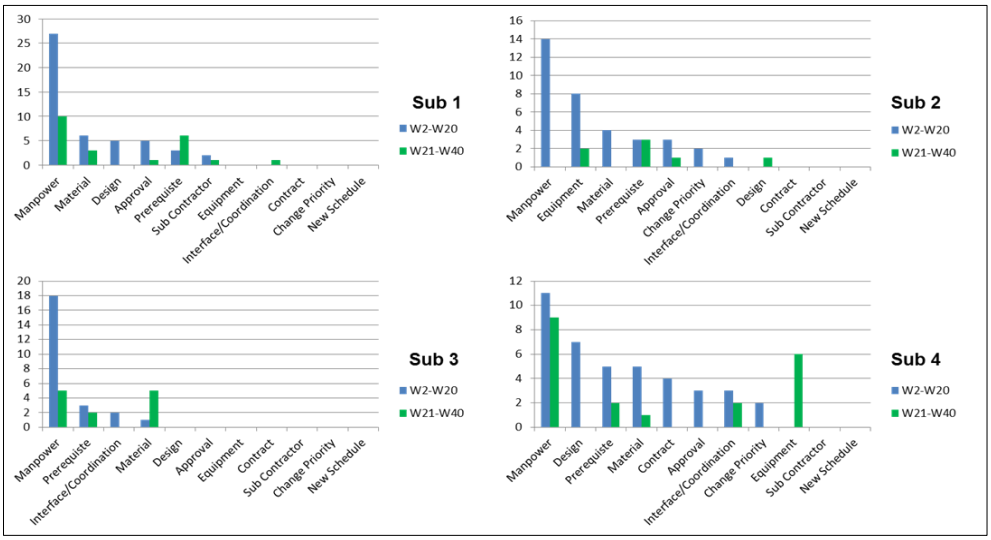


Figure 6-13: Reasons for plan failure per subcontractor

Below, Figure 6-14 shows that all subcontractors have improved their PPC value in different ratios without the integrity concept (phase II in blue) and with the integrity concept (phase III in green).

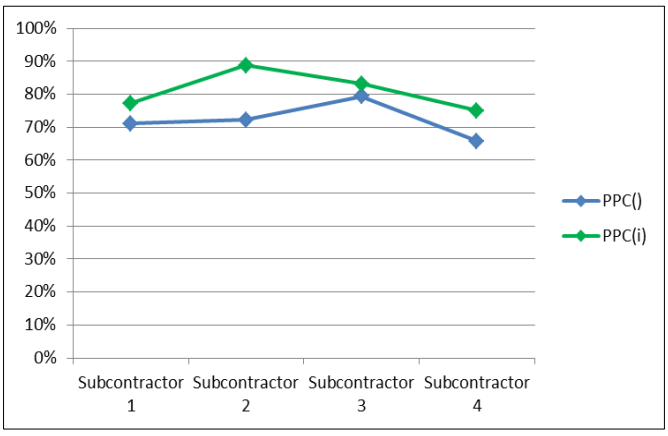


Figure 6-14: Subcontractor's PPC in Phase II and Phase III

The highest improvement was recorded with subcontractor 2, from 72% to 89% which is a 23% improvement. The lowest one was recorded with subcontractor 3, from 79% to 83% which is a 5% improvement.

Having analyzed assignments in phase II and phase III a decrease in assignments with all subcontractors was found as depicted in Figure 6-15.

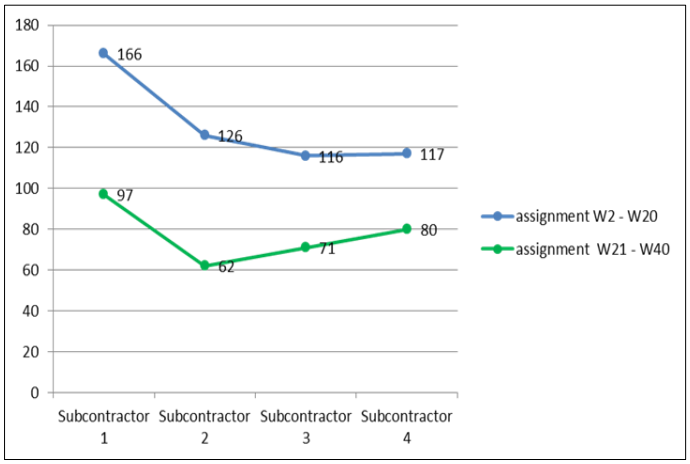


Figure 6-15: Work assignments in Phase II and Phase III

However, this cannot be attributed to the introduction of the integrity concept for several reasons:

According to Figure 6-16 below, the assignment quantity decreased and the trendline mirrors this tendency. The number of assignments dropped from 50 in week 2 to 20 in week 20, before the integrity concept (phase II) was introduced.

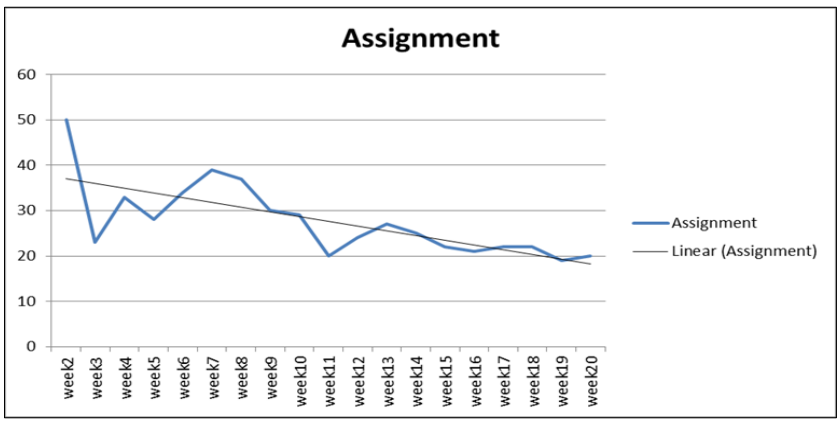


Figure 6-16: Assignment in phase II

The trendline tendency for assignments remained after introducing the integrity concept (see Figure 6-17).

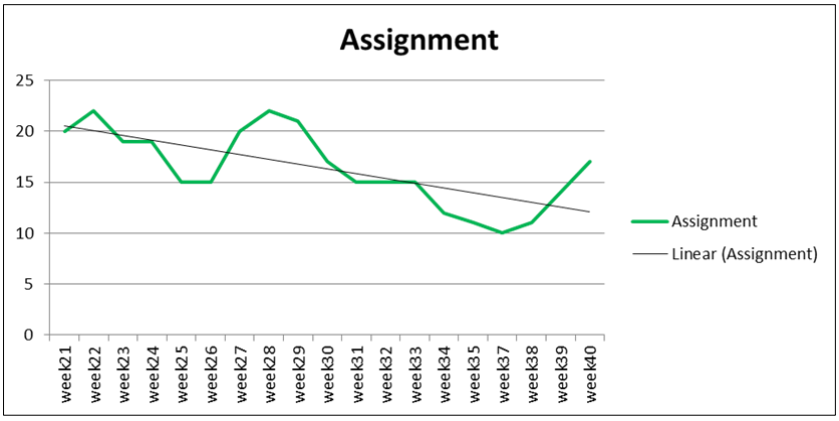


Figure 6-17: Assignment in phase III

Comparing the rate of assignments per subcontractor in phases II and III shows that the rate of assignments (in percentage, not in number) are rather similar, also the same trend when combining both phases together (W 2 to W 40) (see Figure 6-18 below).

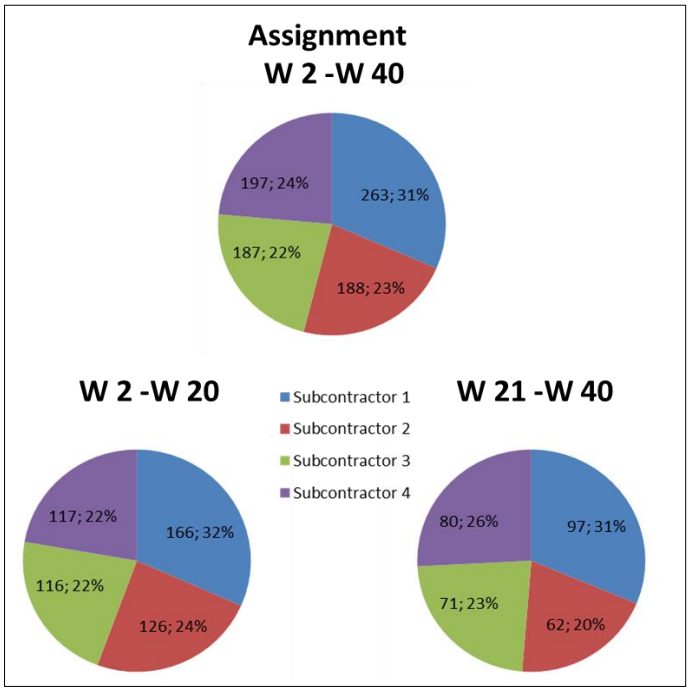


Figure 6-18: Share of assignments per subcontractor

It is important to point out that the weeks 32, 33, 34, and 35 were in Ramadan, the fasting month of the Middle East. Daily working hours during this month decreased from eight to six hours. The week after Ramadan (week 36) is a national holiday and work-free. This period is the largest in which the number of assignments decreased to the average of 13, consequently increasing after the holiday. They increased to 17 assignments in week 40, to 18 when eight working hours were mandatory again, and reached about 20 at the end of phase II before the implementation of the integrity concept. Therefore, this improvement did not come at the expense of productivity.

The results of the evaluation of how the integrity concept affected each subcontractor are as follows:

Subcontractor 1 (sub1):

The PPC of sub1 increased from 71% to 77% with an 8% improvement. Figure 6-13 shows how sub1 could improve PPC value by improving his resource planning with respect to manpower and material, two factors sub1 could control more than other factors. The increase in prerequisite as a factor for plan failure is due to the fact that this factor is linked to others (subcontractors and/or main contractor) who did not prepare the suitable working conditions. This is a factor beyond the control of sub1.

We notice that the rate of assignments for sub1 remained similar between phase II and III (32% in phase II and 31% in phase III). The PPC improvement value of 8% is considered small compared to other subcontractors. It is better than that of sub3, 5%, but less than 14% of sub4 and 23% of sub2.

An important factor which affected the LPS in general as well as the PPC of sub1 was the replacement of one last planner (AA) by another (MI) in week 21 of the LPS implementation. AA was transferred to another area within the same project. It would have been better if he had stayed with the LPS work team because of the experience acquired.

Subcontractor 2 (sub2):

The results achieved by sub2 were the best among the subcontractors. The PPC increased from 72% to 89% with an improvement of 23%. This is the best improvement among all subcontractors. Figure 6-13 shows how sub2 was able to improve the value of PPC by improving specifically the planning for manpower, material and equipment (inputs of production process). These factors can be controlled by him directly. In phase II, failure occurred due to lacking manpower (14 incidents) and due to material factor (4 incidents). However, in phase III no incident was recorded due to material. Here, eight equipment failures decreased to only two, which is a 75% improvement. The failure rate of prerequisite remained three in each phase because this factor was related to work of others and therefore beyond the control of sub2.

In addition to this PPC improvement, there was also a decrease in the number of Sub2's assignments. They amounted to 24% in phase II and 20% in phase III.

The most important reason for this improvement further to the integrity concept is the fact that the last planner (ME) remained the same during the whole period of the LPS implementation from week 2 to week 40.

Subcontractor 3 (sub3):

Despite sub3's improvement of the PPC, it was the smallest gain with only 5%. However, the PPC value for sub3 was high from the beginning (phase II) with 79%, and after the introduction of the integrity concept it increased to 83%. Figure 6-13 shows how sub3 was able to improve this value, especially by improving planning for manpower. There were 18 incidents of plan failure due to lacking manpower in phase II; this number fell to five incidents in phase III. Here, the last planner (MZ) also remained the same during the whole period of the LPS implementation from week 2 to week 40. Nevertheless, plan failure occurred due to missing material once in phase II and increased to five incidents in phase III even though the integrity concept was applied to improve the idea of "can do" and "will do". With the help of the area coordinator the reason for this deterioration was identified: the management of sub3 did not purchase the material required for the site on time because they was having financial problems and used the money from this project to support other projects.

Such an action revealed by the area coordinator during the LPS caused the main contractor to purchase the material required for the work directly and put sub3 in charge of installation work only (i.e. he paid sub3 only the cost of installation instead of supply and installation). The rate of assignment for sub3 increased from 22% to 23% in phase III.

Subcontractor 4 (sub4):

If sub2, according to this study, was the best in improving the work during the period of LPS implementation, sub4 was the worst. Despite the good improvement of 14% in the PPC value it remained below the PPC values of the other subcontractors. It was 66% in phase II and 75% in phase III. However, it stayed below the average in both phases. Figure 6-13 shows the reasons for failure in phase II and phase III for sub4; manpower and material had a big effect in phase II in addition to the design issue.

Sub4 was able to solve the material problem which decreased from five incidents in phase II to one in phase III. However, the lacking manpower remained. This can be attributed to the fact that his assignment involved IT and communication installations requiring expertise not easily found especially in the Middle East area. In phase II, design and approval were the main reasons for plan failure whereas in phase III, this reason disappeared completely and was replaced by an entirely new reason; plan failure due to equipment. Another important factor was the changing last planners. AM continued to work until week 26 and was then replaced by JA in week 27 who stayed for the rest of the month (week 27, 28, 29, and 30). At the beginning of week 31, IR came and stayed until week 40. These changes had a really negative effect on the LPS; especially since there was no internal training within sub4's company on the LPS.

In general, the case study shows that all subcontractors improved their PPC due to the integrity concept and the "honoring one's word" for issues the subcontractors actually have control over.

An important factor was "prerequisite". In some cases, e.g. with sub1, a decrease was detected in phase II (three incidents). However, in phase III it doubled to six incidents. With sub2, three incidents in both phases remained unchanged. However, there was an improvement with sub3 where the incidents changed from three in phase II to two in phase III. The same applied to sub4 where five incidents in phase II decreased to two incidents in phase III. Discussing this issue with the area coordinator it turned out (as will be mentioned in the interview below) that some subcontractors did not have complete control over their work because some of their tasks were done by other subcontractors not involved in the LPS. As a matter of fact, the four key subcontractors in the LPS have many sub-sub-subcontractors which are not participating in the LPS. Therefore, they could not solve the problem of prerequisite or report any delay according to the integrity concept. The solution would be to reduce the degree (chain) of subcontracting and involve all subcontractors in the LPS.

It is important here to refer to the factors "design" and "approval" where we did not discuss their improvement between phases II and III in respect of integrity concept due to the absence of the owner representative (the party which approves design and other activities) from LPS. However, the reason for their improvement between phase II and III goes back to the advanced progress in the project and because at the end of the project, design and approval have already took enough time. Therefore, we noticed the absence of plan failure due to design and approval in phase III. While, there were present in phase II.

The important question is how can the integrity concept in LPS eliminate corruption waste?

The case study shows that the last planner person with integrity works to honour his promise (honoring one's word) and integrity leads to thinking very well about the "can do" and to studying all constraints carefully, because he or she will keep the promises and does not want any surprises to occur. When the "can do" is decided upon the next step will be done and the promise ("will do" = giving word) be given. Then the person works hard to honour the promise that was made. In this case, the last planner (and everybody in this production chain working with integrity) tries to avoid any conflict of interest and simultaneously becomes an internal observer and monitor looking for all obstacles in the way of honoring the promise; of course corruption and corrupt people are main obstacles, like the above mentioned "corrupt area manager".

Consequently, corrupt people within production processes will find themselves monitored and followed by other participants of the production chain, so that they are under pressure to execute their tasks in a honourable way without corrupt actions. Within this concept, they are "visible" (transparency factor). Moreover, the last planner, who is a person of integrity, is more accountable for his promise and he will not let the corrupt person hurt him (accountability factor). Therefore, a corrupt person will not find it easy to undertake corrupt activities. In this manner, integrity, transparency, and accountability will eliminate corruption waste.

The last step in this phase was conducting a semi-structured interview with the area coordinator who played the role of the LPS facilitator and whose cooperation with the author had a great influence on the success of the LPS implementation. Before conducting the interview, the results collected from phase II and III were discussed with him.

The questions asked and the responses were as follows:

Question 1: In five words only, how do you describe the planning process using LPS and the previous planning process used in your project?

He said, "Limiting the answer to just five words would be difficult. However, planning process before LPS could be described as: chaotic, selfish, uncontrolled, conflicting between work parties and inefficient. Whereas after implementing LPS, we would say there was transparency, responsibility, trust, better communication and better teamwork".

Question 2: If you are asked to compare these two processes, what would you find?

He found a difference between planning with and without LPS. The answer to the previous question referred to some ideas in my mind. However, if you want a detailed answer, implementing LPS gave the chance to identify weak points which we had in our planning process. For example, we did not understand the potential power and importance of look-ahead plan which formed the smallest form of planning we had. We considered the three week look-ahead plan as a sheet of paper that we receive from the planning team. It stayed locked in our drawers if it reached us. It is true that we had weekly follow ups and even daily meetings with other parties, but they were conducted irregularly and no minutes were taken, they were mostly done by phone and sometimes by e-mail. Most of the time, we did not reach any convincing results after a phone call. Here, I must confess that the inefficiency of this communication and coordination mode made a lot of subcontractors refuse to respond to our phone calls. LPS developed and strength the communication process between us to come regularly face to face to plan together, "What do we want better than this?"

Another point, he added, before LPS, our knowledge about subcontractor's problems was little and sometimes vague. LPS enriched transparency, so now we can see their problems clearly. We can help them find a solution because subcontractors' problems are first and foremost problems to us as main

contractors and we are responsible for our client. A final point which I liked very much is that with LPS we became more conscientious about the value of time much more. There were many activities which used to take several days to be completed despite the fact that completing them required one day only, but the problems surrounding them were not clear. This was surprising to me personally. How a simple thing could obstruct work for days and weeks and it was not noticed by anybody. LPS, by following the constraints, improved this issue dramatically.

Question 3: If you were asked to send a report to your management about LPS and you wanted to count the benefits LPS provided as project management tool, what would you say in your report?

I would report the management the following points:

- LPS provide the possibility and ability to effectively control work of subcontractors in addition to improving site management by improving the relationship and building trust with subcontractors who, unfortunately, had always tried to hide their faults and weaknesses especially in supplying material and labour. Even further, subcontractors blamed others to justify their delay unfairly using the lack of communication between the different parties. LPS clears all these things up.
- LPS is an interesting tool which gives the workers on site self-confidence as they become a participant in the planning process as well as a part of the project's success.
- LPS is an educational tool through exchanging acquired expertise in LPS meeting discussions.

Question 4: In your report, you should mention some obstacles you encountered while implementing LPS or were there any you think remarkably affected the implementation?

There are many factors that have relative effects. However, I can summarize them as follows:

- Cultural barriers because it was not easy to gather everybody on one table.
- Everybody was afraid somehow of holding the responsibility of providing information, so that they would not be accountable to their management.
- In addition, there is a command chain structure or hierarchy which prohibits an engineer to sit next to a foreman, and a foreman to sit next to a site worker; it is unfortunately "a lack of respect for lower degree employees".
- Another obstacle is the long chain of subcontractors which resulted in hiding the real last planners in many cases. Our subcontractors did not want to bring their subcontractors with them because of issues related to the contract and labour skills, so that their actual capacity regarding labour and tools would not be exposed.

Question 5: In your report, will you put forward some suggestions to your management which you think are major factors for the success of LPS?

As there were many barriers which affected the implementation of LPS effectively, there are several factors which, I think, by considering them; we can get better results for implementing LPS. They are as follows:

- The support of our management themselves through offering official times for LPS sessions and providing the suitable facilities. In addition, to forcing subcontractors contractually to participate in LPS.
- Involvement of all suppliers and subcontractors which helps in remarkably increasing transparency of planning and controlling processes.

- Promoting the belief in the unified target which is to make a successful project. Therefore, it is necessary to promote this idea and work on how we can, as main contractors, convince the subcontractors with the same idea. As main contractors we should take the requirements of subcontractors into consideration and we should not consider them as usual as "the weak side". This is regarding some subcontractors. There are other subcontractors, because of their relation with the top management, who have the power to override our power (site management team of main contractor); therefore, their power needs to be limited. Here, LPS plays an important role in creating balance and equality between all subcontractors, even putting them on the same level with main contractors and unifying them in one time.
- Giving more authority to the site staff (main contractor and subcontractors) and at the same time providing them with more information about the status of the project, available resources and strategical plans of top management, so it will be possible to make decisions processes more efficient especially during LPS sessions. This will support the last planners in honoring their promises much better.

Question 6: In your opinion, what is the difference between the LPS without the integrity concept and with integrity concept?

In general, the PPC value (as reference to measure the team commitment) was increasing. The difference is that subcontractors were able to calculate and control their resources in a better way to keep their words. Honoring one's word was a missing factor in our project because people work not to honor their word but to achieve their interests.

The case study shows how integrity can play a vital role in changing corruptive "culture" through striving for reliable promises. However, eliminating corruption requires from Lean to apply the integrity principle to other tools and to benchmark other tools and ideas as best practice in combatting corruption. This leads us to develop a Lean Anti-Corruption Toolkit which will be introduced in the following chapter.

7 Lean Anti-Corruption Toolkit

In this research, the corruption phenomenon is characterized as a problem which can be solved based on the lean approach. In the solution approach, corruption itself was identified as a waste which should be eliminated. The root causes of corruption are:

1. Lack of transparency
2. Lack of accountability
3. Lack of integrity

The remaining step of the solution approach is to apply effective countermeasures to eliminate and prevent corruption waste.

As mentioned in chapter 5, Womack (1996) sees countermeasures as related tools and techniques which should be developed and implemented or as a best practice benchmarked and applied.

Holloway et al. (1997) argue that best practice benchmarking refers to the pursuit by organizations of enhanced performance by learning from the successful practices of others. Kelessidis (2000) sees the best practices as cause of the best performance. He describes this technique as "benchmarking entails gathering information from one organization to beneficially apply it to another organization". Nesensohn et al. (2012) argue that benchmarking in Lean is always seen as an important continuous improvement tool.

At the same time, most organizations interested in corruption call for adopting "best practices" to fight it. For example, the Integrity Vice Presidency (INT) of the World Bank calls for conducting researches in the area "corruption" using lessons learned approaches and best practices. Another exampleis included in the Construction Industry Ethics and Compliance Initiative (CIECI) which called its members to work together sharing best practices for creating an organizational culture in which ethics and compliance paramount. CIECI asked its members to convene in an annual meeting called "the Annual Best Practices Forum."

This research presented several initiatives and tools in the same context in addition to the important concept of "integrity" which forms together with transparency and accountability the Lean's immune system against corruption.

The most important principles, concepts and tools introduced by other organizations; especially GIACC, TI, ISO and FIDIC; to combat corruption in addition to our new integrity model in Lean construction will be collected in a toolkit and be called "Lean Anti-Corruption Toolkit". It can be defined as the collection of lean principles, concepts, and tools which form the effective countermeasures to prevent and eliminate corruption waste.

Based on this research, the Lean Anti-Corruption Toolkit will contain the following:

Integrity Concept as part of the LPS

After showing the importance of integrity as an essential principle in reducing corruption and its role in increasing reliable commitments in LPS, it is important to modify the current LPS by integrating the integrity into it and train the last planners in "honoring one's word" which will result in spreading the integrity culture among business partners making them the base for spreading it in their organisation.

Integrity Management System (IMS):

One of the most important tools that Lean organization should be supported with to reduce corruption waste is the implementation of an Integrity Management System (IMS). An IMS provides Lean organizations with guidelines on how to apply an integrity concept (including moral and ethics standards) to every aspect of their businesses. It helps Llean organizations to create the right procedure to prevent and eliminate corruption waste. Similar to FIMS, which was discussed in chapter (3.5.5), Lean's IMS can be designed in a way that reflects the spirit of Lean and goes with the size of Lean organizations and their working environment. Lean's IMS can consist of the following:

- Code of conduct
- Integrity polices
- Training mechanism
- Auditing and monitoring
- Discipline for violations of polices
- Procedures to make the polices operational

The methodology of Lean IMS against corruption waste is "prevention" which means that Lean IMS is a proactive approach to integrity behaviour. The system works as a top-down system in promoting integrity in Lean organizations.

A further step for Lean organizations would be to set up a compliance management system including an integrity management system as a vital part of it. However, this research recommended developing IMS to deal with corruption waste on a Lean's organizational level due to its core focus area on "corruption waste" and especially due to its easier operational capability.

ISO 37001

ISO 37001 can be one of a Lean organization's tools in reducing corruption waste, especially bribery. This standard was designed as an anti-bribery management system standard. This can be considered as a tool on its own; however, it is preferable for Lean organizations to connect it to its quality management system ISO 9001. Section 2.4.4 introduced an explanation of ISO 37001. The standard will be useful when a Lean organization requires from its suppliers and subcontractors or other parties of the production process an evidence of the ISO 37001 certificate to ensure at least the attention to the issue of corruption (which is bribery here) is existed and to guarantee that they have certain procedures within their organization to prevent corruption.

Due Diligence (DD)

Lean organizations can use Due Diligence (DD) as an effective tool to talk to their customers on one hand and suppliers and subcontractors or other parties of the production process on the other to determine the issues from which corruption waste can result during the construction process. This way, Lean organizations can assemble a collective plan to overcome corruption and reduce it. The ISO 37001 sees DD as a main requirement for an anti-bribery standard.

Lean organizations can consider the results of Due Diligence as a preliminary feedback when preparing the suitable mechanism to prevent and reduce corruption waste. Therefore, it is preferable that the lean organization conduct Due Diligence as early as possible (when discussing the contract). Also, it is preferable to depend on the Corruption Perceptions Index (CPI) of the respective project country: This will help to estimate the effort required to conduct Due Diligence with suppliers and subcontractors before signing contracts with them. The FIDIC, for example, considers a project in a

country with a CPI ≤ 70 as a critical project since this value indicates it as high corruption risk country. However, Lean organizations can also rely on the other five indicators introduced in section 2.5 to design their Due Diligence process.

Anti-Corruption Contract Terms

Lean Contracts, IPD, IFoA and Alliance Contracts or any form of innovative contracts introduced by Lean should contain anti-corruption terms which can be considered as anti-corruption commitments included in the contract. Generally, all Lean organization's contracts with clients; suppliers, and subcontractors or other parties of the production process should include anti-corruption clauses.

The design of anti-corruption clauses may differ from very simple, i.e. requiring business partners not to participate in any corruption conduct, or it may be more sophisticated with definitions of corruption and its forms included, e.g. partners are requested to confirm their commitment not to enter or conduct any corrupt action as an organization and/or their staff. Moreover, it is possible to engage the partner to provide evidence of training their staff on the issue of corruption and agree on a set of correction in case any corrupt actions are committed. Of course, here, it is preferable to emphasize the integrity, transparency and accountability principles in addition to emphasizing "honoring one's word" in the contract.

Section 5.3.3 introduced a simple model of contract clauses in FIDIC's contract. Appendix 4 shows more comprehensive anti-corruption provisions which can be included in the contract presented by GIACC.

Integrity Pact (IP)

This tool presented by Transparency International can be used by lean organizations and could be further developed with respect to the Lean principle to be applied when choosing partners in the production process (suppliers and subcontractors). Furthermore, if lean organizations were to adopt this tool it would make them more trustworthy for customers of public procurement because it was originally developed for preventing corruption in public contracting. Section 5.2.2 discussed this tool in details and provided evidence about its success in reducing corruption and cutting the costs of dozens of procurement procedures in many international projects.

Project Code of Conduct (P-CoC)

The production process in construction may include hundreds of partners with thousands of workers coming from different cultures and communities with different attitudes and values. Not every organization or partner in the production process has anti-corruption programs or similar. Therefore, Lean organizations should develop a code of conduct applicable at project level. The P-CoC could be a formal declaration of project values and its working rules and should reflect the spirit of Lean project delivery. Also, it should be formulated in a simple and clear way keeping it brief and understandable to all people involved in the production process. Lean organizations should make sure that all partners in the production process explained the project code of conduct to their workers in the project and that all those workers agreed to these terms.

The project code of conduct should include some essential elements for example:

- Commitment to project values
- Quality of service
- Commitment to transparency, accountability and integrity

- Commitment to preventing and eliminating wastes including corruption waste

It is preferable to enforce the code of conduct by referring to it in the contract and ensuring commitment to its terms.

Reward and Discipline Policy

Rewarding and discipline behaviour with or without integrity can be linked to the incentive system of the Lean organization in order to enhance integrity. For example, by integrating the integrity into the LPS, we can use the PPC values of every last planner to determine the

- Last planner of the week
- Last planner of the month
- Last planner of the phase
- Last planner of the project

At the same time, the repeated plan failure should be discussed with last planners from an integrity point of view and failure reasons should be analysed profoundly without neglecting corruption causes. Termination of the contract, debarment from future work could be a form of Lean discipline policy against corrupt partners.

Declaration of Conflict of Interest

Lean Construction should use a declaration of conflict of interest as a tool in which a person in leading position declares whether he has relatives in the project or with the suppliers, or whether he has a partnership or relation with subcontractors working in the project, so that this relation leads to a kind of conflict of interest affecting the aims and value of the project.. It is preferable that the person in question signs this declaration as soon as she is involved in the project.

Green box (GB)

This tool called “Green box” and has its place in the hall of the project management office so anybody can report any corrupt incident they may have encountered, have known about, or have been asked to participate in.

After providing the workers with proper training on the principles of reducing corruption and its forms and types, they will better understand attempted corruption and report it. Most probably because of the sensitivity of this issue, few of the people who come to know any corrupt action would like to report it directly. Therefore, this tool will facilitate reporting without referring to the person who gave the information, i.e. this tool includes the whistleblowing protection policy mentioned in sections 2.4.2 and 3.4.3.

Training

Training remains the essential and effective tool to achieve Lean’s goal in reducing corruption waste. As mentioned in chapter six, it is necessary to update the current training platforms within Lean construction to consider corruption waste. In this context, LPS provides the best training platform to achieve this purpose.

Capacity Building in Corruption waste

Combating corruption and considering it as an important waste to be avoided and eliminated in Lean Construction requires Lean organizations to build capacities in this field so that they have the know-how in eliminating corruption.

Building capacity requires training staffs continuously in addition to analyzing data from different projects, detecting problems and realizing them to make sure they will not happen again in the future.

Capacity building in Lean Construction also involves the important principle of "train the trainer". Members of Lean organizations who received advanced training and knowledge on how to reduce corruption should be required to train other staff members in projects (on-site) on how to spread the culture of integrity and eliminate corruption waste in their projects. Also, they could act as developers of anti-corruption activities and programs within Lean organizations.

The following Figure 7-1 shows the tools of the Lean Anti-Corruption Toolkit as suggested above.

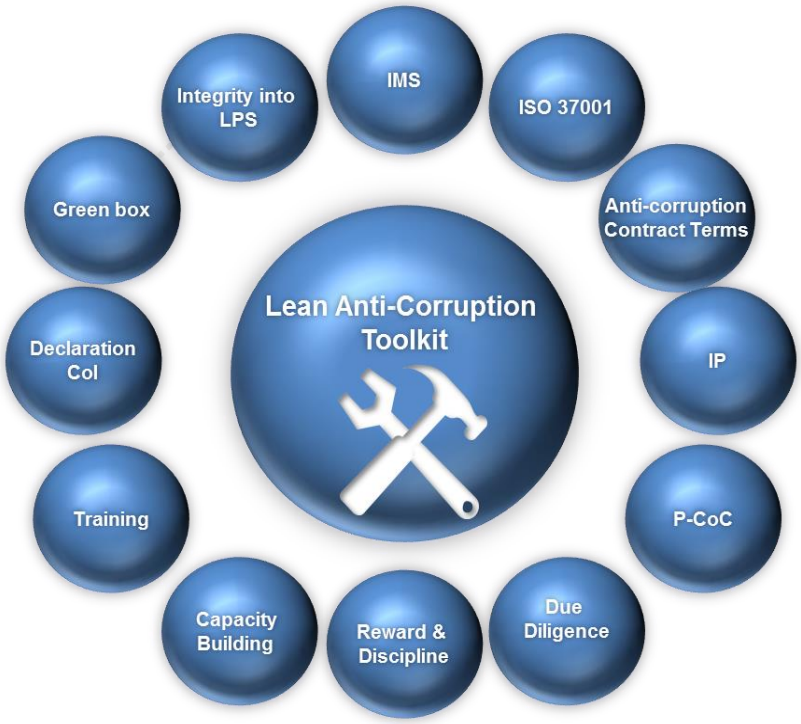


Figure 7-1: Lean Anti-Corruption Toolkit

The most important thing that links all these tools is the Lean's immune system where each tool or concept of the toolkit should include the integrity, transparency and accountability principles together. The same applies to any of the current Lean Construction tools or any other tools under development to reduce corruption waste. It is mandatory to increase integrity, transparency and accountability to consequently eliminate corruption since its causes are rooted in the lack of these three principles.

It is regarded to be of utmost importance to integrate the components of the toolkit into Lean and maximize the use of their potential by combining them for maximum effect. However, Lean organizations may not be able to simultaneously implement all the above tools due to their project conditions, surrounding environment, or their structure. Therefore an implementation strategy is

suggested, where Lean organization can implement these tools as effective countermeasures against corruption using short- and long term strategies as follows:

1. Short term strategy (on project level)
2. Long term strategy (on organizational level)

Figure 7-2 shows the distribution of the Lean Anti-Corruption Toolkit according to these two implementation strategies. Some tools could be implemented on project level as well as on organizational level, e.g. training when implemented on project level targets project teams and when implemented on organizational level it targets all staff on Lean's organizational level.

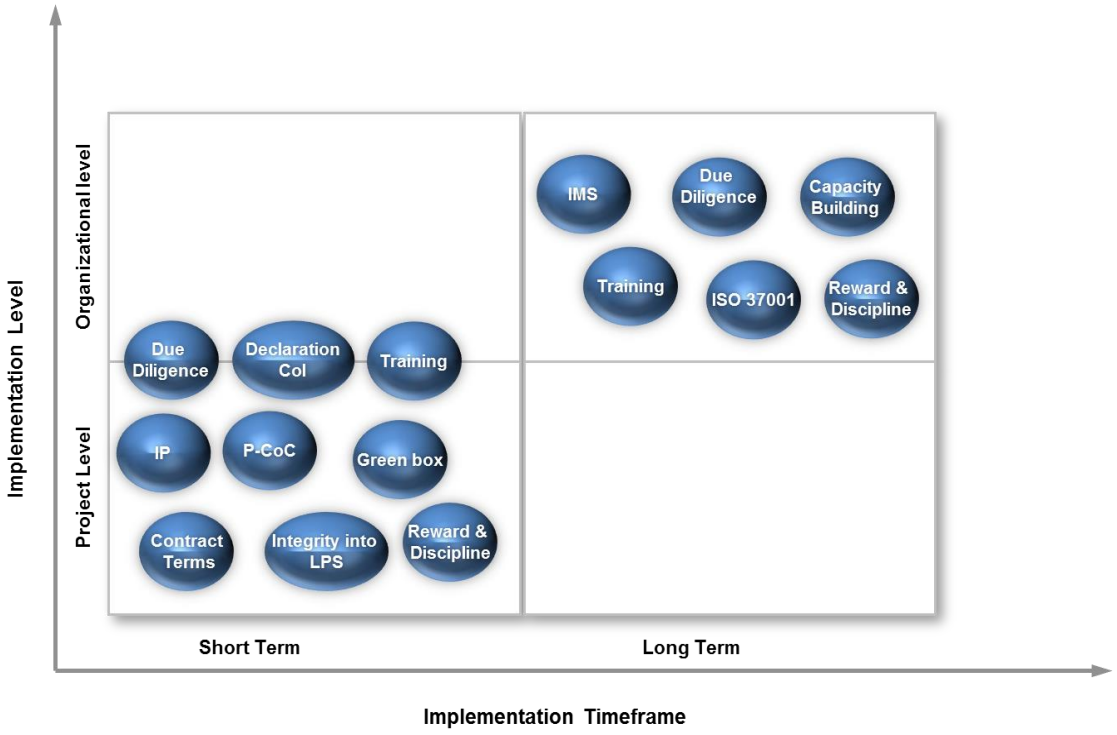


Figure 7-2: Implementation Strategy of Lean Anti-Corruption Toolkit

8 Conclusion

This chapter will conclude the dissertation by re-emphasizing the answer to the hypothesis and the research question. Then it will move to briefly explain the research contribution to knowledge and practice in the construction industry. Furthermore, it will present advice from this research for researchers in their future works. Then, the dissertation will be concluded with a short statement addressed to the readers about the core of this work.

8.1 Answering the Research Question

The research hypothesis was based on the consideration that there is a contradictory relationship between corruption in construction and Lean Construction. The researcher presupposed that this relationship is a contradictory one where the existence of one leads to the reduction of the other.

This hypothesis was divided into two parts, the first being the idea that corruption forms a barrier in front of Lean Construction. Hence, the negative effects of corruption on the inputs of the production process and consequently on its outputs was proven. This was done when the author proved the negative effects of corruption on the TFV theory and on the implementation of the LPS. This, as a result, proved that corruption is in fact a barrier to an effective and successful implementation of Lean Construction.

Part two of the hypothesis is that Lean Construction has the ability to combat corruption in construction. It was also proven that Lean Construction has the potential to reduce corruption, and that Lean Construction could be utilized to eliminate corruption in construction via its problem solving approach. Following this approach led to the important research question whether corruption could be considered as a type of waste.

The answer to this question was yes, and considering corruption as a type of waste in Lean Construction opened the way to defining the root causes of corruption and seeking effective measures to reduce this waste.

The research introduced the main causes of corruption in Lean as a lack of transparency, accountability, and integrity. Consequently, the increase in any of the three principles would help in reducing corruption.

Since transparency and accountability are essential principles of the Lean approach, and Lean always seeks to increase transparency and accountability, the research has proven that Lean in its current form has the potential to reduce corruption to an extent. The research went further by expanding the Lean philosophy, adding the integrity principle which was defined in the research as "honoring one's word". Through the case study, it was proven that the integrity principle could be implemented in Lean, i.e. into the Last Planner System (LPS) specifically. The most obvious evidence on the success of this approach was the increase in PPC with the presence of the integrity principle in the LPS.

8.2 Contribution to Knowledge and Practice

One of the most important characteristics that distinguish Lean Construction from classical construction management is the connection between knowledge and practice. In the same context, this research contributed positively on both levels. On the knowledge side, this research put the corruption phenomenon up for discussion for the first time on Lean Construction's table. The research added, by discussing the TFV theory, the missing principle of integrity in Lean. This principle mainly relates to

an important element in Lean, i.e. people who have the biggest and the most important impact on the second element, i.e. processes.

The research introduced also a new form of waste in Lean Construction by proving that corruption is a core waste creating other lead wastes.

The final contribution to knowledge is the introduce of the Lean's immune system which will initiate a review of several Lean Construction ideas and further develop existing tools as well as new tools to eliminate corruption waste.

On the practical side, this research enriched the LPS with important principle "integrity" and it complements the transparency and accountability already existent in the LPS. In this way, the research turned the LPS into a practical platform that contributes to reduce corruption in construction projects.

For those interested in fighting corruption in their construction industry projects, this research advises them to use Lean Construction as a project management methodology and to implement LPS as a planning and controlling tool in their projects.

One of the contributions of this research is to simplify complexities that surround the corruption phenomenon by simplifying and analyzing it from a Lean point of view so that corruption becomes a type of waste and then providing a toolkit within Lean to deal with it in a practical way.

Another important contribution is the implementation of integrity into the LPS which can bridge the gap of how to make integrity operational moving this important principle from the strategical (organizational) to the operational (project) level.

8.3 Directions for Further Research

Since this research is considered one of the first studying the corruption phenomenon in depth within Lean Construction, it can be generally assumed that there are still many opportunities for researches on this topic within Lean Construction.

Moreover, this research suggests that scholars interested in the field of corruption in construction look at Lean Construction in order to know their potential abilities that can be utilized in fighting corruption in construction.

By introducing the Lean's immune system, the research opens the door for different researches to study how to implement integrity, transparency and accountability into Lean Construction tools.

As introduced by this research, reviewing the role of the LPS as a platform to reduce corruption waste would give the LPS special importance when considering it a training platform against corruption which again offers many possibilities for future researches.

8.4 Final Statement

Corruption is a dangerous topic on social, economic, and political levels. Although all references confirm that it is widely spread in the industries, the also confirm the scarcity of researches in this domain and the scarcity of work against corruption in the construction industry. Therefore, any effort done in fighting corruption is a kind of continuous improvement of the industry in general (from a holistic point of view), and this research contributes to this effort.

The research is at the same time an invitation to scholars in Lean Construction to adopt the idea of fighting corruption so that it becomes part and parcel of Lean's revolution on the poor situation of the construction industry in comparison to other industries.

This research is meant to provide a solution for the corruption problem in construction from inside because the people of this sector are more acquainted with their troubles and are more capable of comprehending them than others are. In other words, this research offers a practicable solution to reduce corruption which is distinguished by being “designed for engineers by an engineer".

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