COST OVERRUNS AND TIME DELAYS IN HIGHWAY AND BRIDGE PROJECTS IN DEVELOPING COUNTRIES- *EXPERIENCES FROM CAMEROON*

By

Bertin Bella Akoa

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Construction Management

2011

ABSTRACT

COST OVERRUNS AND TIME DELAYS
IN HIGHWAY AND BRIDGE PROJECTS IN
DEVELOPING COUNTRIES -
EXPERIENCES FROM CAMEROON

By

Bertin Bella Akoa

Cost and time performance is a concern for construction project stake-holders and specifically for highway and bridge projects, due to the uncertainty that characterizes these projects. Cost overruns and time delays have been recorded for centuries, and still occur during projects today. Despite technological innovations in project management, there has been little improvement in cost and time performance of transportation projects for over eighty years (Flyvbjerg, 2008).

For developing countries, there is a need for statistically sound studies that describe cost overruns and time delays from which appropriate solutions can be derived. This research aimed to contribute to filling this gap, through case-study research at the Ministry of Public Works (MINTP) in Cameroon.

Literature on cost overruns and time delays was reviewed, historical contract data was collected, and a survey was administered to construction professionals in Cameroon.
After contract data analysis, it was found that projects funded by foreign aid had the largest project overrun rates, and small projects had higher project overruns. Project overrun rates decreased when project size or duration increased. Inadequate site visits during technical studies and the bidding phase for construction projects were found to be the main causes of cost overruns and time delays for MINTP. Causes of project overruns were found in all phases of project development, specifically in the bidding phase.

Copyright by
BERTIN BELLA AKOA
2011

DEDICATION

To the departed ones who left us during the course of my studies at Michigan State University:

- My father, Prof. Engelbert Akoa, who always taught us discipline, hard work, and the spirit of initiative; and no favoritism. His own children received the grade they deserved in his class.
- My grandmother, Marie Bernadette Mengue, thanks to her blessings, I am now becoming "Salt and Light", truly an expert in my professional activities. Her words were: "Whatever you start searching at noon, you will find it before 2 P.M."

ACKNOWLEDGEMENTS

This research was inspired by H. E. Paul Biya, President of the Republic of Cameroon with his vision of a "Cameroon of Great Ambitions". Now, I am more than ready to complete Great Realizations for Cameroon and for the world.

Countless thanks to H. E. Bernard Messengue Avom, Minister of Public Works, and "architect" of this work. Nothing would have been done without his goodwill: only the Almighty One can reward him. Thanks to H. E. Joseph Charles Bienvenu Foe Atangana, Ambassador of the Republic of Cameroon in the U.S., and to his wife Colette for their permanent and fatherly support. Thanks to Dr. Medjo Mintom for his assistance.

Thanks to President Lou Anna K. Simon of Michigan State University, who always encouraged international students to contribute to advance knowledge and transform lives all over the world; Sincere gratitude to Associate Deans Richard Brandenburg, Tony Nuñez and Brenda Alston-Mills. Thanks to Prof. Scott Witter, Director of the School of Planning, Design, and Construction, to Prof. Mark Wilson, our tireless Associate Director, a great planner who always inspired students about "being strategic"; thanks to Prof. Matt Syal, the CM Program Coordinator. Thanks to Prof. Tim Mrozowski, my major professor for all the insights and guidance during this tedious effort. My gratitude is also expressed to my devoted committee members: Prof. Hinojosa and Dr. El-Gafy, always available in spite of their huge workload.

God is so Good! He made me the son of Bella Genevieve, my exceptional mother who not only gave me life but also took care of me until now: there are no words good enough to thank her.

Immense gratitude to anyone else not mentioned here: you are just unforgettable.

I am missing you, Helene and Maeva, now writing these lines; I will soon join you home!

This master's program was completed with special support from the Government of the Republic of Cameroon.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AFD	Agence Française de Développement (French Cooperation)
EU	European Union
FAD	African Development Fund
GOV	Government
HIPC	Highly Indebted and Poor Countries Initiative
IDA	International Development Association (World Bank Group)
IDB	Islamic Development Fund
IMF	International Monetary Fund
KFW	Kreditanstalt für Wiederaufbau (German Cooperation)
MDOT	Michigan Department of Transportation
MINTP	Ministry of Public Works, Republic of Cameroon
PRC	Presidency of the Republic of Cameroon
SPM	Prime Minister's Office of the Republic of Cameroon
USDOT	United States Department of Transportation
XAF	CFA Franc

CHAPTER 1
INTRODUCTION

1.1 Overview

Transportation infrastructure, specifically road infrastructure, is the backbone of economic and social development of countries. It is useful for communication and trade exchanges locally and internationally. In addition, there is a long process from project conception to completion and availability for taxpayer use. Successful road infrastructure projects are delivered with reduced cost, on time, and in accordance with technical specifications for an optimal economic return. Unfortunately, many road infrastructure projects, such as highways and bridges, do not meet cost and time performance requirements: cost overruns and time delays are a worldwide phenomenon to the detriment of economic development and taxpayers (Flyvbjerg et al., 2004). Less infrastructure development occurs when ongoing projects run over budget and consume resources, initially scheduled for other projects.

The causes of cost overruns and time delays are often attributed to the constructor and the construction environment. However, project implementation is only one phase of project development; the entire process needs to be investigated to detect weaknesses which lead to cost overruns and time delays during project implementation. The present study addresses the project development phases illustrated in Figure 1.1.

During planning, a vision and long term goals are defined. Socioeconomic studies are held including public participation and right-of-way estimation. Funding opportunities are also discussed. As an outcome of preliminary planning, a project is transformed from an idea to a preliminary design consisting of a conceptual cost estimate, environmental studies, project parameters, geometry design and preliminary plans and layouts (Anderson et al., 2008). In general, once funding is available, projects are programmed on a case by case basis.

Programs, sometimes referred to as Capital Improvement Programs, cover a period of years during which final designs are developed, land is acquired, and engineering cost estimates and

schedules are approved. In a traditional project delivery approach, projects are procured through advertisement and bid processes. Then contracts are awarded and construction or maintenance operations follow under inspection of the project owner or its representatives. Before occupancy or delivery to users, contracts are closed-out. In some organizations, contract administration is delegated to third parties, generally private consultants, who supervise the work until completion.

Through a participatory approach, project stake-holders were surveyed, and contract data was collected and analyzed in a case-study organization from Cameroon: the Ministry of Public Works (MINTP). This study developed recommendations for reducing cost overruns and time delays for projects in developing countries, and addresses all project development phases.

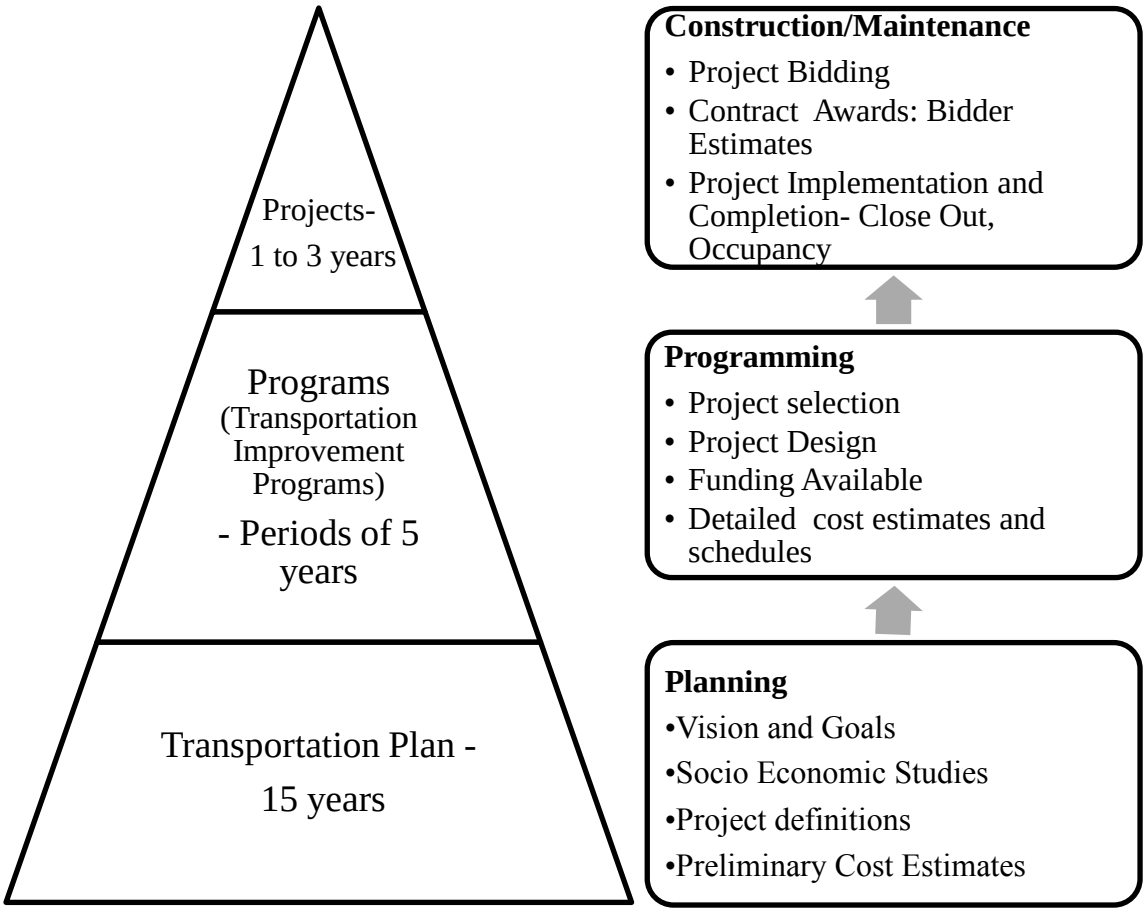

Figure 1.1 Transportation Project Development

1.2 Proposed Research

1.2.1 Need for the Proposed Research

Cost and time performance has not significantly improved over time; little learning seemed to have occurred in eight decades (Flyvbjerg, 2008). Few studies provide data on cost overruns, and only one study by Flyvbjerg and co-authors was statistically sound (Gamez and Touran , 2010), (Jergeas and Ruwanpura, 2009), (Jin-Kyung, L., 2008) . Flyvbjerg's study focused on 258 transportation projects implemented in 20 nations, mainly in Europe and North America from 1925 to 2000. For developing nations, there is a lack of data. Only research using interviews and surveys of construction professionals was found, which addressed cost overruns and time delays

in construction projects. Flyvbjerg found that cost underestimation was expected to be more pronounced in developing countries than in North America and Europe (Flyvbjerg et al, 2003).

Since the 1990s, economic difficulties led many developing countries worldwide to reform and modernize their transportation sectors. With the fall of the Berlin Wall, liberalization was adopted, and privatization was implemented in many developing nations. Cameroon, Ethiopia, Togo, Malawi, Kenya, Tanzania, Zambia, and Ghana, as well as many others in Africa and developing countries in other continents, created Road Funds to secure stable funding for road projects. They also adopted Design-Bid-Build as their project delivery method (World Bank, 1997). However, it is well known that cost overruns and time delays (or time overruns) are major factors affecting construction projects in spite of reforms. Many transportation infrastructure projects in developing countries were added with supplemental financial resources in recent years. These projects were characterized by slowness and time delay during implementation (World Bank, 2009). In Botswana, Chinese contractors were instructed to deliver Government projects of a quality that were durable, on time and on budget (Kebadiretse, 2010). The issue of cost and time performance had to be solved to ensure delivery of efficient projects to taxpayers.

1.2.2 Overview of Research Questions

This research investigated the causes of cost overruns and time delays during all project development phases; additionally the influence of project characteristics on cost overruns and time delays were explored.

1.2.3 Research Goal and Objectives

The goals of the research were to examine cost overruns and time delays in highway and bridge projects in developing countries, and to provide relevant recommendations for substantially alleviating these problems. The objectives of the study were:

- To develop a database of historical contract data and conduct statistical data analyses to obtain cost and time overrun rates for the case-study organization and to find relevant relationships for cost and time overruns
- To conduct a survey of construction professionals to obtain their perceptions on the main causes of cost overruns and time delays for their organizations
- To develop recommendations which would help improve organizations and their contracting processes with regard to cost overruns and time delays for road infrastructure projects

1.2.4 Research Scope and Limitations

This study was limited to highway and bridge projects in Cameroon, and considered the case-study country as a single geographic location. In addition, only controllable cost overrun factors affecting contract costs were analyzed: optimism bias in cost estimates was not studied. The initial construction contract amount was used as the basis for overrun measurements: for simplicity, engineering estimates were not considered. The study did not consider the award-estimate difference factor: only the award amount was considered.

In addition, time delays were limited to excused delays for which contractors received time extensions through change orders; unexcused delays were not documented in the data collected. Time overrun or time delay rate was computed as the total time extension divided by the initial contract duration, or project duration.

1.2.5 Case-Study of Highway and Bridge projects in Cameroon

1.2.5.1 Presentation of the Country

Called “Africa in miniature” because of its diversity of peoples, cultures, and natural environment, Cameroon is an interesting case to study for general issues. In addition to French and English, official languages of the country, 240 African languages are spoken there. The figure in Appendix 1 presents socioeconomic facts for Cameroon.

1.2.5.2 Overview of the Road Infrastructure Sector of Cameroon

In Cameroon, only 5,000 km of highways are paved; 12,000 km are unpaved and need more frequent maintenance compared to paved highways. The country has approximately 1200 bridges and structures (MINTP, 2008). There are no freeways, no cable stayed bridges and no suspended bridges. For management of its road infrastructure, MINTP has geographically divided the country into three networks as presented below.

Road Network Name	Regions Covered
South Network	Centre, South, East
West Network	Littoral, West, South West, North West
Northern Network	Adamaoua, North, Far Northern

Table 1.1 Road Networks of Cameroon

Fifteen years ago, the Ministry of Public Works, in charge of highways and bridges was reformed and adopted privatization for project delivery and work supervision. Unit-price contracts were used in MINTP. Design-Bid-Build was introduced as a delivery method for better project efficiency. However, a study carried out by a private consultancy firm unveiled that there

have been no improvements since 1997 in project delivery or management reform (CRTV, 2010a, 2010b, 2010c). The findings of that study indicated:

- The organization was incoherent in spite of the adoption of multi-annual contracts and a Road Fund
- There was a lack of equipment
- Contracts were awarded solely on the basis of bidding declarations by contractors and the Public Contract Code did not allow the awarding of contracts solely to competent contractors
- Highways ratings had degraded:

Highway nature	Year	Ratings
Paved	1995	1/2 in good condition
	2007	1/3 in good condition
Unpaved	1995	10% in good condition
	2007	6% in good condition

Table 1.2 Evolution of Highway Ratings (CRTV, 2010a)

- The cost of unpaved roads had tripled and the cost of paved roads has doubled in the same period.

In addition, contractors frequently requested change orders for time extensions and cost overruns. Furthermore, 32 contracts out of 244 signed in 2006 were cancelled by the Ministry during their implementation because of contractor abandonment or lateness (MINTP, 2008). Similarly, other studies found that since 1996, road maintenance costs were increasing year after year; meanwhile the road network still seemed to deteriorate (Okole , 2009c). The Ministry had also emphasized the necessity of building lasting infrastructure that costs less in relation to its quality control (Bainkong, 2009). Time delays during project implementation were common in

Cameroon and many highway infrastructure projects were often delayed for years after their beginning (Okole, 2009a, 2009b).

1.2.6 Methodology and Deliverables

Informal discussions were held with the management of MINTP, to help shape this research. After initial planning, the following steps were established for carrying out the research.

1. Literature review on cost overrun and time delay in construction projects
2. Research data collection steps
    2.1 Contract Data
        2.1.1 Planning for collection of contract data in Cameroon
        2.1.2 Implementation of contract data collection in Cameroon
        2.1.3 Development of a historical contract database
    2.2 Survey of Construction Professionals
        2.2.1 Development of a survey targeted to construction professionals
        2.2.2 Identification of subject groups
        2.2.3 Submission of an IRB application
        2.2.4 Implementation of the survey in Cameroon
        2.2.5 Development of a survey response database
3. Statistical analysis of data
4. Development and presentation of the results, recommendations and proof of concepts.

This study presents statistical analyses of cost overruns and time delays in Cameroon, as a case-study for developing countries. It also suggests recommendations to solve these problems.

1.3 Significance of the Study

This research helps reduce the lack of statistically sound studies in the literature on cost overruns and time delays by statistically describing their magnitude, causes and proposed remedies for the case study of Cameroon, for all project development phases including: Planning and Programming, Design, Bidding, Implementation, and post-implementation.

1.4 Summary and Organization of the Research

This chapter introduced the research and the organization of the thesis.
The thesis is organized in six chapters, in addition to the introduction. The literature review is addressed in Chapter Two, and focused on the existing research on cost overruns and time delays.

Chapter Three presents the methodology for the research and identifies the steps conducted during the study. Chapter Four presents the contract data and its analysis. Chapter Five presents the survey data. Chapter Six presents the results and guidelines for helping to solve cost overruns and time delays in developing countries, mainly for the case-study organization, as well as a suggested proof of concept approach. Chapter Seven concludes the study and makes suggestions for further areas of research.

CHAPTER 2
EXISTING LITERATURE ON COST OVERRUNS AND TIME DELAYS

2.1 Overview

There is an abundance of literature on cost overruns and time delays in infrastructure projects. Flyvbjerg, in several papers with co-authors, provided the most relevant research, and some of the only statistically sound research in the area to date (Gamez and Touran, 2010), (Jergeas and Ruwanpura, 2009), (Jin-Kyung, L. 2008). Other studies (Hinze and Selstead, 1991), (Bordat et al., 2004), and (Merewitz, 1973) also contributed to knowledge of cost overruns. In addition, research has been conducted worldwide which investigates the causes of cost overruns and time delays through surveys. Researchers have attempted to provide remedies for this seminal problem.

The state of the existing literature on cost overruns and time delays was reviewed to date, and is illustrated in Figure 2.1.

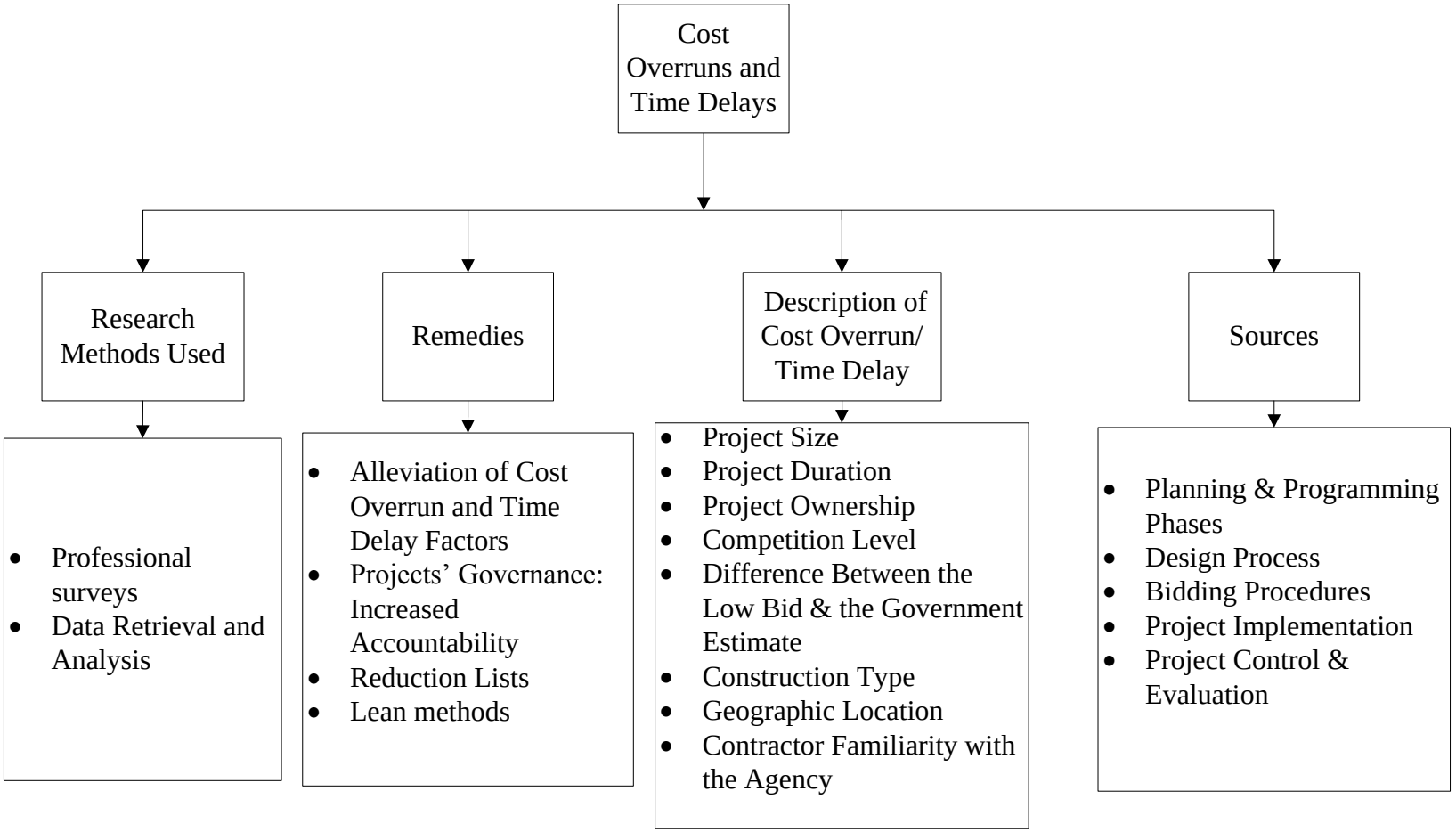

Figure 2.1 Hierarchical Organization of the Literature Review

2.2 Selected References

The key words *Cost Overruns* and *Time Delays* were used in searching electronic resources and journals and books which addressed cost overruns and time delays were reviewed. The Web of Science and Proquest were used, as well as daily Google Alerts. Relevant research was reviewed and classified by the methodology and related geographical area. The literature is presented in Table 2.1.

No	Author(s)/Year	Description of the Study	Research Method	Country	Observations
1	(Abd El-Razek et al., 2008); (Le-Hoai et al., 2008); (Lo et al., 2006); (Sambasivan and Soon, 2007), (Abdul-Rahman et al., 2006); (Ajibade and Odeyinka, 2006), (Mansfield et al., 1994), (Okpala and Aniekwu, 1988); (Frimpong et al., 2003)	The papers reviewed project delays/cost overruns causes from the literature, adopted and ranked those which are common in the case- study country. Remedies were proposed.	Interviews and Survey Analysis.	Egypt, Vietnam, Hong Kong, Malaysia, Nigeria, Ghana.	The studies were limited to participants' opinions.
2	(Bramble and Callahan, 2000)	• Delay claims in the construction industry. Identified factors of time delays were classified between the owner, designer, contractor and delays out of the control of these parties. • Consequences and remedies to delays were also discussed.	Case-law based analysis of construction projects that are delayed.	U.S.A.	Covers time overruns for all project phases.
3	(Creedy et al., 2010)	The paper presented results from 231 highway projects which were investigated to determine their cost overrun factors, from historic highway data.	Interviews, Data collection and analysis, expert elicitation.	Australia (State of Queensland)	Mitigated correlation found between project characteristics and cost overruns.
4	(Cui and Olsson, 2008)	The paper presented "reduction lists" prepared ahead of the beginning of a project. They were defined as the list of cost items which could be reduced if other parts of a project were actually more costly than planned.	Data collection and analysis	Northway	Reduction lists were used to avoid cost overruns before project implementation.

Table 2.1 Selected References

Table 2.1 Selected References (Cont'd)

No	Author(s)/Year	Description of the Study	Research Method	Country	Observations
5	(Flyvbjerg, 2008), (Flyvbjerg et al, 2004), (Flyvbjerg and COWI, 2004), (Flyvbjerg et al, 2004), (Flyvbjerg et al, 2003)	• The studies statistically analyzed 258 rail, bridge, tunnel and road projects to determine the factors of cost escalation in transport infrastructure projects. • Findings were that not only the duration of project implementation, the size of the project were factors of cost escalation, but also optimism bias. This later is mainly due to the political or self-interest economic factors through deceptive, biased costs underestimated and benefits overestimated : a strategic misrepresentation to obtain decision-makers' approval or to make profits. However, private ownership has no effect on cost escalation. Solutions were proposed.	Lengthy historical data collection and statistical analysis	Europe, North America, Japan and 10 developing nations.	Covers the planning phase of projects, with an emphasis on the influence of politics on planners.
6	(Gamez and Touran, 2010)	• The paper analyzed the cost, schedule and scope performance metrics of 89 transportation projects founded by the World Bank. • Findings were that costs were overestimated, and schedules were optimistic. However, no improvement in these performances was observed during the period of study, 1991-2007.	Historical data collection and statistical analysis	International	This study had optimistic results about project cost and schedule performance, compared to others.

Table 2.1 Selected References (Cont'd)

No	Author(s)/Year	Description of the Study	Research Method	Country	Observations
7	(Hinze and Selstead, 1991)	• Review of 433 unit price contracts of WSDOT*. • Findings were that the number of bids received, project size and type, geographic location, frequency of awarding WSDOT contracts to a contractor were factors which impacted construction cost overruns.	Interviews of WSDOT engineers, data collection and statistical analysis	U.S.A.	Local study focusing on contract characteristics.
8	(Jahren and Ashe, 1990)	The authors suggested that change order and cost overrun factors were similar. Therefore, these factors which were known for change orders were relevant to investigate cost overruns.	Focused on the literature	U.S.A.	The paper introduced factors which can be used to forecast cost overruns
9	(Jergeas and Ruwanpura, 2009)	The authors found cost and schedule overruns' causes in inaccurate cost estimates and schedules, inadequate scope definition and project strategies, poor project management.	Professionals' survey	Canada	The statistical analysis was not available.
10	(Jin-Kyung, L., 2008)	The paper presented cost overrun rates for 161 projects of roads, rails, airports and ports in South Korea. The causes and remedies of cost overruns in South Korea were suggested.	Data retrieval	South Korea	No statistical analysis or survey was performed.
11	(Merewitz, L.,1973)	•The study evoked the "bias" in cost estimates, and classified cost overrun reasons in controllable and uncontrollable factors. •Comparative analysis of cost estimates for 200 large projects of water resources, highways, buildings, rapid transit and ad hoc public works.	Data collection and statistical analysis	International	Aimed to compare the 45% cost overruns of the San Francisco Rapid Transit project to other project cost overruns

Table 2.1 Selected References (Cont'd)

12	(Shane et al., 2009)	•This study found 18 primary factors classified as internal or external to the agency/owner, for transportation project cost overruns.	Focused on a literature review and interviews of state highway agencies	U.S.A.	General causes of cost overruns are listed in the study
13	(Siemiatycki, M., 2009)	• The author compared the results of transportation project cost overruns between two groups: academics and independent government auditors. The first hardly had access to data compared to the second, and the explanations of cost overruns differed for both groups • The paper also suggested remedies to cost overruns	Focused on the literature and retrieved auditors' studies of cost overruns	International: Europe, South Korea, USA	The paper summarized the studies on transportation cost overruns

(*)WSDOT: Washington State Department of Transportation.

2.3 Sources of Cost Overruns and Time Delays in Projects

2.3.1 Overview

There are various causes or factors of cost overruns and time delays in projects identified in the literature. The definition of cost overrun varies depending on the project phase considered by researchers; however, from a construction management perspective, it is perceived to be the difference between the final project cost and the original contract amount (Hinze and Selstead, 1991). Others consider the difference between the actual project cost and the original engineer's (or owner's) estimate. For government agencies, cost overrun also means the escalation of project cost over time. Cost overruns and time delays affect all project development phases, from project initial concept to construction and maintenance. For MINTP, there are contracts with consultants and design firms for preliminary studies and design, contracts with builders to perform the work, and contracts with consultants for work supervision. Some lending agencies require that the same consultant does the design, assists the owner in the bidding process and supervises the work later. This means that any delay in the bidding process would be costly to MINTP even before the work starts or the contractor is selected. Often extra cost is due to the consultant being paid for a longer period. "Time delay" for such an owner is more a matter of a "project delay" rather than a "contract delay." The delivery of one physical project consists of different types of contracts.

In general, Bramble and Callahan (2000) defined delay as the time period during which some part of the construction project has been extended beyond the initial time, or the incident affecting the performance of an activity of the project. Delay factors from a litigation perspective in the U.S. construction industry are summarized in Table 2.2.

Owner Access to project site Right-of-Way Utility relocation delays Unidentified utilities Demolition of existing structures Differing site conditions Relocation of tenants Approvals from governing authorities Payment delays Project financing Design defects Defective specifications Tardy shop drawing processing Inspection delays Delayed notice to proceed/contract award Inappropriate stop work orders Owner-furnished items Over inspection Changes Constructive changes Owner interference Failure to coordinate multiple prime contractors	**Designer** Design defects, errors, and omissions Slow correction of defects Tardy shop drawings review Delayed testing and inspection Poor contract administration **Contractor** Failure to evaluate site Failure to evaluate design Underbidding Management failures Inadequacy of labor force Scheduling and planning Coordination and subcontractors Subcontractor delays Material procurement Equipment failures Financial resources Construction defects
Delays that may be beyond the control of the parties	
Unusual weather Labor disputes Unavoidable calamities Acts of God	Unusual delays in transportation Floods Governmental acts Vandalism Fire

Table 2.2 Factors of Delay in the U.S. Construction (Source: Bramble & Callahan, 2000)

Because costs generally are related to time in projects, time delays directly affect projects, and lead to cost overruns. Responsible parties of a delay will frequently have to compensate the affected parties. As illustration, “Time is of the Essence” is a common clause in U.S. contracts which indicate that time provisions are contractual requirements, instead of mere guidelines. During this research, the factors were classified according to project cycle: phases of planning

and programming, design process, bidding procedures, project implementation, project control, and *ex post* evaluation which helped to understand how time delays or mistakes during one phase, could affect others.

2.3.2 Planning and Programming Phases

Insufficient planning and programming of projects is one cause of cost overruns and delays. Poor planning methods or unplanned projects have a high risk of cost overruns or project failure. Anderson et al. (2008) identified right-of-way costs as a crucial factor of cost escalation in highway projects. Specifically, Flyvbjerg and co-authors pointed out the use of deception and lying, to be sources of cost overruns during transportation project planning. Under the influence of politicians, or to increase project stake-holders revenues and profits, project planners deliberately underestimate project costs and overestimate the potential benefits. Such a "strategic misrepresentation" will quickly convince decision makers to authorize projects, implying increased economic self-interest of consultants and contractors to the detriment of taxpayers or funding agencies. However, de-biasing cost estimates can lead to the problem of higher costs which would prevent projects from being undertaken and cause slow economic development (Merewitz, 1973). According to this point of view, "technical" optimism or low estimating would be better than correct cost estimating.

2.3.3 Design Process

At the project design stage, Jergeas (2009) pointed out poor project implementation strategies that impacted the actual costs of projects in Canadian mega oil sand projects. In Nigeria, Okpala and Aniekwu (1998) indicated that mistakes and discrepancies in documents caused cost overruns. Similarly from Jergeas' (2009) research, another factor is under-estimating. In South Korea, Jin-Kyung (2008) wrote that unreasonable underestimation in the adjustments of project costs caused overrun issues during implementation. Furthermore, Ajibade and Odeyinka(2006),

Anderson et al. (2007), Creedy et al.(2010) presented the design process as a potential source of cost overruns and time delays in projects. For illustration, Sweet and Schneier (2009) presented the case *Stanley Consultants, Inc. v. H. Kalicak Construction Co*., where the design professional of a sixty-one-unit housing project in Zaire (Now Democratic Republic of Congo, Africa) did not use Zaire's data during his studies. As a result, the only bid submitted was double that of the design cost estimate.

2.3.4 Bidding Procedures

Site conditions need to be known by project counterparts at all phases, mainly during the bidding phase for contractors (Bramble and Callahan, 2000). Visits should be mandatory (Pratt, 2004). The consequences of misunderstanding due to lack of site visits are cost escalation or abandonment. A key factor outlined by Okpala and Aniekwu (1998) seems to be the period of bidding, which often takes a long time for highway projects in developing countries. Site conditions can change noticeably between the time of bidding and contract award.

Furthermore, the level of competition based on the number of bidders and the difference between low bids and engineering estimates impact construction cost overruns. Projects in which low bids are less than the engineering estimates are prone to increased cost overruns (Hinze and Selstead 1991). In South Korea, Jin-Kyung (2008) criticized the lowest bid price system where irrational estimating occurred by the winning contractor, who might not efficiently complete the contract.

2.3.5 Project Implementation

Merewitz (1973) presented inflation, which is not controllable by contract parties, as a factor in cost overruns. Unforeseen scope changes can also affect project costs. The following excerpt from Merewitz presents "controllable cost overruns":

> *Controllable overruns are due to poor administration of projects, starting with incomplete surveys of engineering, financial and legal problem which might have been anticipated ahead of time. Poor administration may also include overly complex organizational structures for planning and constructing projects, poor contracting practices, unnecessary scope changes, and simple inexperience of personnel for the type of project or the area in which the project is undertaken.*

Other factors introduced by Anderson et al (2007) are delivery and procurement methods, scope creep, faulty execution, ambiguous contract provisions and conflicting contract documents. Moreover, according to Jergeas (2009), poor communication is another reason for cost overruns. Okpala and Aniekwu (1998) provided additional points from Nigeria's experience including preparation and approval of shop drawings, shortage of materials, payment methods, lack of equipment and materials that were imported, construction errors, on-site test approval, unethical attitudes and kickbacks. Weather conditions also needed to be considered given the growing influence of climate change, although they did not consider the influence of weather in Nigerian projects. The studies of Naoum(1994), Ajibade and Odeyinka(2006), Tumi et al. (2009) and Sambasivan (2006) also focused on comparable problems to explain cost overruns and time delays.

2.3.6 Project Control and Evaluation

Few authors focused on work evaluation in their research. Jin-Kyung (2008) indicated that periodic reports on contract progress from contractors were not sufficiently studied by owners to detect causes of cost overruns and to solve problems: the consequence was cost escalation. Similarly, Okpala and Aniekwu (1998), Tumi et al. (2009) indicated that the period of inspection and testing after project completion could also influence costs.

Political risk can be found in all project phases above and can be critical when it is ignored. Political tensions and insecurity can dramatically affect project cost and time (Akinci and Fischer, 1998).

2.4 Descriptive Analysis of Cost Overruns and Time Delays

2.4.1 Overview

Change orders and project overruns are closely related. Preventing change orders in projects and reducing the time for change-order processing were objectives defined to limit project cost overruns in a study for Michigan State University (Mrozowski et al., 2004). Factors known to affect change order rates were used to investigate cost overruns: project size, difference between the low bid and government estimate, the type of construction and the level of competition (Jahren and Ashe, 1990).

2.4.2 Project Size and Project Duration

Flyvbjerg and co-authors in diverse papers, and Hinze and Selstead (1991) found through statistical analyses that large projects were prone to higher cost overruns. Also, Flyvbjerg studied the influence of project duration and project sluggishness: a large implementation phase can lead to larger cost overruns. Specifically, the scope of road projects was found to increase overtime.

2.4.3 Project Ownership

The private sector, characterized by competition and seeking performance, is generally said to be more disciplined and efficient than the public sector. In an attempt to investigate whether the private sector had better cost performance than the public sector, Flyvbjerg and co-authors found no statistical evidence. Instead, cost overrun rates of some privately-owned projects were larger than average.

2.4.4 Competition Level and Difference between the Low Bid and Government Estimate

A greater number of bidders often leads to low, underestimated bids. Hinze and Selstead (1991) found the difference between the high bid and low bid to be a main factor of cost overruns. A bid winner with an estimate lower than the engineer's estimate would attempt to recover the difference through all sorts of claims and change requests.

2.4.5 Construction Type

In the literature, cost overrun rates varied with the type of construction such as buildings, roads, fixed links which are bridges or tunnels, and rails. Studies provided different rates and ranking of cost overruns according to the type of construction. However, Flyvbjerg and co-authors attributed the lowest cost overrun rates to road projects, in the context of Europe and North America.

2.4.6 Geographic Location

Hinze and Selstead (1991) working in the state of Washington did not find any evidence between cost overruns and the geographic district or project location. However, Flyvbjerg and co-authors at a worldwide level found that geography accounts for cost escalation: the highest rates were supposedly found in developing countries. It also appears that more data is needed and studies conducted to explain the geographical variations of cost overruns.

Table 2.3 summarizes cost overruns by project type and geographic location.

Region	Project type	Period covered by the study	Average cost overrun rate (%)			Author(s)
Europe	Rail	1927-1998	34.2			(Flyvbjerg et al, 2003)
	Fixed links		43.4			
	Roads		22.4			
North America	Rail		40.8			
	Fixed links		25.7			
	Roads		8.4			
USA (State of Washington)	**Highways:**	1985-1989				(Hinze and Selstead, 1991)
	New construction		9.23			
	Resurfacing		3.90			
	Bridge only		8.20			
	Safety Improvement		2.98			
South Korea		1985-2005	Min.	Avrg.(**)	Max.	(Jin-Kyung, L. , 2008)
	Roads		<0 *	10.7	85	
	Rails		<0	47.64	65.34	
	Airports		16.2	60.4	64.5	
	Ports		8.3	36.3	182.5	
	(*) <0 means cost underruns, (**) Derived from Jin-Kyung's study .					

Table 2.3 Cost Overruns by Project Type and Geographic Location

However, Gamez and Touran (2010) found contradictory results to the ones of Flyvbjerg and co-authors for developing countries. In a study of 89 transportation projects funded by the World Bank in developing countries, Gamez and Touran (2010) found that costs were overestimated and schedules were optimistic. In addition, project duration did not influence project performance. The reason given was that project environments in developing countries are different from those in developed countries, which was the focus of Flyvbjerg's work.

2.4.7 Contractor Familiarity with the Agency

While investigating if specific contractors working with WSDOT were prone to file claims and request additional compensation, Hinze and Selstead (1991) found no statistical evidence that contractor familiarity and working relationship with an agency increased cost overruns.

2.5 Remedies to Cost Overruns and Time Delays

2.5.1 Alleviation of Cost Overrun and Time Delay Factors

In the literature, the main objectives of studies were to present cost overrun and time delay factors at all project phases to stake-holders. This would help to prevent the occurrence of these factors in project planning and implementation. Among other suggestions, the lowest bid system needed to be improved by considering potential for project overruns during the work. Anderson et al. (2007) studied right-of-way (ROW) estimation to prevent cost escalation in highway projects, and developed a process flowchart for ROW estimate improvements. Also, Sweet and Schneier (2009) studied the introduction of cost conditions in consultant contracts, so that design professionals would produce more accurate cost predictions.

2.5.2 Project Governance: Increased Accountability

A relevant remedy to project overruns was the application of good governance in transportation projects. Flyvbjerg and co-authors proposed increased focus on transparency and public control for public sector accountability. Similarly, competition and market control were necessary for accountability in the private sector. Transparency is achieved when required documents and information are available to the public. Flyvbjerg (2008) summarized accountability as follows:

> *The project organization may be a company or not, public or private, or a mixture. What is important is that this organization enforces accountability vis-à-vis contractors, operators, etc., and that in turn, the directors of the organization are held accountable for any cost overrun, benefits shortfall, faulty designs, unmitigated risks, etc. that may occur during project planning, implementation and operations. The governance framework should discourage organizational entrenchment, i.e., the existence of the organization for longer than it is needed. If the institutions with responsibility for developing and building major infrastructure projects effectively implemented, embedded and enforced such measures of accountability, then the misrepresentation in cost, benefits and risk estimates, which is widespread today, would be*

mitigated. If this is not done, misrepresentation is likely to continue, and the allocation of funds for infrastructure projects is likely to continue to be wasteful and undemocratic.

2.5.3 Reduction Lists

Ahead of project implementation, Cui and Olsson's (2008) paper presented "reduction lists", i. e. the list of cost items which could be reduced if other items of a project were actually more costly than estimated. This would help to prevent cost overruns; however projects would have a "reduced" quality.

2.5.4 Lean Methods

Invented by Toyota, the lean production system is a technique of project improvement based on six principles: productivity, quality, cost, delivery, safety, and employee morale. The introduction of lean methods in other industrial sectors, such as construction, could improve project performance (Patty and Denton, 2010).

2.6 Professional Survey, Data Retrieval and Analysis of Project Cost Overruns and Time Delays

2.6.1 Surveys of Professionals

Most of the studies on cost overrun and time delay factors were based on surveys of industry professionals. The following table summarizes the results of these studies.

Author(s)/Year	Country	Number of Respondents	Number of factors studied	Major causes(or factors) of cost overruns/ time delays
(Creedy et al., 2010)	Australia	8	37	1. Design and scope change 2. Insufficient investigations and latent conditions 3. Deficient documentation (specification and design)
(Tumi et al. , 2009)	Libya	N/A	43	1.Improper planning 2.Lack of effective communication 3.Design errors
(Abd El-Razek et al., 2008)	Egypt	74	32	1. Financing by contractor during construction 2. Delays in contractor's payment by owner 3. Design changes by owner or his agent during construction
(Le-Hoai et al., 2008)	Vietnam	87	21	1. Poor site management and supervision 2. Poor project management assistance 3. Financial difficulties of owner
(Sambasivan and Soon, 2007)	Malaysia	150	28	1. Improper planning 2. Site management 3. Inadequate contractor experience
(Abdul-Rahman et al., 2006)	Malaysia	204	20	1. Additional work 2. Labor shortage and lack of skills 3. Poor planning and scheduling
(Ajibade and Odeyinka, 2006)	Nigeria	102	44	1. Contractors' financial difficulties 2. Clients' cash flow problems 3. Architects' incomplete drawings
(Lo et al., 2006)	Hong Kong	151	30	1.Inadequate resources due to contractor lack of capital 2.Unforeseen ground conditions 3.Exceptionally low bids
(Frimpong et al., 2003)	Ghana	72	26	1.Monthly payment difficulties from agencies for completed work 2.Poor contractor management 3.Material procurement

Table 2.4 Surveys of Construction Professionals in the Literature

Table 2.4 Surveys of Construction Professionals in the Literature (Cont'd)

(Mansfield et al., 1994)	Nigeria	37	23	1. Poor contract management 2. Financing and payment of completed work 3. Changes in site conditions
(Okpala and Aniekwu, 1988)	Nigeria	192	27	1. Shortage of materials 2. Finance and payment for completed works 3. Poor contract management
(Merewitz, L., 1973)	U.S.A.	N/A	N/A	1. Price level increases 2. Scope changes 3. Unforeseen conditions and structural modifications

Likert scales were typically used during these studies and statistical analyses performed to check sample adequacy and to find associations and correlations among data. Statistical approaches used for these studies are listed below.

- The Kendall's coefficient of concordance was utilized to test whether the factors could be prioritized (Frimpong et al. 2003). Similarly, Barlett's test of sphericity tested the suitability of data and the Kaiser-Meyer-Olkin test was used for sampling adequacy test (Le-Hoai et al., 2008), (Creedy and co-authors, 2010).
- The Spearman's coefficient of rank correlation was used to evaluate the agreement or disagreement between two groups of survey respondents (Le-Hoai et al., 2008).

2.6.2 Data Retrieval and Analysis

Flyvbjerg et al. (2004), Bordat et al. (2004), Hinze and Sealstead (1991), and Merewitz (1973) used the statistical techniques listed below for data analysis during their studies on cost overruns.

- Histograms, data mean, median, mode, standard deviation and confidence intervals
- Chi-square test to check data goodness of fit

- R^2, the coefficient of multiple determination, was necessary to choose the right model for data analysis
- Pearson's correlation test and tailed statistical level of significance
- Multiple regression analysis, scatter plots, box-and-whisker plots
- T-tests utilized to check the statistical significance of hypothesis, and p-value for the level of significance

2.7 Summary

The literature on cost overruns and time delays in construction projects, specifically in highway and bridge projects, was summarized in this chapter. In addition, research methods and statistical models used in the literature to study cost and time performance of projects were reviewed. These studies stated the current knowledge about cost and time overruns, and the studies also unveiled a gap concerning statistically sound research in this area about developing countries. This literature review was the starting point for the research about cost and time overruns for developing countries, by the illustration of approaches and methodologies used by researchers. The intent of this research is to fulfill the gap observed in the literature for developing countries, by providing a related statistically sound study on cost overruns and time delays. As innovation, causes of cost and time overruns through the project cycle and overrun rates and sizes were sought along with their influence on the project type, project ownership or project source of funding, project size, and project duration.

Factors which may contribute to cost overruns and time delays were identified and presented in Table 2.2. These factors were used as the basis for a survey of industry professionals described in Chapter Three.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Overview

This chapter lays out the steps which were used for this research. The goals of the project were presented in Chapter One, and the literature review presented in Chapter Two was conducted to assess the current knowledge and research regarding cost overruns and time delays in construction projects. After approval of the project, highway and bridge contract data were collected for statistical analysis. In addition, a survey of construction professionals was conducted addressing the causes of cost overruns and time delays. From the results, recommendations were developed to help reduce cost and time overruns for infrastructure projects in developing countries.

3.2 Methodology

The methodology proposed for this research is shown in Figure 3.1. To study cost overruns and time delays in highway and bridge projects, the Ministry of Public Works of Cameroon was chosen as a case study organization. Prior to the development of the research proposal, preliminary discussions were held in MINTP for the design of the survey and guidelines for contract data collection. Survey responses and contract data were collected and then statistically examined. The study attempted to help fill the gap found in the literature between developing countries, and cost overruns and time delays.

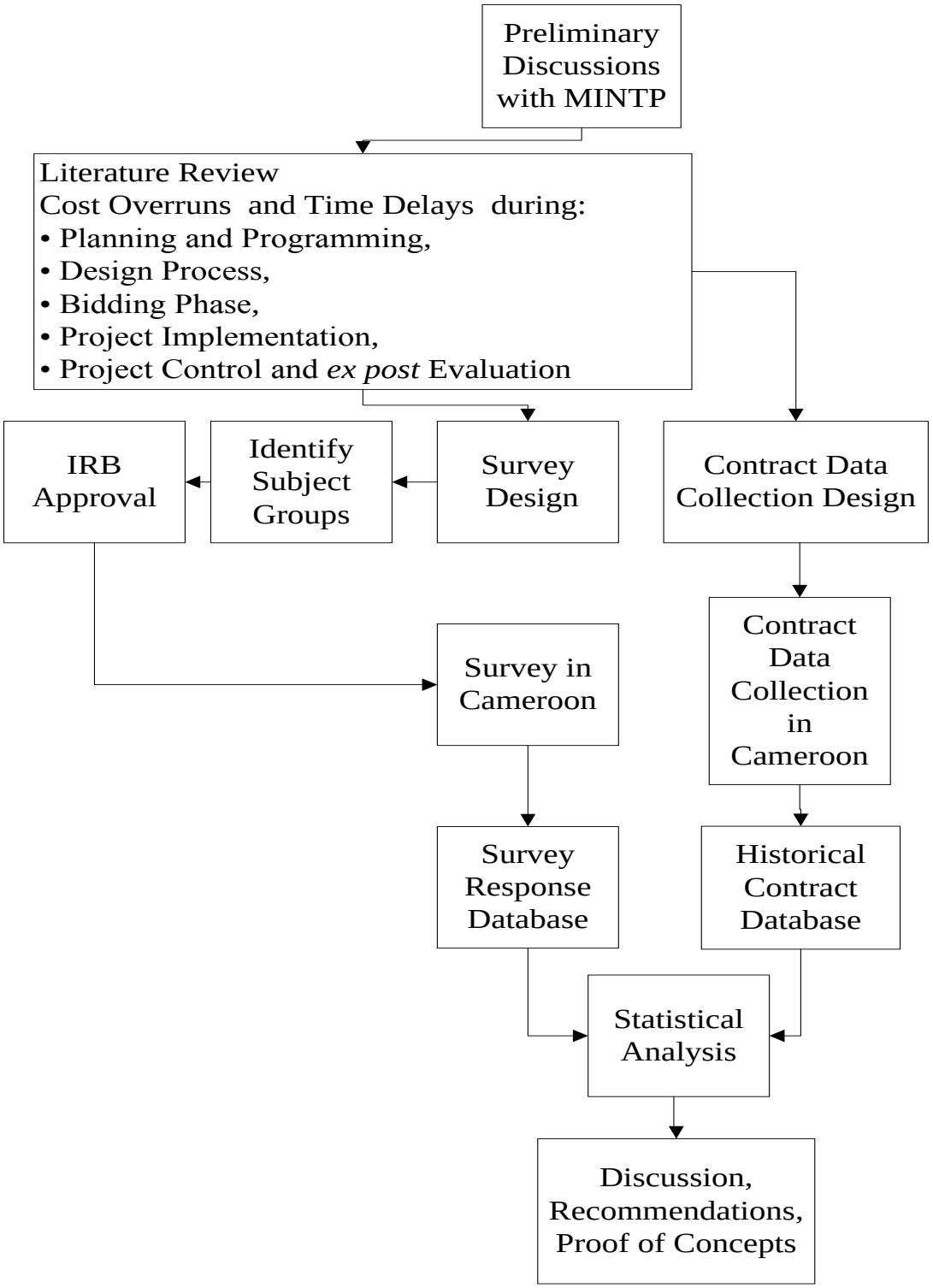

Figure 3.1 Hierarchical Organization of the Research Methodology

3.3 Literature Review

A variety of sources were surveyed during the literature review. Electronic resources were extensively used such as Web of Science and daily Google Alerts using the key words *Cost Overruns* and *Time Delays*. A number of journal articles were found and the most relevant ones were selected. In addition, secondary sources consisted of books, conference proceedings, newspapers, doctoral dissertations and master's theses. The sources were classified according to project development phases including: planning and programming, design process, bidding phase, project implementation, project control and *ex post* evaluation. The literature was reviewed to obtain the state of the knowledge about cost overruns and time delays in construction, and to identify gaps for developing countries.

3.4 Case Study Organization - Cost and Time Issues

The initial step for this study was to apply for its authorization from MINTP. An application file consisting of a letter, a literature review, and the research timeline was sent to MINTP. The research was approved and a contract data collection as well as a construction project stake–holder survey were authorized based on the documents presented. Informal discussions were held with MINTP to design the survey according to the local practices of project development.

It was said that in Cameroon, weaknesses during land acquisition frequently caused people to protest and interrupt site work (Okole, 2009). Such situations influenced negatively cost and time. Weak and insufficient technical studies were also presented as causes of cost overruns in Cameroon's highways projects (Cameroon Tribune archives, 2009). Furthermore, the displacement of existing networks (Cameroon Tribune archives, 2009) and supervisor and contractor claims and disputes delayed projects, as well as the period of bidding. All these were time-consuming for highway projects in Cameroon (Okole, 2009a). Similarly, bidding

procedures were complicated and negatively influenced project implementation. These studies helped to motivate this research.

In addition, available reports from MINTP and past or ongoing studies related to the research were utilized.

3.5 Contract Data Retrieval and Analysis

3.5.1 Contract Data Retrieval

Along with the survey of construction professionals, contract data was retrieved to qualitatively determine cost overruns and time delays in MINTP.

3.5.1.1 Retrieval Operation

Bidding operations and contract services of MINTP were mainly centralized at the Ministry headquarters in Yaounde. Some highway and bridge projects were also contracted at the local level, in Cameroon's regions. Periodically, local delegations sent reports on the implementation of delegated projects to the Ministry's headquarters. Therefore, contract data covering the whole country was only collected at the Ministry headquarters. Key departments involved in highway and bridge projects provided relevant documentation including contract registers, field reports and annual project reports for use in this research.

The concerned units were the following:

- Department of Highway Investment and Maintenance
- Department of Rural Roads
- Department of General Affairs
- Department of Planning
- Department of Road Protection and Environment

Only publicly available sources were considered for the present study. Electronic contract files were requested for a faster retrieval for 2009, and physical documents or contract registers were used for other years; about five thousands contracting agreements were retrieved.

In addition, sources of funding for projects were considered important because rules vary according to budgetary items or lender policies. Two main groups were considered for funding: projects funded by Cameroon's government only and projects co-funded by donors. Projects owned by Cameroon's government only were funded through the Road Funds, the Public Investment Budget and other budgetary items. For this last group, MINTP funded all the taxes and a percent of project costs before taxes such as 25%, 50% or 75% of project amounts. Co-funded projects were implemented following the rules of the lender.

The main lending agencies which cooperated with MINTP were the following:

- European Union
- African Development Bank
- Islamic Development Bank
- Organization of the Petroleum Exporting Countries (OPEC) Funds
- Highly Indebted and Poor Countries Initiative (HIPC) Funds, a multilateral source of funds
- World Bank, through its International Development Agency (IDA)
- Koweitian Funds
- Saudian Funds
- Belgium
- France, through its cooperation agency (AFD)
- Germany, by its cooperation agency (KFW)

3.5.1.2 Sampling

For a statistically significant analysis, a large set of historical contract data covering more than ten years was retrieved backwards from 2009; contracts signed in 2009 were not studied because many of them were not yet closed-out at the time of this study. The data was selected based on its availability. Year by year, all contracts were retrieved, even those without change orders, or with no cost overruns or time delays. Contracts which were not directly related to highway and bridge projects were excluded during data analysis. The research considered recorded change orders and cost and time overruns for contracts at the cut-off date of January 8, 2010, and started in January 1994.

Only a portion of contracts experienced change orders signed into agreement between MINTP and contractors over the past decade. In Cameroon, change orders were signed in agreement only for changes greater than thirty percent of any cost item as specified in the contract general provisions. Change orders were also signed for changes that necessitated new cost items, because the contractor could not perform any work that was not in the contract; or any work destined to be performed in new locations that were not stated in the initial contract. However, change orders were not issued for changes affecting cost items for less than thirty percent. These changes were typically documented in a daily diary of the job site for construction or maintenance projects, or in progress reports for other types of contracts.

Overall, the files used in this study contained about 5,000 contracts and change orders and consisted of about 4,000 contracts and 1,000 change orders. Only 394 recorded contracts relating to highway and bridge projects experienced cost overruns or time delays. These 394 were used in this research.

3.5.1.3: Data Categories

Contracts and change orders signed from 1994 to 2009 were categorized as follows: contract code, nature of agreement, object of agreement, agreement amount, project type, funding source, contract duration, date of signature, contractor identification, agreement date for each contract or change order, contractor identification for change orders, project type, contract type, contract/change order amount, contract/change order duration, and source of funding. The object or purpose of each change order where available was also included for further analysis. For data analysis, a codification for contractors and consultants with cost overruns was used: CONTR_XX for constructors and CONSLT_XX for consultants. XX refers to an ordinal number.

Contract Code: The contract code used by MINTP was recorded for contracts which incurred change orders. This variable was initialized as a string of characters. It consisted of the contract number, year, nature of contract, bidding board or call for bid reference and the ministry as owner.

Nature of Agreement: The nature of the agreement was defined as a string of characters taking three values respectively for regular contracts, small size contracts, and change orders. MINTP has two classification sizes for contracts: small size contracts have an amount ranging between 5,000,000 XAF and 30,000,000 XAF and regular contracts start above 30,000,000 XAF. No contract is needed for projects below 5,000,000 XAF, and they were not included in this study.

Object of Agreement: The purpose of a project was retrieved only for change orders under this entry, and it was recorded as a string of characters.

Amount: This variable was set up to input the amount of each contract or change order.

Project Type: This category was defined as a string of characters and recorded the type of project for each agreement as follows:

- Road Construction or Maintenance
- Road Signs and Markings
- Bridges and Structures
- Equipment Renting
- Material Supplies
- Design or Technical Studies
- Mowing Roadsides
- Geotechnical Testing
- Technical Assistance, this specific item referred to agreements signed between MINTP and consultants to assist the ministry for specific missions, mostly for the management of projects co-funded by foreign lenders.
- Work Supervision, MINTP systematically recruited consultants to insure contract administration; these consultants had separate contracts to supervise highway and bridge construction or maintenance projects.
- Other types of projects, although recorded, were discarded from data analysis because they were not directly related to highways or bridges. Examples of projects not considered include: buildings, office furniture and supplies, water supply infrastructure, and other equipment for general use such as cars.

Funding Source: The source of funding was recorded as a string of characters for the following entities:

- Government Only Funding

- European Union
- African Development Bank
- Islamic Development Bank
- Organization of the Petroleum Exporting Countries (OPEC) Funds
- Highly Indebted and Poor Countries Initiative (HIPC)
- World Bank (IDA)
- Koweitian Funds
- Saudian Funds
- Belgium
- France (AFD)
- Germany (KFW)

Contract Duration: The duration of each agreement was recorded and expressed in months.

Signature: For each agreement, the signature date by the Minister of Public Works was recorded.

Contractor Identification: The contractor's name was included as a string of characters for change orders and related contracts.

3.5.2 Historical Data

3.5.2.1: Generalities

Yearly, each contract or change order had a unique number for identification in the Ministry which was also used for this study. Microsoft (MS) Excel was the software used to organize the data and for statistical analysis. During this process, data coherence was tested as well as input errors using MS Excel tools for checking duplicates, searching and sorting strings of characters.

3.5.2.2: Data Organization

Data were classified in worksheets by fiscal year which varied from 1994-1995 to 2009. The inputs were reviewed several times by the researcher to detect mistakes in the typing and sorted by amount, type of contract, type of work, source of funding. Duplicates were identified from the contract registers and corrected. Beginning by year 2009, for each change order, the original contract was sought using criteria such as the date of signature, contract amount, contractor name, and contract code. Once the original contract was found, all corresponding change orders were pasted next to it for further analysis. Both contract registers and electronic files were used to match contracts and related change orders.

For some projects, design and work supervision were combined, and one design-build project was identified. These cases were classified as "Work Supervision" because design studies continued during work supervision. The design – build project was considered a construction project because most of its activities related to construction. Also, retaining walls, bridges and car-ferries maintenance projects were grouped together, in some parts of Cameroon, car-ferries are used on rivers to bridge portions of roads.

Also, change orders without an initial contract in the registers were not considered for cost and time overrun calculations. This happened mostly for contracts dated in the 1990s which were not handled by MINTP, before reforms which intervened about 1995. Those change orders were only used in this study for comparisons between the sources of funding, and reporting of their purposes.

The cost overrun rate for a contract was extracted as the total amount of its aggregated change orders divided by the original contract amount. Similarly, time overrun rates were taken by dividing the total value of time overruns from corresponding aggregated change orders, by the

initial contract time duration. Contractor cost overruns or time delays which were not excused by the owner, such as for terminated contracts, were not considered. They were not documented in the contract registers. For overrun rates the primary source of funding of the initial contract was considered as the project funding source: For one contract, different change orders could have different sources of funding. Furthermore, the final cost of contracts was assumed to be the addition of the initial contract amounts and all change orders; the consequence is that contracts with cost or time underruns were not studied.

After calculating the contract cost and time overrun (or time delay) rates, studies were conducted by project funding and type from 1998 to 2008 because of data availability. Before 1997-98, funding sources were not detailed in the contract registers and contract amounts were aggregated for all sources.

3.5.3 Data Analysis

Aided by Microsoft Excel and SPSS Statistics, data was analyzed to find frequency distributions, means, standard deviations, correlations and associations between cost and time overruns and contract categories in the case study organization. Histograms, tables, pie charts, scatter plots and line graphs were used. The method of data analysis was based on the following guidelines:

> *Because of experimental and other errors of measurement, the points shown on the scatter diagram will not fall precisely on a smooth curve. For this reason the task of the analyst becomes threefold: to hypothesize the mathematical form of the relationship between the two variables (model postulation), to estimate the parameters of the model based on the experimental data (model calibration), and to determine how well the calibrated relationship explains the observed data (goodness of fit).*
> (Papacostas and Prevedouros, 2001)

For overrun rates, data reporting was broken down by contract categories. The categories were project type, project ownership, project size, and project duration. Frequency distributions for each category were plotted following interval groups of cost or time overrun rates, then means and standard deviations were calculated. Categories of project size and project duration were broken down in sub-categories for analysis, according to MINTP current practices for contract classifications. For project size, sub-categories were as follows:

- Contract amounts under 100,000,000 XAF
- Contract amounts between 100,000,000 – 250,000,000 XAF
- Contract amounts between 250,000,000 – 700,000,000 XAF
- Contract amounts between 700,000,000 – 2,000,000,000 XAF
- Contract amounts between 2,000,000,000 – 5,000,000,000 XAF
- Contract amounts over 5,000,000,000 XAF

Sub-categories for project duration were:

- Contract duration under 6 Months
- Contract duration between 6 Months - 12 Months
- Contract duration between 12 Months - 24 Months
- Contract duration between 24 Months - 36 Months
- Contract duration over 36 Months

After calculating means and standard deviations, linear regression analyses were performed to find relevant relationships between project size, project duration and the project overrun rates. Cost overrun rates or amounts, and time overrun rates were the dependent variables, which were examined in relation to the independent variable, the initial contract amount, or initial contract duration. The coefficient of determination R indicated the strength of correlation among

variables and p-value were calculated for the level of significance of linear regressions. Linear regression was conducted to find the relationship between cost overrun rates and time overrun rates.

Seeking the influence of contractor familiarity with the agency on cost and time overruns, the frequency of occurrence of at least one change order for contractors during a given year of the period of study was also analyzed. In the case of joint venture, each contractor was counted separately. This frequency possibly ranged from one, for contractors who obtained only one change order, to fifteen for contractors who received at least one change order, each year, in the considered period. Relationships were then investigated for the resulting classifications.

3.6 Survey of Professionals

3.6.1 Design: Methods and Procedures

A survey was designed and implemented in Cameroon to collect perceptions of construction professionals about cost overruns and time delays.

Survey design

The survey began by a statement to explain the research to the subject and to obtain his or her consent to participate. It was anonymous, neither name nor signature were required. However, the respondent indicated his or her profession and sector in the construction industry.

After this introduction, the survey presented the main factors of cost overruns and time delays identified from the literature. Factors were classified by source of cost overruns and time delays for each project phase including: Planning and Programming, Design Process, Bidding, Project Implementation, Project Control and *ex post* Evaluation. The following table summarizes the organization of survey factors.

No	Part	No of Questions(Factors)
1	Planning and Programming	5
2	Design Process	4
3	Bidding Phase	4
4	Project Implementation	17
5	Project Control and *ex post* Evaluation	4
Total		**34**

Table 3.1 Survey Structure

Specific factors were derived from the literature and discussions with MINTP staff. Table 3.2 presents the factors and their related sources.

Factors	Sources
Planning and Programming	
Lack of Project Planning/Programming	Merewitz (1973)
Inadequate Project Planning/Programming	Flyvbjerg (2008)
Weaknesses during the land takings process	Okole (2009a)
Expropriation costs	Jergeas (2009), Anderson et al. (2008)
Legal environmental requirements	Jergeas (2009), Anderson et al. (2008)
Design Process	
Weak and insufficient technical studies	Ajibade and Odeyinka(2006), Anderson et al. (2007), Creedy et al.(2010),Cameroon-Tribune Archives (2009)
Underestimating of cost estimates and schedules/ Overestimating of Benefits	Flyvbjerg et al. (2004)
Poor project implementation strategies	Jergeas (2009), Anderson et al (2007), Shane et al. (2009)
Mistakes and discrepancies in documents	Okpala and Aniekwu (1998)

Table 3.2 Sources of the Factors in the Questionnaire

Table 3.2 Sources of the Factors in the Questionnaire (Cont'd)

Factors	Sources
Bidding Phase	
Bidding Procedures	MINTP Specific
Duration of the Period of Bidding	Okpala and Aniekwu (1998)
The Lowest Bid Price System:	Hinze and Selstead (1991),Jin-Kyung (2008), Lo et al. (2006), Frimpong et al. (2003)
Unreasonable adjustment of project cost by contractors	Jin-Kyung (2008)
Project Implementation	
Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions.	Pratt (2004), Sweet and Schneier (2009), Lo et al. (2006)
Mismanagement Due to Inexperienced Supervisors.	Merewitz (1973), Le-Hoai et al. (2008), Mansfield et al. (1994), Jergeas (2009)
Supervisor and Contractor Claims and Disputes	Abd El-Razek et al. (2008)
Many Stakeholders	Abd El-Razek et al. (2008)
Poor Communication Among Contract Stakeholders	Tumi et al. (2009), Le-Hoai et al. (2008), Sambasivan and Soon (2007), Jergeas (2009)
Unethical Activities And Kickbacks	Okpala and Aniekwu (1998)
Equivocal/Unclear Contracts	Anderson et al (2007), Shane et al. (2009)
Changes in Scope of Contracts	Merewitz (1973), Anderson et al (2007)
The Displacement of Existing Networks	Cameroon-Tribune Archives (2009)
Construction Errors and On Site Testing Approval	Anderson et al (2007), Okpala and Aniekwu (1998)
Building on unexpected archaeological sites	Lo et al. (2006), Le-Hoai et al. (2008), Abd El-Razek et al. (2008)
Shortages of Materials	Okpala and Aniekwu (1998), Abd El-Razek et al. (2008)
Material Price Fluctuation	Merewitz (1973), Le-Hoai et al. (2008), Frimpong et al. (2003)
Methods of Payment	Okpala and Aniekwu (1998)
Lack of Equipment	Okpala and Aniekwu (1998), Abd El-Razek et al. (2008)
Weather Conditions	Bramble and Callahan (2000), Abd El-Razek et al. (2008), Le-Hoai et al. (2008), Okpala and Aniekwu (1998)
Political Tensions/Insecurity	Akinci and Fischer (1998)

Table 3.2 Sources of the Factors in the Questionnaire (Cont'd)

Factors	Sources
Project Control and *ex post* Evaluation	
No Action Taken After Contract' Progress Reports	Jin-Kyung (2008)
Periods of Inspection and Testing After Contract Completion	Okpala and Aniekwu (1998), Tumi et al. (2009), Mansfield et al. (1994)
Lack of Contract *ex post* Evaluation	Jin-Kyung (2008)
Negligence of Past Experiences	MINTP Specific

Questions were closed-ended for quick responses and pre-coded to allow statistical analysis. The last question was open ended and asked the respondent to provide his or her suggestions for solutions. On a five-category Likert scale varying from 1(Strongly Agree) to 5(Strongly Disagree), respondents rated each factor based on their experience. The survey took ten to fifteen minutes on average to complete. It also had a French version.

In addition to the use of a Likert scale, because respondents were anonymous during the survey, the following coding process was used to record each respondent's characteristics: PPP_CCCC_XX. The table below explains this coding for each respondent:

PPP	The first three letters of the profession.
CCCC	The first four letters of the sector in construction.
XX	Two digits representing the numbering of each questionnaire.

Table 3.3 Respondents' Coding for Data Input

In order to organize the set of data, variables were coded as presented in Table 3.4 and Table 3.5 for software statistical analysis.

No	Variable	Code	Type	Values
	Characteristics of Respondents			
1	Profession of the Respondent	Profession	String	• Man = "Manager" • Eng= "Engineer" • Acc= "Accountant" • Oth= "Other"
2	Sector in the industry	Sector	String	• Cons ="Consultant" • Cont= "Constructor" • Dono= "Donor" • Fina= "Finance" • Gove= "Government"

Table 3.4 Respondents' Coding for Data Analysis

No	Variable	Code	Type	Values
	Responses of Respondents			1= "Strongly Agree" 2= "Agree" 3= "Neither" 4= "Disagree" 5= "Strongly Disagree"
1.	Lack of Project Planning/Programming	Lack_Pl_Prog	Ordinal	1,2,3,4,5
2.	Inadequate Project Planning/Programming	Inad_Plan_Prog	Ordinal	1,2,3,4,5
3.	Weaknesses during the land takings process	Weakness_Takings	Ordinal	1,2,3,4,5
4.	Expropriation costs	Expropriation_Costs	Ordinal	1,2,3,4,5
5.	Legal environmental requirements	legal_Envir_Req	Ordinal	1,2,3,4,5
6.	Weak and insufficient technical studies	Weak_Tech_Stud	Ordinal	1,2,3,4,5
7.	Underestimating of cost estimates and schedules/ Overestimating of Benefits	Underestimating_Cost_over_benf	Ordinal	1,2,3,4,5
8.	Poor project implementation strategies	Poor_Impl_Stratg	Ordinal	1,2,3,4,5
9.	Mistakes and discrepancies in documents	Mistakes_Discrep	Ordinal	1,2,3,4,5
10.	Bidding Procedures	Bidding_proced	Ordinal	1,2,3,4,5
11.	Duration of the Period of Bidding	Duration_Bidd	Ordinal	1,2,3,4,5
12.	The Lowest Bid Price System:	Lowest_Bid_Sys	Ordinal	1,2,3,4,5
13.	Unreasonable adjustment of project cost by contractors	Unreasonnable_Adjust	Ordinal	1,2,3,4,5
14.	Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions.	Negligence_Site_visits	Ordinal	1,2,3,4,5
15.	Mismanagement Due to Inexperienced Supervisors	Mismanagt_Inexp_Supv	Ordinal	1,2,3,4,5
16.	Supervisor and Contractor Claims and Disputes	Supv_Contr_Claims	Ordinal	1,2,3,4,5
17.	Many Stakeholders	Many_Stakeholders	Ordinal	1,2,3,4,5
18.	Poor Communication Among Contract Stakeholders	Poor_Communicat	Ordinal	1,2,3,4,5

Table 3.5 Software Coding of Factors

Table 3.5 Software Coding of Factors (Cont'd)

No	Variable	Code	Type	Values
19.	Unethical Activities And Kickbacks	Unethical_Actvties	Ordinal	1,2,3,4,5
20.	Equivocal/Unclear Contracts	Equivocl_Contracts	Ordinal	1,2,3,4,5
21.	Changes in Scope of Contracts	Change_Scope	Ordinal	1,2,3,4,5
22.	The Displacement of Existing Networks	Displacement_Networks	Ordinal	1,2,3,4,5
23.	Construction Errors and On Site Testing Approval	Constr_Errors	Ordinal	1,2,3,4,5
24.	Building on unexpected archaeological sites	Unexpted_Archeolg_Sites	Ordinal	1,2,3,4,5
25.	Shortages of Materials	Shortage_Materials	Ordinal	1,2,3,4,5
26.	Material Price Fluctuation	Materials_Price_Fluct	Ordinal	1,2,3,4,5
27.	Methods of Payment	Payment_Method	Ordinal	1,2,3,4,5
28.	Lack of Equipment	Equipment_Lack	Ordinal	1,2,3,4,5
29.	Weather Conditions	Weather	Ordinal	1,2,3,4,5
30.	Political Tensions/Insecurity	Politic_Tensions	Ordinal	1,2,3,4,5
31.	No Action Taken After Contract Progress Reports	No_Action_Reports	Ordinal	1,2,3,4,5
32.	Periods of Inspection and Testing After Contract Completion	Period_Inspect_Test	Ordinal	1,2,3,4,5
33.	Lack of Contract *ex post* Evaluation	Lack_Post_Impl Lack_Pl_Prog	Ordinal	1,2,3,4,5
34.	Negligence of Past Experiences	Negl_Past_Expces	Ordinal	1,2,3,4,5

Survey versions in English and French are presented in appendices.

3.6.2 Sampling

3.6.2.1 Survey Location

The survey was conducted at the capital city, Yaounde, where the central services of MINTP and most of all other agencies involved in transportation projects are based.

3.6.2.2 Survey Participants

The investigator focused on technical and administrative departments of MINTP and its partners, involved with highway and bridge project management. For the ministry, they were:

- The Department of Highway Investments and Maintenance
- The Sub Department of Contracts and Bidding (General Affairs Department)
- The Department of Rural Roads
- The Department of Planning
- The Regional Delegation of Public Works for the Centre region

MINTP had hundreds of engineers, and in addition, 137 contractors and 35 consultants partnering with the ministry in 2007 (MINTP, 2008). Participants completed the survey in their offices. A balance between government agencies, contractors, consultants, funding agencies and donors was sought. The size and local classification of contractors and consultants was also considered.

The investigator had informative telephone meetings with top managers of the ministry departments to request participation of their unit in the survey. Approximately five heads of department at MINTP participated, along with the five to ten experienced project engineers, managers or accountants within their respective departments. The forms were electronically sent by email to the departments, printed and distributed to targeted participants in an envelope or left with the secretary of the department if the targeted respondents were not available. Participants returned their responses in a sealed envelope provided with the survey. Responses were collected daily by agents of the MINTP Mailing Service, where the responses were gathered and mailed by express means to the investigator at MSU. These agents usually tour the Ministry and its partnering organizations many times daily to distribute or collect mail and internal documents from one service to the other.

For donors, only those having projects with MINTP were surveyed: the respondents were preferably project managers or accountants.

Lastly, contractors and consultants who were active, i.e. have ongoing contracts with MINTP were targeted. The heads of departments of the ministry were asked to provide shortlists of contractors and consultants who could be surveyed. Field engineers, superintendents, field supervisors and project managers were targeted for the survey. Most public works contractors and consultants working countrywide are based in Yaounde or have an agency there. In total, 30 out of 137 contractors were scheduled for the survey for a rate of 22%; and eleven consultants out of 35 as well, and the forecasted survey rate was 31 % for the latter group. Overall 41 respondents from contractors and consultants, and 59 respondents from Government and funding agencies were sought. A response rate greater than 40% was targeted for an acceptable bias (Moser and Kalton, 1972). Therefore, about one hundred survey forms were printed and administered to construction professionals during a three to four week period.

Table 3.6 presents the stratified sampling considered for this survey.

No	Location(City)	Agency	Department(Sub-Department)	No of Targeted Respondents
1	Yaounde	MINTP Central services	Highway Investment and Maintenance	15
			General Affairs(Contracts& Bidding)	10
			Rural Roads	15
			Planning	8
		Donors and Lenders: European Union Delegation, World Bank , African Development Bank		5
		Road Fund		2
		Consultants/Supervisors		11
		Contractors		30
		MINTP Regional Delegation of Centre		4
		Total		**100**

Table 3.6 Sampling- Potential Respondents of the Survey

3.6.3 Survey Data Analysis

After receiving the data in hard copies, using the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel, data were computerized using the coding presented previously. Missing values for each variable were identified and all corresponding responses were discarded from the survey analysis. Then, valid responses were analyzed using descriptive statistics. Variables were ranked according to the response frequencies for each possibility from one to five. Cross-tabulation was also performed to study associations and correlations among variables. Overall ranking of responses was first performed; for each variable, the frequencies of respondents for the values "Strongly Agree" and "Agree" were summed and the score used for ranking. Variables were ranked in decreasing order from the highest score to the lowest.
The statistical models of Lambda and Goodman and Kruskal tau were automatically performed to evaluate correlation among the variables used for cross-tabulation.

3.7 Other Sources Retrieved

Along with contract data, other documents were received, for a better understanding of cost and time issues in MINTP, and its contracting process. The most relevant were:

- The public contract code of Cameroon, and related by-laws and circular letters
- The decree organizing MINTP signed on April 29 2011
- Typical call for bids electronic files
- MINTP Annual Reports for 2004, 2006,2007,2008 and 2009
- Project and field reports for road funds and public investment budget, European Union funded road rehabilitation and maintenance programs, project reports of the African Development Bank, and an implementation completion report of the Transport Sector Project of the World Bank

- Work Supervision Report for the Construction of Ayos - Bonis road (June 2008)
- Work Supervision Final Report for the construction of Ngaoundere-Touboro-Chad frontier road(March 2007)
- Final report on the study to obtain standardized costs for road projects, technical studies, and work supervision in Cameroon (MINTP, 2009a)
- Final report on the study to analyze problems related to the bidding of public contracts of MINTP (MINTP, 2008b)
- Twenty recent contracts and change orders for road and bridge construction and maintenance, work supervision, socio-economic studies and preliminary design, detailed design, mowing roadsides, traffic studies.

These sources were used help substantiate conclusions drawn from the survey and contract data analysis and formulate guidelines and recommendations.

3.8 Research Questions

The following research questions were investigated, during the present study:

- There are causes of cost overrun and time delay in the planning/programming phases of projects that are identifiable
- Design processes and bidding influence cost overrun and time delay during project implementation
- During project implementation, there are identifiable factors of cost overruns and time delays
- Deficiencies in project post evaluation impact future projects cost overrun and time delay
- The project type, project size, project ownership, project duration, and contractor familiarity with the case study organization are factors of the cost overrun rate

- The cost overrun rate and time overrun rate are related to each other

3.9 Deliverables

Discussion in the thesis included the survey results, project overrun rates and their statistical inferences. It also considered past studies and legal and administrative documents relating to cost overruns and time delays, which were collected at MINTP along with data.

This research unveiled cost overrun rates, their relationships to project categories, and perceptions of their causes by industry professionals in highway and bridge projects in Cameroon, as a case study for developing countries. Furthermore, it contributed to the literature in helping to identify the main factors of cost overruns and time delays in Cameroon. Guidelines to overcome cost overruns and time delays were developed for the case study agency, which would have application in other countries with similar conditions. As proof of concepts, the researcher has a broad knowledge of the case-study organization and these guidelines considered the diverse solutions proposed by the management of the MINTP and other survey respondents to solve the issues of cost overruns and time delays.

3.10 Chapter Summary

Based on the background studies presented in Chapter Two, the methodology used for this research was described in this chapter. Research questions and projected outcomes of the study were also presented.

CHAPTER 4
CONTRACT DATA ANALYSIS

4.1 Introduction - Preliminaries

This chapter presents the results of the contract data analysis. After contracts and change orders were entered in the database, a detailed analysis was performed to determine project overruns for MINTP. The arithmetic mean and standard deviation of cost and time overrun rates were performed for each of the project categories. Then, a linear regression model was used to investigate relationships among the data.

MINTP consumes important budgetary resources of the Republic of Cameroon, for highway infrastructure construction and maintenance. Each year since the mid-1990s, hundreds of contracts were signed since the mid-1990s. The currency of Cameroon is the CFA Franc (XAF). It has an invariable constant exchange rate with the Euro: Euro 1 = 655.96 XAF; on August 1 2011, US$1= 460 XAF. Monetary amounts were not adjusted for inflation.

Time was measured in months for all contracts; few projects had durations less than one month. The definitions of cost overrun and time overrun presented in the glossary for contracts are similar for programs or projects which consist of many contracts. The cost or time overrun rates represent the ratio between the cost or time overrun and the initial contract, project, program amount or duration. Rates are expressed as percentages of the initial contract, project or program cost or duration.

Table 4.1 summarizes the volume of contracts during the time period considered for the research.

Year (Period)	1994-95	1995-96	1996-97	1997-1999	99-2000	2001-02
Number of Contracts Signed for highway and bridge projects	196	140	712	374	403	331
Total Amount of Contracts Signed (XAF)	7,790,548,570	5,908,371,918	27,005,131,550	37,680,119,941	52,321,414,289	167,171,541,572
Number of Change Orders Signed	4	5	18	80	132	162
Total Amount of Corresponding Change Orders and others(*) (XAF)	102,409,944	124,048,147	154,405,872	26,909,853,066	4,561,362,799	35,252,289,594

(*) "Others": Change Orders for initial contract not in the database

Table 4.1 Volume of the Contracts Registered

Table 4.1 Volume of the Contracts Registered (Cont'd)

Year (Period)	2003	2004	2005	2006
Number of Contracts Signed for highway and bridge projects	190	222	355	202
Total Amount of Contracts Signed (XAF)	51,750,458,562	72,854,036,091	106,592,532,115	132,311,964,847
Number of Change Orders Signed	90	65	67	33
Total Amount of Corresponding Change Orders and others(*) (XAF)	10,300,632,952	11,141,968,415	11,967,037,403	3,379,832,674

(*) "Others" are Change Orders for initial contract not in the database

Table 4.1 Volume of the Contracts Registered (Cont'd)

Year (Period)	2007	2008	2009
Number of Contracts Signed for highway and bridge projects	77	267	399
Total Amount of Contracts Signed (XAF)	52,080,242,217	160,656,817,485	280,771,098,989.2
Number of Change Orders Signed	13	26	5
Total Amount of Corresponding Change Orders and others(*) (XAF)	1,476,655,360	421,635,611	0
Overall Number of Contracts (1994-2009)	**3868**		
Overall Number of Change Orders(1994-2009)	**700**		

(*) "Others" are Change Orders for initial contract not in the database

Table 4.2 and Figure 4.1 below summarize the volume of contracts and change orders for the period of study, by project type.

Type	Total Contract Amounts	Total Cost Overruns	Global Amount by Project Type
Road Construction/Maintenance	545,472,244,192.00	57,294,182,778.00	602,766,426,970.00
Work Supervision	48,700,487,193.00	12,237,193,407.00	60,937,680,600.00
Bridges and Structures	41,394,727,818.00	560,974,087.00	41,955,701,905.00
Design/Technical Studies, Technical Assistance	17,517,937,055.00	1,196,632,317.00	18,714,569,372.00
Mowing Roadsides	14,700,432,431.00	168,701,672.00	14,869,134,103.00
TOTAL	**667,785,828,689.00**	**71,457,684,261.00**	**739,243,512,950.00**

Table 4.2 Volume of Contracts with Cost and Time Overruns (1994-2009)

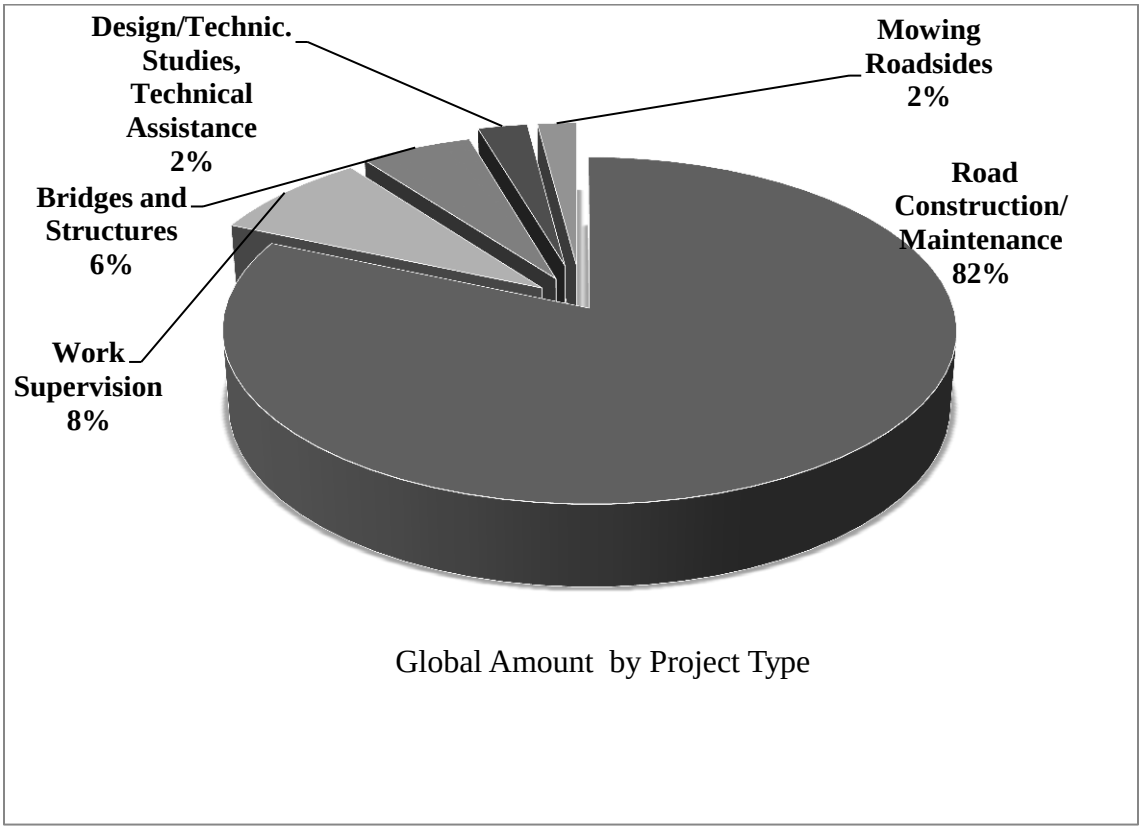

Figure 4.1 Repartition of Contract Global Amount by Project Type (1994 – 2009)

4.2 Change Orders

4.2.1 Overview

Change orders recorded during the overall period of study were broken-down as follows between the diverse sources of funding, for MINTP activities. Projects funded by foreign donors or lenders incorporated government contributions, in the form of taxes or a percentage of the estimated costs. However, for simplicity, they are considered owned by the corresponding donor or lending agencies because the rules of these organizations applied for project implementation. The volume of change orders varied for each source of funding as presented in Table 4.3 below.

Organization	Overall Change Order Volume in the Database (XAF Amount)
African Dev. Bank	605,583,744.00
World Bank (IDA)	23,790,596,830.00
Cameroon's Government Only	28,525,280,749.00
France-AFD	8,883,417,840.00
European Union	30,790,525,005.00
Islamic Dev. Bank(IDB), OPEC Funds, Koweitian Funds, Saudian Funds	4,502,686,423.00
HIPC Funds	8,391,873,683.00
TOTAL	**105,489,964,274.00**

Table 4.3 Overall Change Order Volume in the Database by Project Ownership (1994-2009)

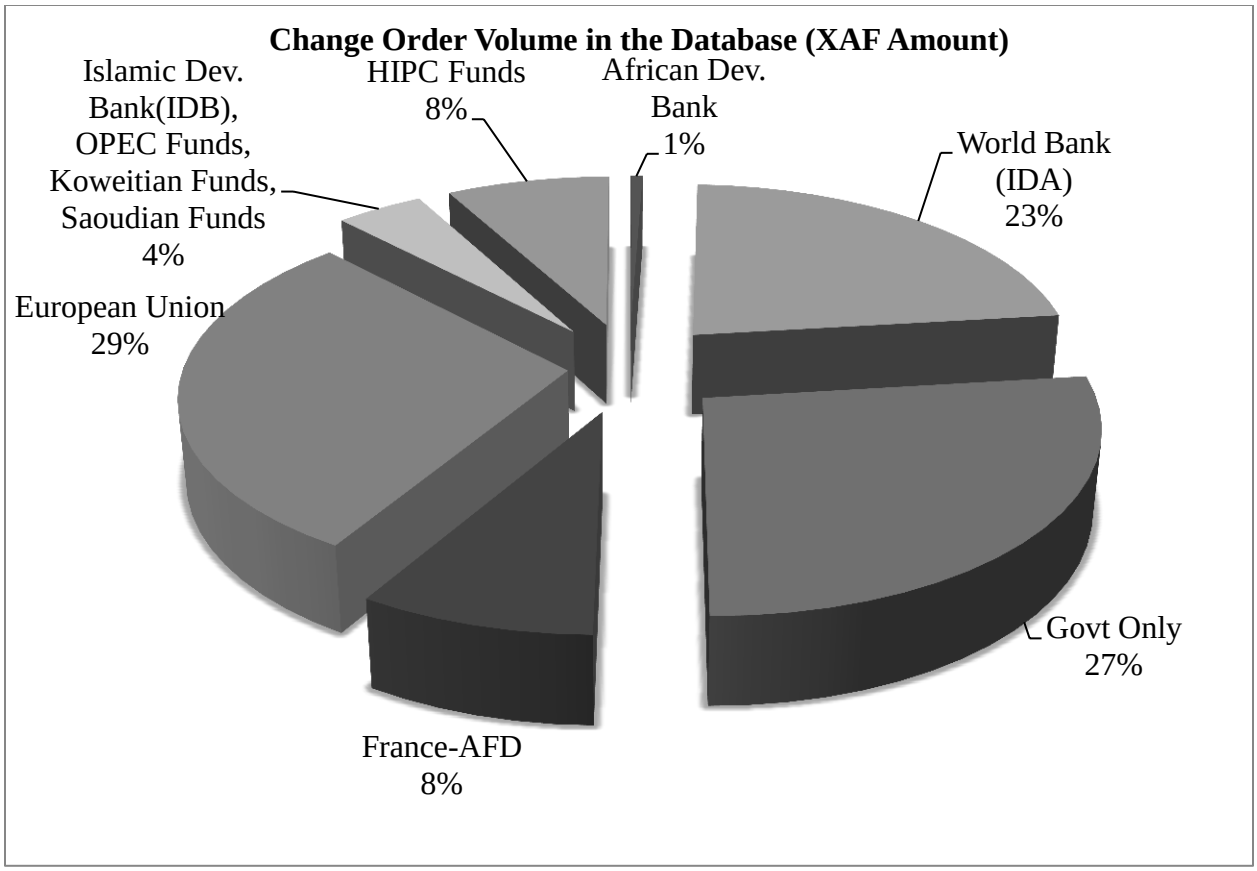

Figure 4.2 Repartition of Change Orders in the Database (XAF Amount) By Funding Source (1994-2009)

4.2.2 Causes of Change Orders

From MINTP and donors reports (MINTP, 2009a), (MINTP, 2008b), (MINTP, 2008c), MINTP, 2007a), (Groupe de la Banque Africaine de Développement, 2008), some causes of change orders which impacted cost and time for large projects were indicated, among which were listed:

- Interruption of work because funds were exhausted before contract completion, this situation mainly concerned projects co-funded by foreign aid, and many times MINTP had to finance related change orders itself

- The practice of cash advances by MINTP: on some large projects, contractors required cash advances before starting work, and they sometimes ended with high cost overruns and time extensions
- Acts of God and vandalism
- Lateness of MINTP in the issuance of contractual documents
- Lateness of MINTP in land expropriation and “right-of-way” processing
- Displacement of aerial or underground networks
- Wrong design studies which had to be re-done at the beginning of work implementation. Some contracts experienced cost overruns from the period of the notice to proceed
- Processing of taxes and customs exemption for international contractors working on co-funded projects
- Defective equipment
- Extraordinary lengthy bidding and payment procedures, involving donor agreement at each step

Such causes did not appear in the contract registers, when only the intent of each change order was recorded.

4.2.3 Purpose of Change Orders Recorded

Change orders in the database could be broken down in four groups:

- Change orders with no impact on cost and time
- Change orders with cost overruns only
- Change orders with time overruns only
- Change orders with both cost and time overruns

However, these change orders could have a similar purpose, regardless of their group. Table 4.4 below summarizes the 37 purposes of change orders which were recorded in the contract files.

Changing Contractor's Bank Account	Modifying the Scope of Work
Modifying the Contract's Budgetary Item	Modifying Some Contract Provisions
Changing the Method of Payment	Extension of the Work Supervision Period
Changing Unit Prices	Time Extension for Work
Update of Design Studies	Extra Work
Paying Contractor's Extra Work	Paying Cost Overruns due to Work Interruption because of Insecurity
Extra Work Supervision	Paying Cost Overruns due to Asphalt Shortage
Extra Design Studies During Work Supervision	Adjusting Prices
Paying a Consultant for Assistance during Bidding Procedures	Change of Contractor's Name
Correcting Contract's Duration	Refund of Some Taxes to Contractor
Approving New Prices for the Contract's estimate	Extra costs for Work Supervision due to Contractor Lateness
Extra Technical Assistance	Modifying Repartition of Funding
Modification of Project Itinerary	Adjustment for New Value Added Taxes
Extra Geotechnical Studies	Replacing Deceased Contractor Manager by Legal Representative
Change of Work Scheduling	Correction of Mistakes on Estimate Errors
Environmental Impact Studies during Work Supervision	Modification of Definitions and Attributions
Extension of Design Studies Proposal	Cancellation of Parts of Work
Modification of Budgetary Year	Modification of Work Supervision Contract following Increases in Construction Costs
Change of Construction Site	

Table 4.4 General Purposes of Change Orders Recorded at MINTP

4.3 Detailed Analysis of Cost and Time Overruns

4.3.1 Overview

Cost and time overrun rates were reported depending on data availability year after year, and then summarized for the whole period of study. Cost overrun and time delay rates were

investigated by project type, project ownership, project size, and project duration. The relationship between cost overrun rates and time overrun rates was also sought. The sample of 394 contracts was used for regression analysis, which was performed at 90% for the level of significance. These 394 contracts were selected because they had either cost overruns or time delays.

4.3.2 Summary of Data for 2001-2002

Contracts signed in 2001-2002 had the largest number of change orders for the period studied, therefore this fiscal year was chosen for illustration since it has the most significance on cost overruns and time delays for MINTP.

Table 4.5 indicates contract amounts and their cost and time overrun rates for 2001-2002 by project type and by source of funding. These project overrun rates for all contracts for 2001-2002 are classified by ascending cost overrun rates.

No	Contract Amounts	Cost Overrun Rates	Time Overrun Rates	Type	Funding
-	*11,945,358,369.00(*)*	*0.00%*	*0.00%*	*All*	*All*
1.	347,462,795.00	0.00%	33.33%	Bridge & Structure	Gov
2.	195,532,605.00	0.00%	25.00%	Construction/Maintenance	Gov
3.	398,695,495.00	0.00%	50.00%	Construction/Maintenance	HIPC
4.	411,499,838.00	0.00%	50.00%	Construction/Maintenance	Gov
5.	412,927,672.00	0.00%	50.00%	Construction/Maintenance	HIPC
6.	423,902,152.00	0.00%	50.00%	Construction/Maintenance	HIPC
7.	428,813,462.00	0.00%	50.00%	Construction/Maintenance	HIPC
8.	454,638,423.00	0.00%	50.00%	Construction/Maintenance	HIPC
9.	480,867,316.00	0.00%	50.00%	Construction/Maintenance	HIPC
10.	6,034,808,829.00	0.33%	22.22%	Construction/Maintenance	Gov
11.	2,849,972,793.00	1.28%	0.00%	Construction/Maintenance	EU
12.	2,750,414,002.00	1.38%	0.00%	Construction/Maintenance	EU
13.	4,006,281,419.00	1.63%	0.00%	Construction/Maintenance	EU
14.	3,446,267,827.00	1.74%	0.00%	Construction/Maintenance	EU
15.	171,354,070.00	2.35%	8.33%	Construction/Maintenance	Gov
16.	569,757,145.00	2.96%	0.00%	Construction/Maintenance	EU
17.	774,911,963.00	2.97%	8.33%	Technical studies	HIPC
18.	4,357,805,562.00	2.99%	5.56%	Construction/Maintenance	Gov
19.	1,087,683,356.00	3.31%	0.00%	Construction/Maintenance	EU
20.	737,320,934.00	3.39%	0.00%	Construction/Maintenance	EU
21.	921,712,897.00	3.81%	0.00%	Construction/Maintenance	EU
22.	1,029,439,154.00	4.21%	0.00%	Construction/Maintenance	EU
23.	812,147,317.00	4.39%	0.00%	Construction/Maintenance	EU
24.	939,954,150.00	4.70%	0.00%	Construction/Maintenance	EU
25.	693,152,006.00	4.89%	0.00%	Construction/Maintenance	EU
26.	4,143,625,414.00	5.76%	2.78%	Construction/Maintenance	Gov
27.	99,520,568.00	8.27%	4.17%	Mowing	Gov
28.	64,941,786.00	10.48%	16.67%	Mowing	Gov
29.	31,542,318.00	10.59%	25.00%	Mowing	Gov
30.	2,728,524,578.00	15.55%	4.17%	Construction/Maintenance	EU

(*) Aggregated amount for contracts without cost or time overruns

Table 4.5 Cost and Time Overrun Rates for All Contracts - Year 2001-2002

Table 4.5 Cost and Time Overrun Rates for All Contracts - Year 2001-2002 (Cont'd)

No	Contract Amounts	Cost Overrun Rate	Time Overrun Rate	Type	Funding
31.	302,112,293.00	16.26%	0.00%	Construction/Maintenance	Gov
32.	247,652,825.00	17.02%	0.00%	Construction/Maintenance	Gov
33.	889,591,215.00	18.79%	38.89%	Work supervision	EU
34.	261,680,865.00	21.25%	8.33%	Construction/Maintenance	Gov
35.	209,821,492.00	21.67%	8.33%	Construction/Maintenance	Gov
36.	374,182,758.00	21.97%	44.44%	Work supervision	EU
37.	616,763,099.00	22.65%	44.44%	Work supervision	EU
38.	107,687,816.00	25.64%	0.00%	Construction/Maintenance	Gov
39.	30,999,492.00	25.66%	0.00%	Mowing	Gov
40.	645,585,085.00	26.43%	44.44%	Work supervision	EU
41.	875,365,071.00	26.58%	44.44%	Work supervision	EU
42.	70,017,755.00	28.47%	100.00%	Technical studies	Gov
43.	163,395,564.00	28.58%	8.33%	Construction/Maintenance	Gov
44.	3,437,290,860.00	29.00%	34.91%	Work supervision	EU
45.	70,325,994.00	29.87%	100.00%	Technical studies	Gov
46.	58,094,154.00	29.88%	100.00%	Technical studies	Gov
47.	63,374,470.00	29.90%	100.00%	Technical studies	Gov
48.	45,723,240.00	29.94%	100.00%	Technical studies	Gov
49.	74,624,593.00	29.99%	100.00%	Technical studies	Gov
50.	161,832,945.00	31.54%	0.00%	Construction/Maintenance	Gov
51.	138,039,791.00	31.94%	41.67%	Work supervision	Gov
52.	96,925,483.00	32.38%	0.00%	Bridge & Structure	Gov
53.	449,917,916.00	34.00%	30.00%	Construction/Maintenance	Gov
54.	173,058,807.00	34.18%	0.00%	Construction/Maintenance	Gov
55.	24,388,276.00	34.71%	170.00%	Bridge & Structure	Gov
56.	418,790,178.00	35.91%	145.45%	Work supervision	EU
57.	117,366,168.00	37.23%	41.67%	Work supervision	Gov
58.	109,240,396.00	37.63%	41.67%	Work supervision	Gov
59.	106,103,444.00	38.99%	41.67%	Work supervision	Gov
60.	121,137,018.00	39.39%	0.00%	Technical studies	Gov
61.	74,904,446.00	39.88%	41.67%	Work supervision	Gov
62.	86,739,953.00	41.64%	41.67%	Work supervision	Gov
63.	111,109,743.00	41.81%	41.67%	Work supervision	Gov
64.	317,771,770.00	44.12%	31.58%	Work supervision	Gov
65.	58,754,386,191.00	44.76%	36.36%	Construction/Maintenance	EU
66.	464,417,577.00	45.93%	19.44%	Work supervision	EU

Table 4.5 Cost and Time Overrun Rates for all contracts, Year 2001-2002(Cont'd)

No	Contract Amounts	Cost Overrun Rate	Time Overrun Rate	Type	Funding
67.	118,292,871.00	47.43%	12.50%	Construction/Maintenance	Gov
68.	846,435,450.00	47.76%	44.44%	Work supervision	EU
69.	71,696,909.00	47.90%	0.00%	Construction/Maintenance	Gov
70.	410,200,849.00	47.91%	47.22%	Work supervision	EU
71.	101,090,437.00	49.49%	25.00%	Construction/Maintenance	Gov
72.	29,960,405.00	50.07%	66.67%	Construction/Maintenance	Gov
73.	417,589,673.00	50.13%	8.33%	Construction/Maintenance	Gov
74.	52,799,618.00	50.73%	50.00%	Construction/Maintenance	Gov
75.	530,345,339.00	53.04%	47.22%	Work supervision	EU
76.	173,592,815.00	57.24%	101.82%	Work supervision	IDB
77.	29,932,491.00	60.08%	66.67%	Construction/Maintenance	Gov
78.	47,628,606.00	62.07%	40.00%	Construction/Maintenance	Gov
79.	91,610,878.00	62.45%	0.00%	Construction/Maintenance	Gov
80.	547,413,543.00	65.79%	19.44%	Work supervision	EU
81.	138,077,751.00	67.00%	12.50%	Construction/Maintenance	Gov
82.	110,034,636.00	67.69%	12.50%	Construction/Maintenance	Gov
83.	572,959,572.00	69.13%	20.83%	Work supervision	EU
84.	558,510,801.00	70.85%	20.83%	Work supervision	EU
85.	73,792,941.00	72.14%	141.67%	Work supervision	Gov
86.	96,085,246.00	83.61%	0.00%	Construction/Maintenance	Gov
87.	27,528,904.00	92.27%	50.00%	Construction/Maintenance	Gov
88.	101,159,738.00	98.68%	8.33%	Construction/Maintenance	Gov
89.	78,756,688.00	100.00%	75.00%	Technical studies	Gov
90.	125,601,293.00	100.00%	12.50%	Construction/Maintenance	Gov
91.	164,281,690.00	110.62%	143.64%	Work supervision	IDB
92.	122,486,530.00	140.41%	41.67%	Work supervision	Gov
93.	74,582,178.00	155.01%	8.33%	Technical studies	AFD
94.	26,122,186.00	284.18%	100.00%	Construction/Maintenance	Gov

Table 4.5 Cost and Time Overrun Rates for all contracts, Year 2001-2002 (Cont'd)

4.3.3 Project Type

Contracts were first classified by project type, as presented in table 4.2.: road construction and maintenance, work supervision, bridges and structures, design/technical studies and

technical assistance, and mowing roadsides. For each type, the frequency distribution of cost overruns and time delays was plotted, and then means and standard deviations calculated.

4.3.3.1 Frequency Distributions of Cost Overrun Rates by Project Type

Frequency distributions of cost overrun rates varied with project type. The largest number of contracts was recorded for road construction and maintenance. Regardless of project type, most contracts had no change orders recorded for them in the database. Cost overrun rates ranged from 0% to 284%. Work supervision had the highest frequency of cost overrun rates, and bridge and structure projects recorded the lowest frequency of cost overrun rates. Corresponding distributions are plotted in the Figures 4.3- 4.7.

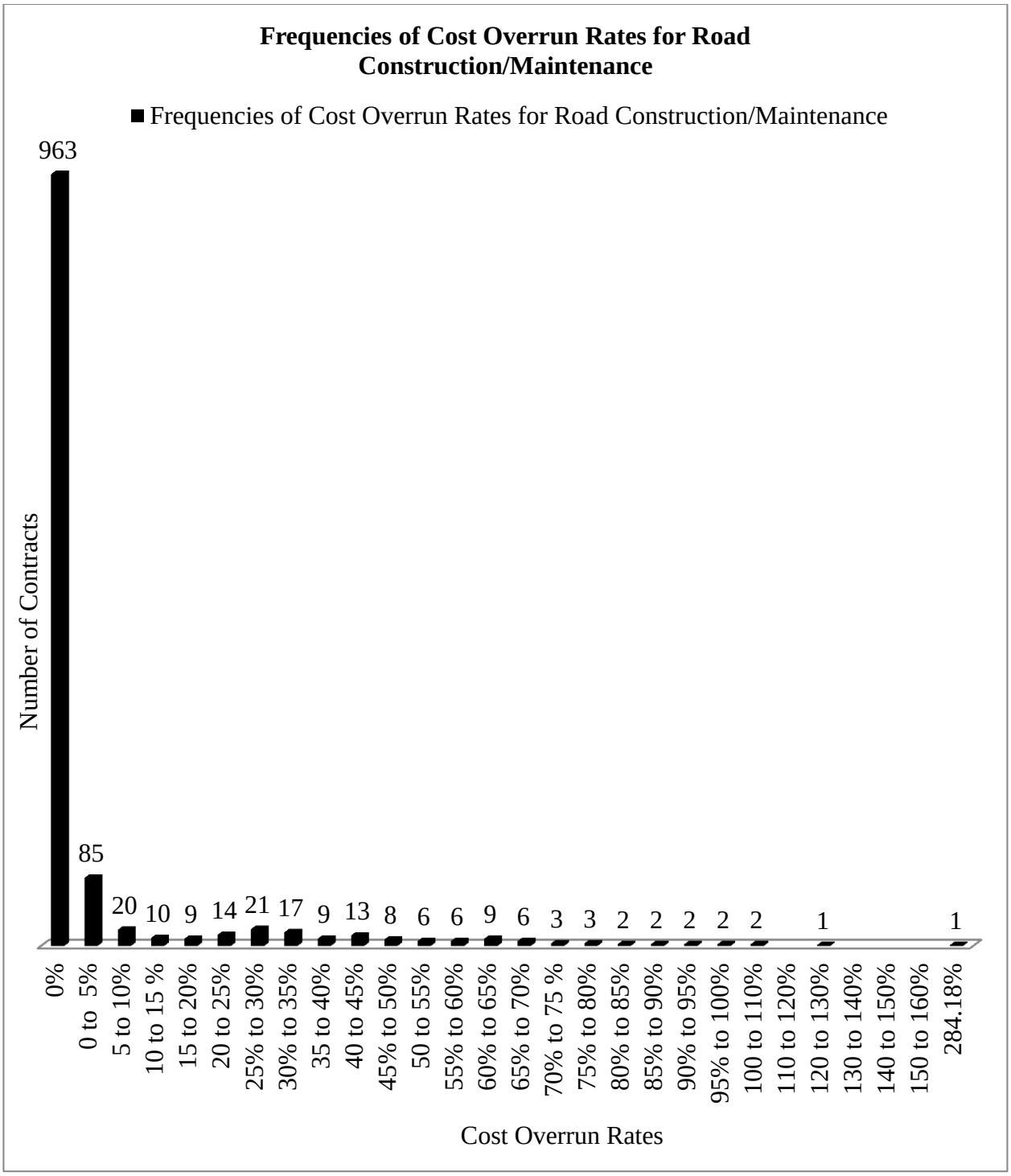

Figure 4.3 Frequency Distribution of Cost Overrun Rates - Road Construction and Maintenance (1994-2009)

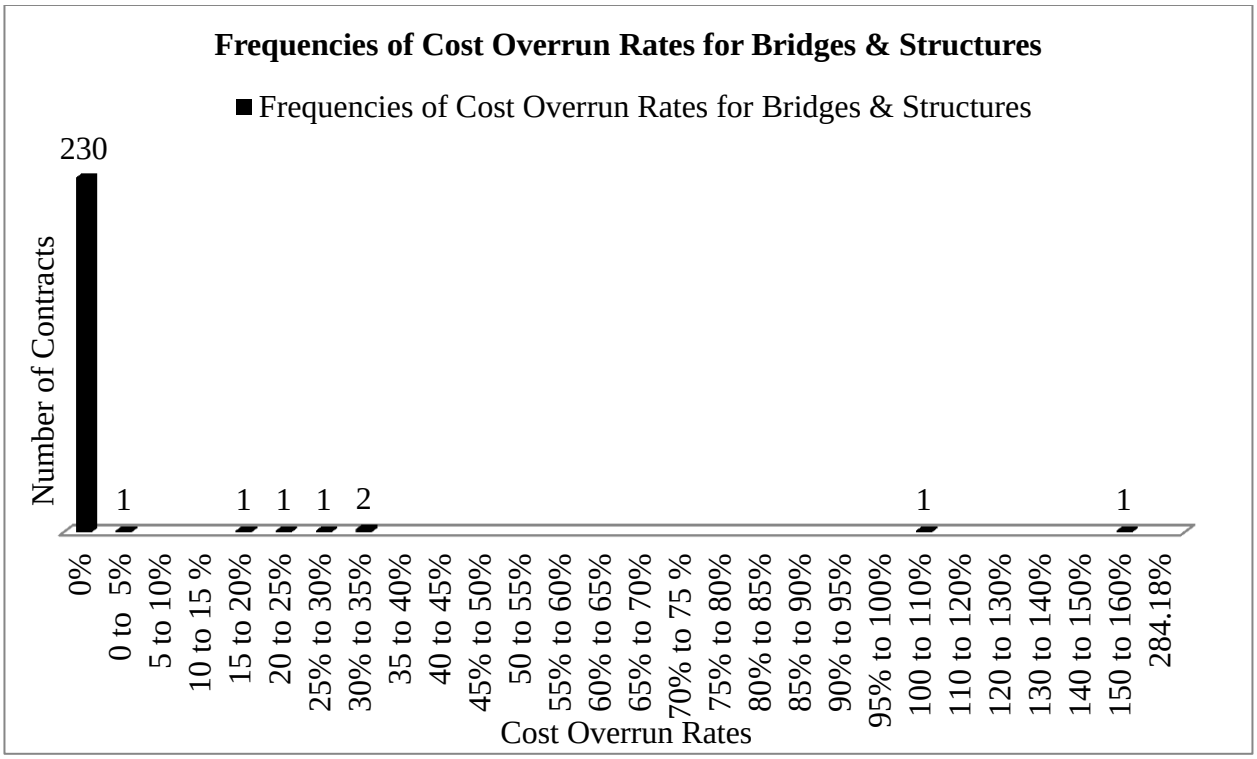

Figure 4.4 Frequency Distribution of Cost Overrun Rates – Bridges and Structures (1994-2009)

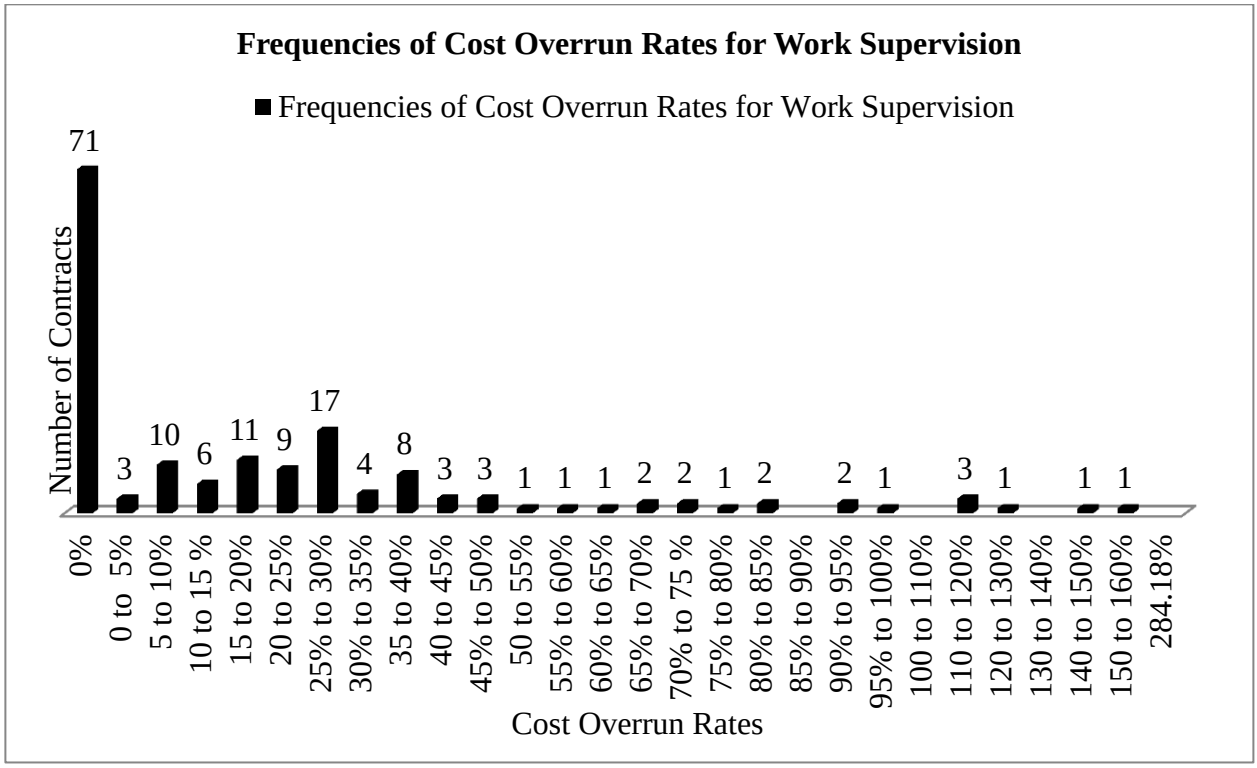

Figure 4.5 Frequency Distribution of Cost Overrun Rates – Work Supervision (1994-2009)

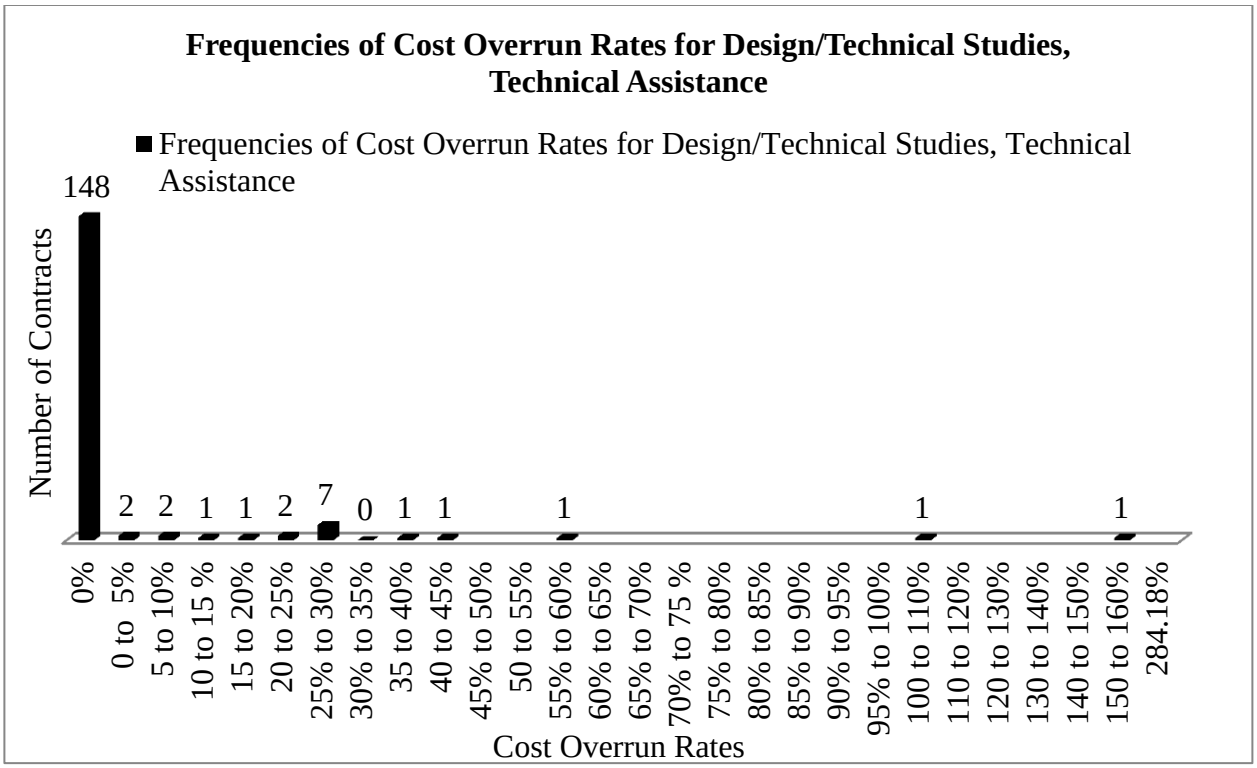

Figure 4.6 Frequency Distribution of Cost Overrun Rates – Design/Technical Studies, Technical Assistance (1994-2009)

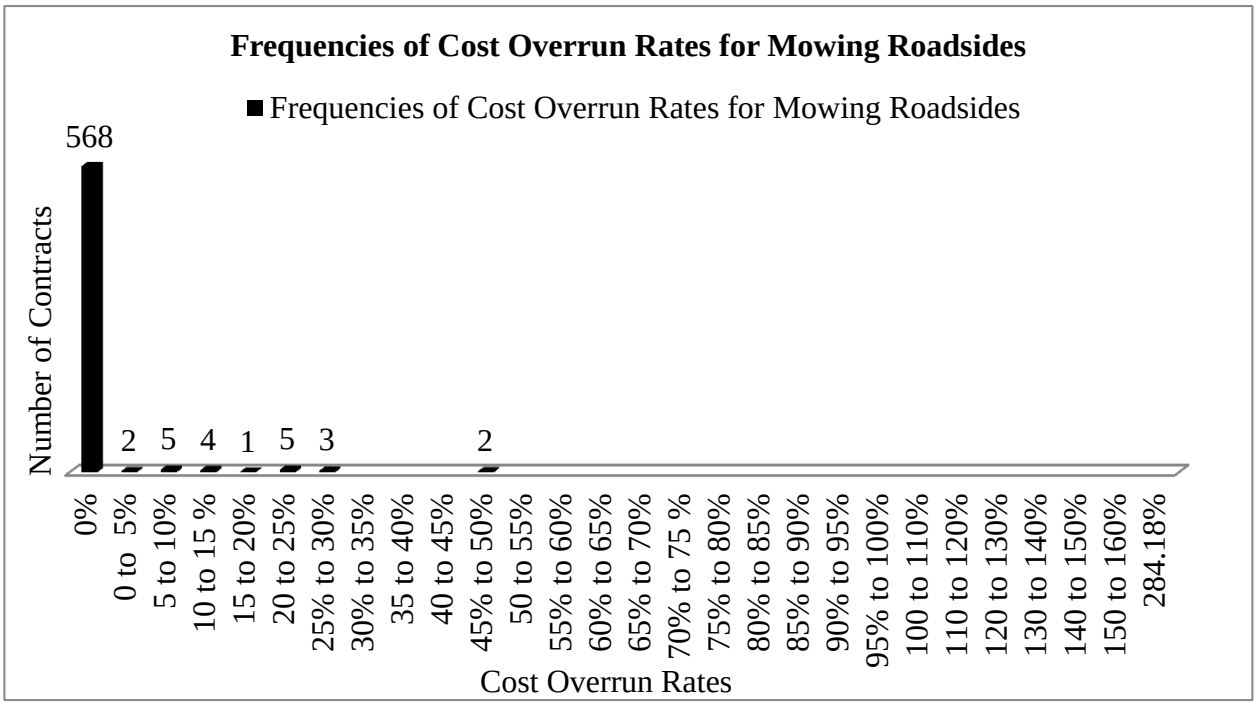

Figure 4.7 Frequency Distribution of Cost Overrun Rates – Mowing Roadsides (1994-2009)

4.3.3.2 Summary of Results for Cost Overrun Rates by Project Type

All types of projects had low average cost overrun rates below six percent except work supervision with averaged 21.23%. Table 4.6 shows the mean of cost overrun rates for each project type, along with standard deviations. These rates look lower than rates of developed countries. The scarcity of financial resources in developing countries is a possible reason for this situation. These lower rates do not necessarily imply a better project management in the case study organization however.

Project Type	Cases	Mean (%)	Standard Deviation (%)
Road Construction/Maintenance	1214	5.50	17.66
Bridges & Structures	238	1.69	13.04
Work Supervision	164	21.23	30.63
Design/Technical Studies, Technical Assistance	168	4.13	16.51
Mowing Roadsides	590	0.67	4.16

Table 4.6 Means and Standard Deviations of Cost Overrun Rates by Project Type

4.3.3.3 Frequency Distributions of Time Overrun Rates by Project Type

Similar to cost overrun rates, frequency distributions of time overrun rates varied with project type. Again, irrespective of project type, the majority of contracts had a zero percent time overrun rate. In general, the range of time overrun rates is greater than the range of cost overrun rates. Time overrun rates ranged from 0% to 270%. The frequency distributions of time overrun rates are shown in Figures 4.8 - 4.12.

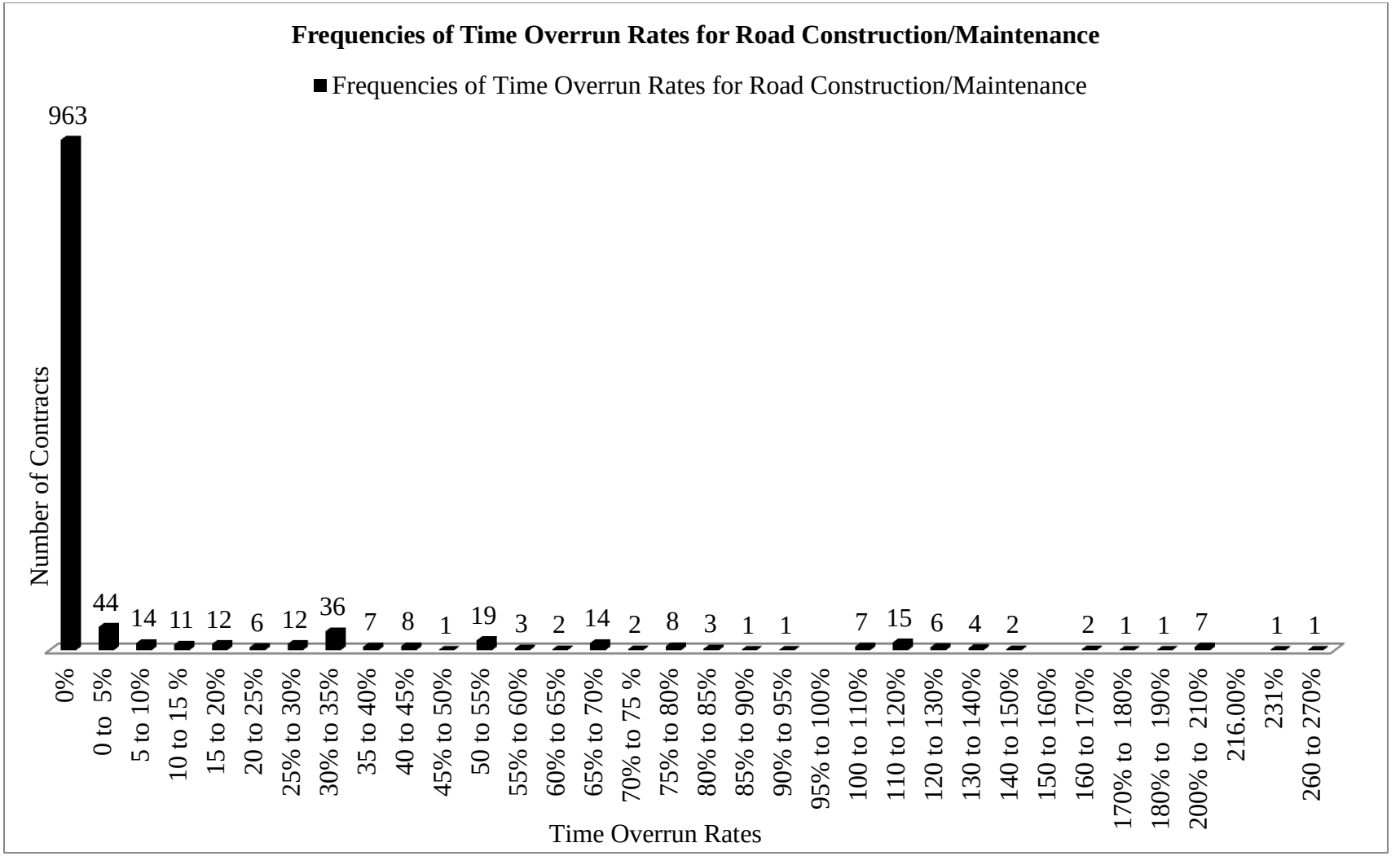

Figure 4.8 Frequency Distribution of Time Overrun Rates – Road Construction/Maintenance (1994-2009)

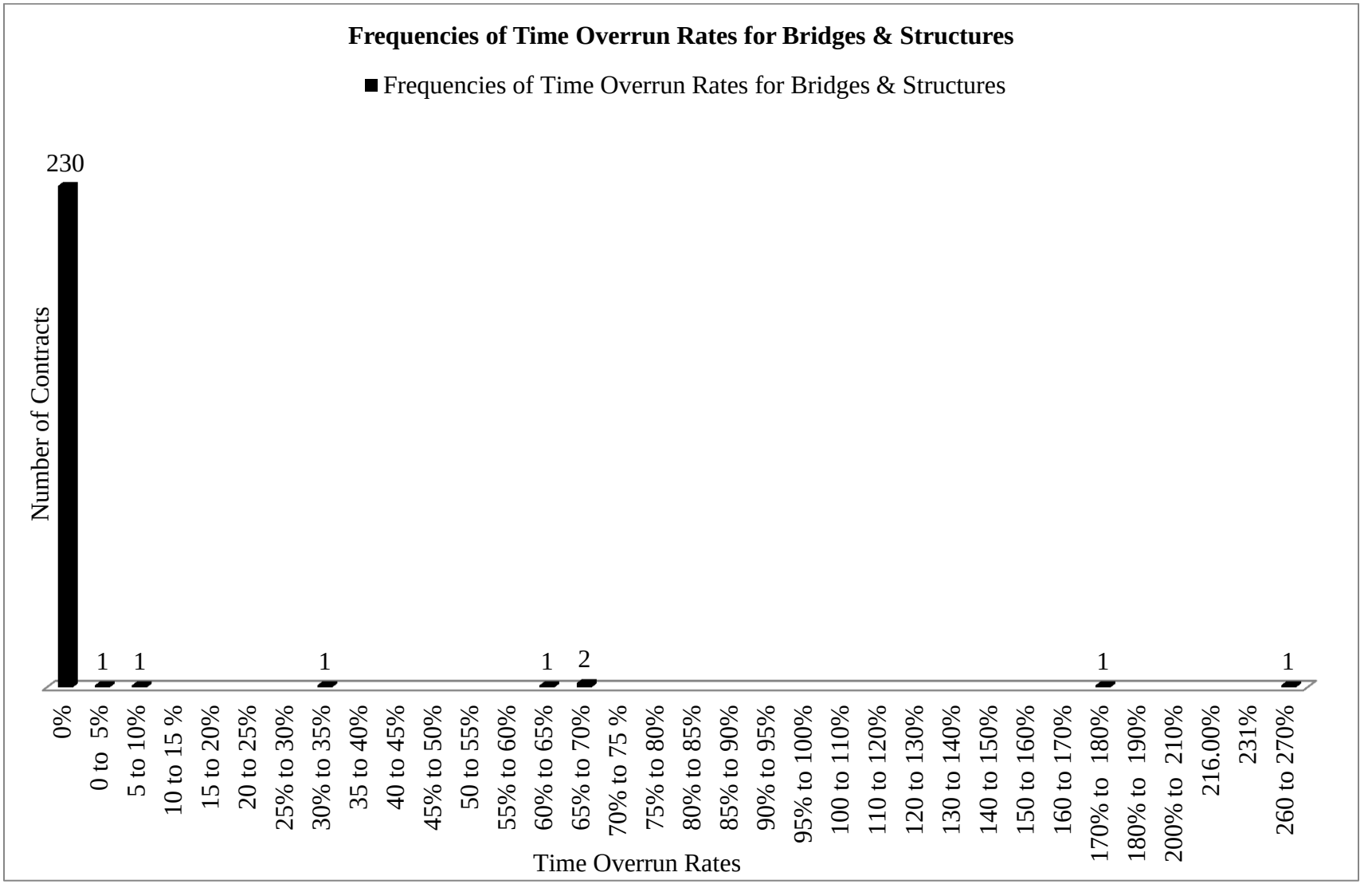

Figure 4.9 Frequency Distribution of Time Overrun Rates – Bridges and Structures (1994-2009)

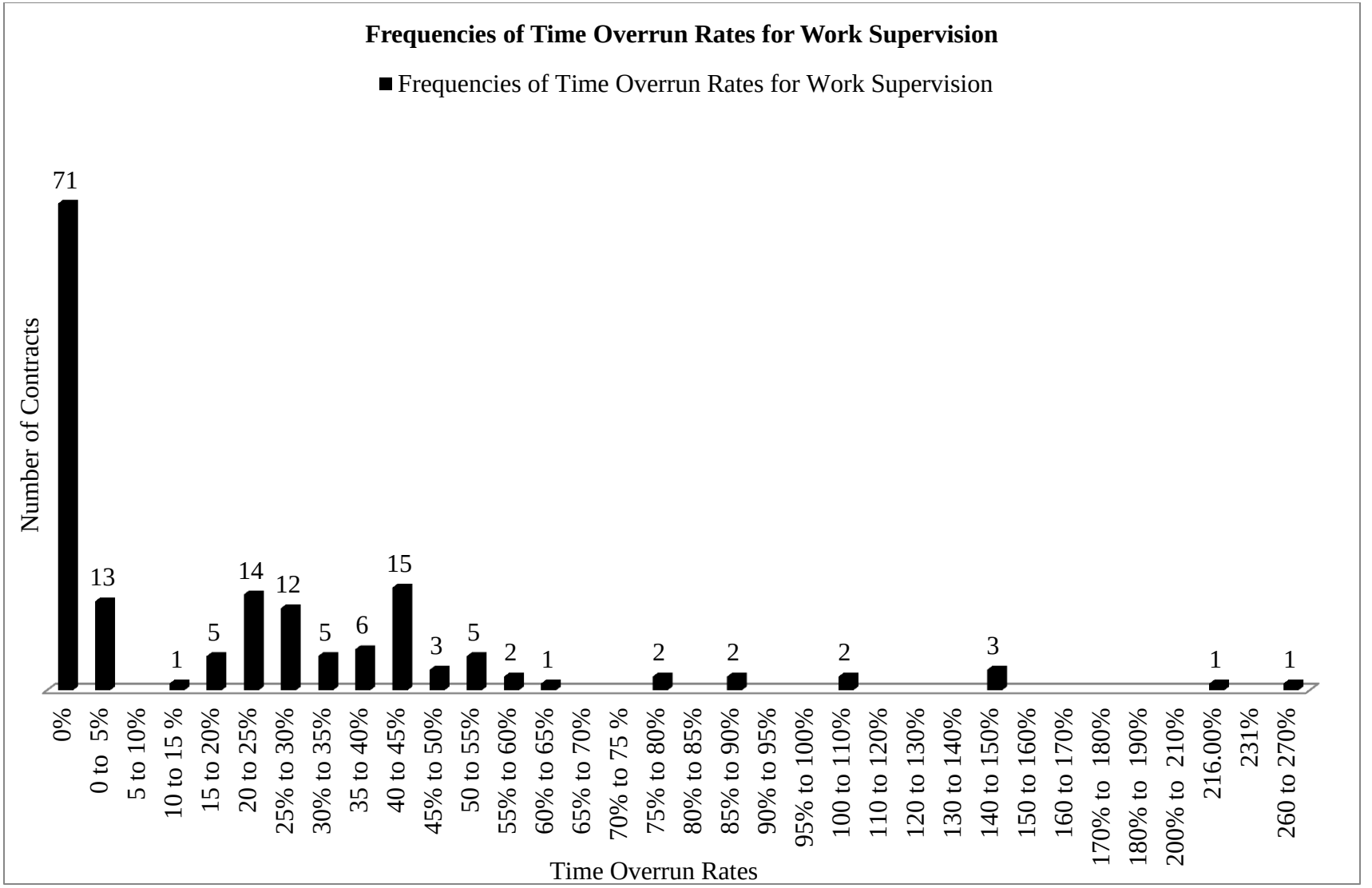

Figure 4.10 Frequency Distribution of Time Overrun Rates – Work Supervision (1994-2009)

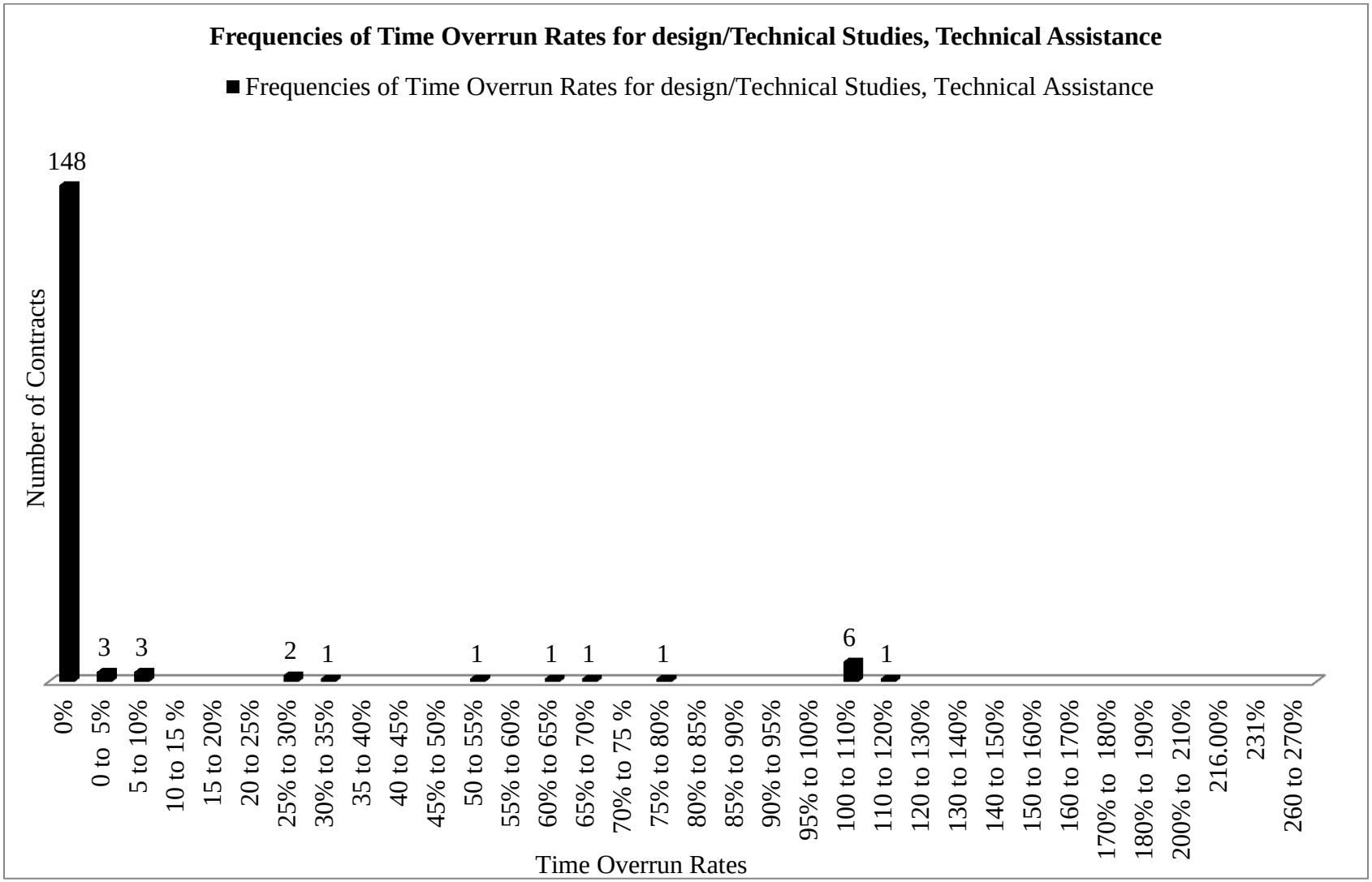

Figure 4.11 Frequency Distribution of Time Overrun Rates – Design/Technical Studies, Technical Assistance (1994-2009)

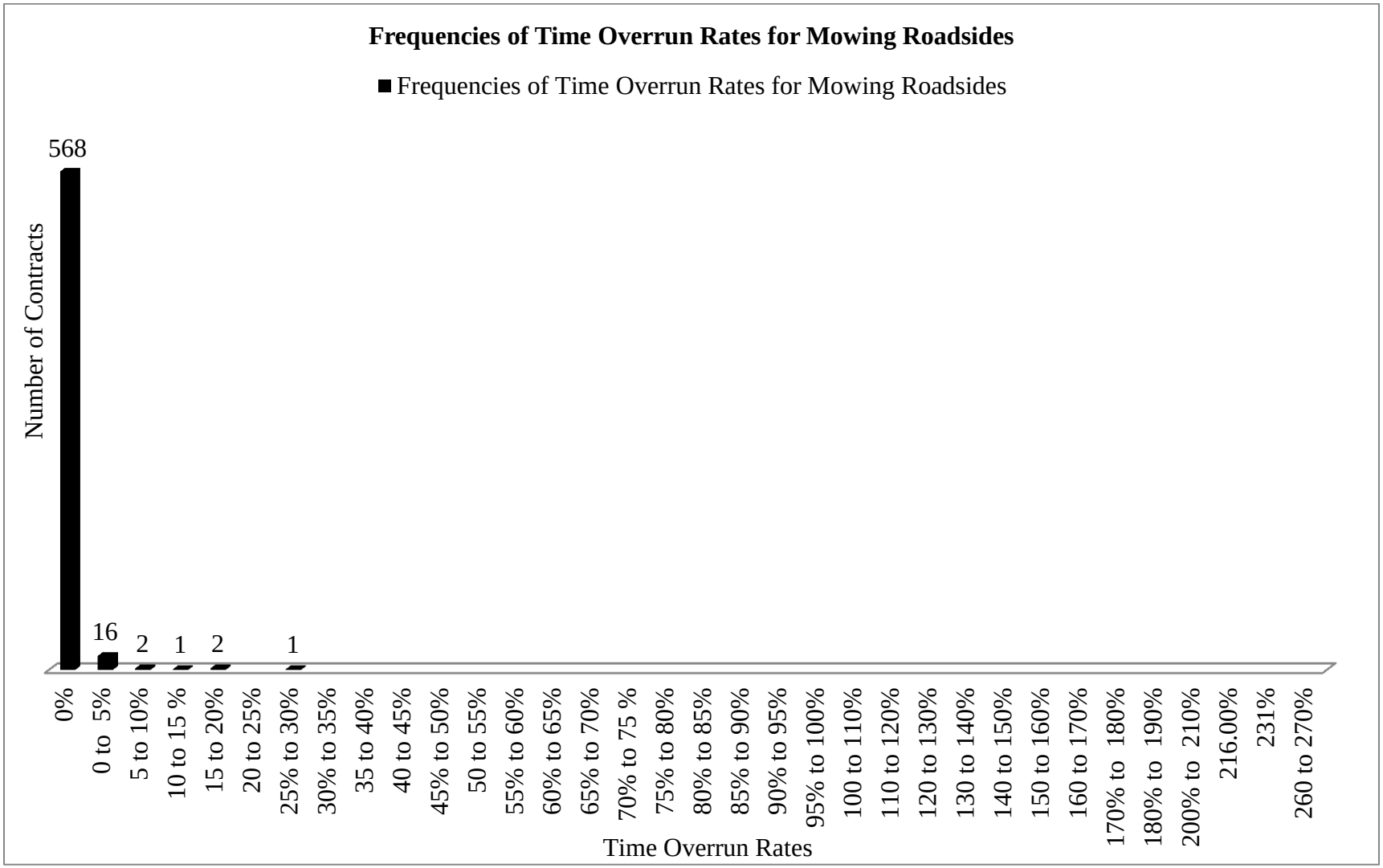

Figure 4.12 Frequency Distribution of Time Overrun Rates – Mowing Roadsides (1994-2009)

4.3.3.4 Summary of Results for Time Overrun Rates by Project Type

The means of time overrun rates had greater values compared to those for cost overrun rates when classified by project type, except for mowing roadsides. Work supervision had the highest time overrun rate at 22.93%. Standard deviations were larger than for cost overruns.

Project Type	Cases	Mean (%)	Standard Deviation (%)
Road Construction/Maintenance	1214	10.43	31.01
Bridges & Structures	238	2.81	21.72
Work Supervision	164	22.93	37.25
Design/Technical Studies, Technical Assistance	168	6.39	22.52
Mowing Roadsides	590	0.17	1.57

Table 4.7 Means and Standard Deviations of Time Overrun Rates by Project Type (1994-2009)

4.3.4 Project Ownership

To investigate if project ownership, or source of funding influenced cost overruns and time delays, contracts were studied by source of funding. For each source of funding, frequency distributions of cost overrun rates and time delays were graphed, and means and standard deviations computed. Results are illustrated in the Figures 4.13-4.19.

4.3.4.1 Frequency Distributions of Cost Overrun Rates by Project Ownership

When classified by project ownership, frequency distributions of cost overrun rates varied with the project type classification. For several sources of funding, most projects had a cost overrun rate greater than zero. Most contracts funded by Government only had lower rates or no time overruns.

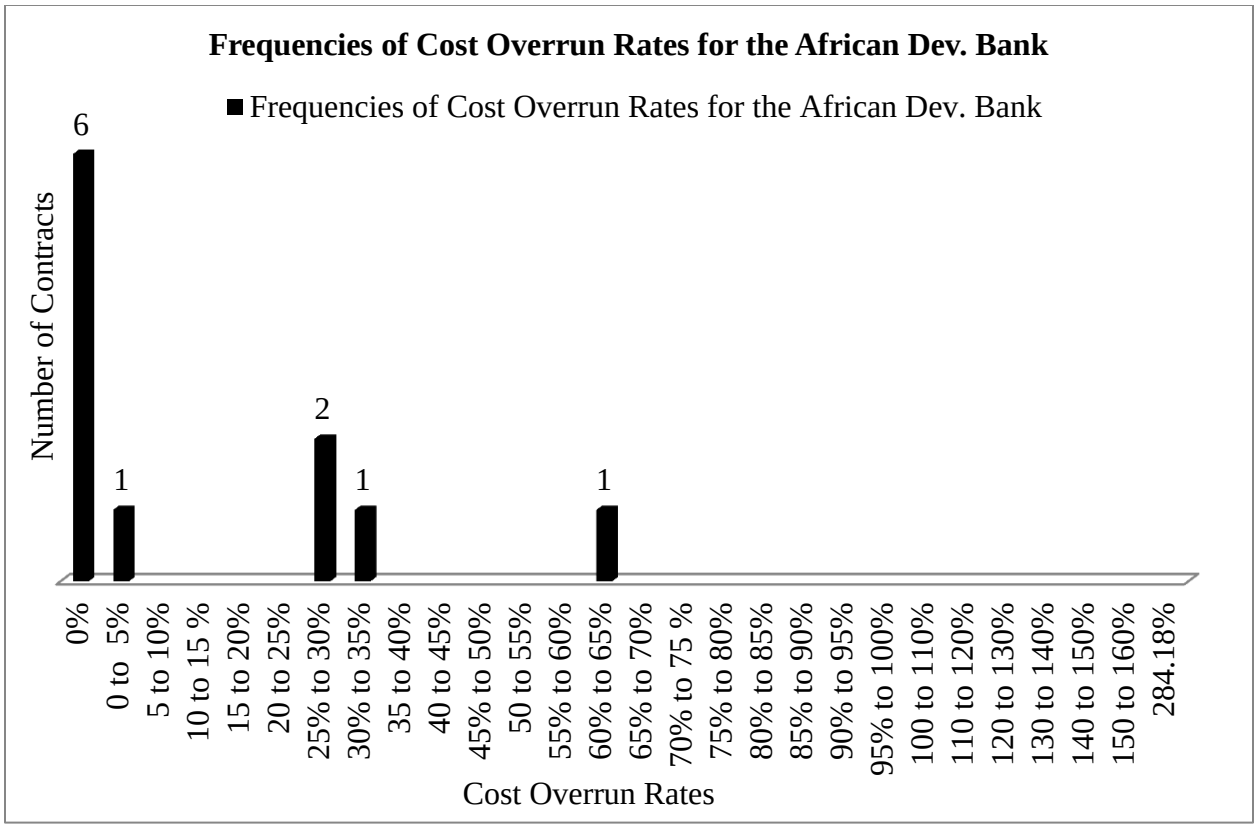

Figure 4.13 Frequency Distribution of Cost Overrun Rates –
Project Co-Funded by the African Dev. Bank (1994-2009)

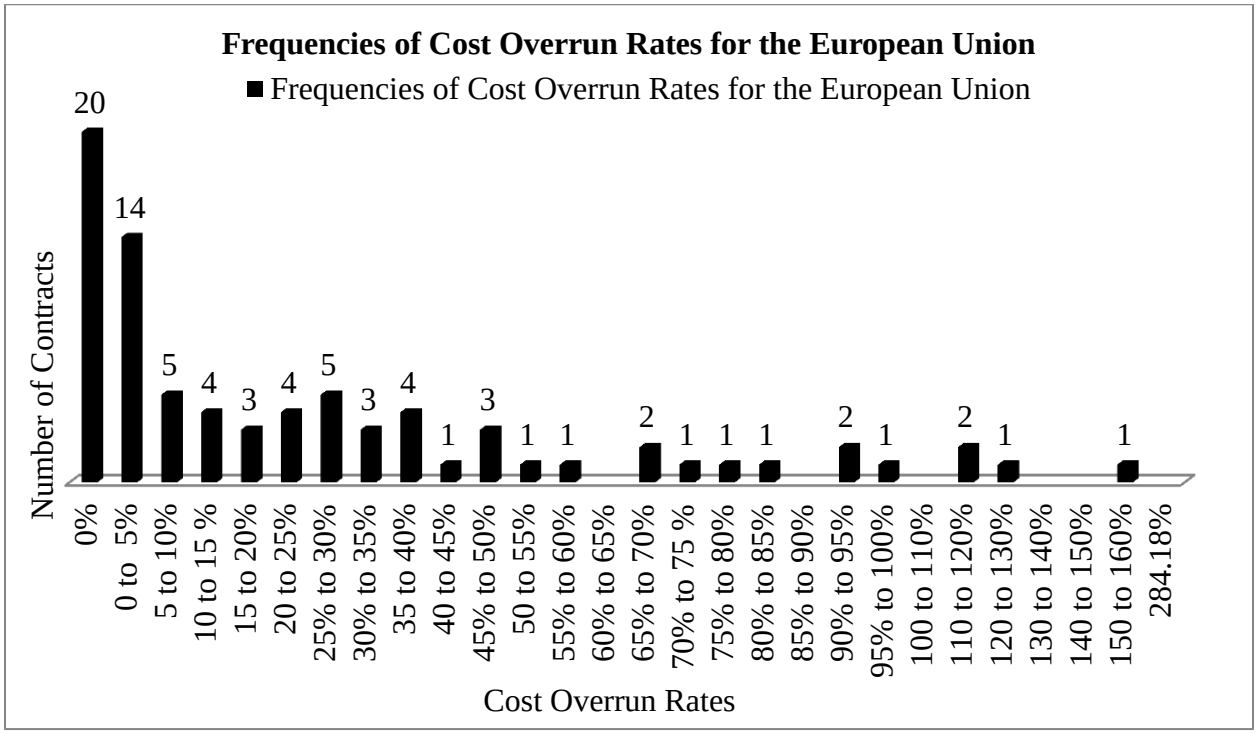

Figure 4.14 Frequency Distribution of Cost Overrun Rates –
Project Co-Funded by the European Union (1994-2009)

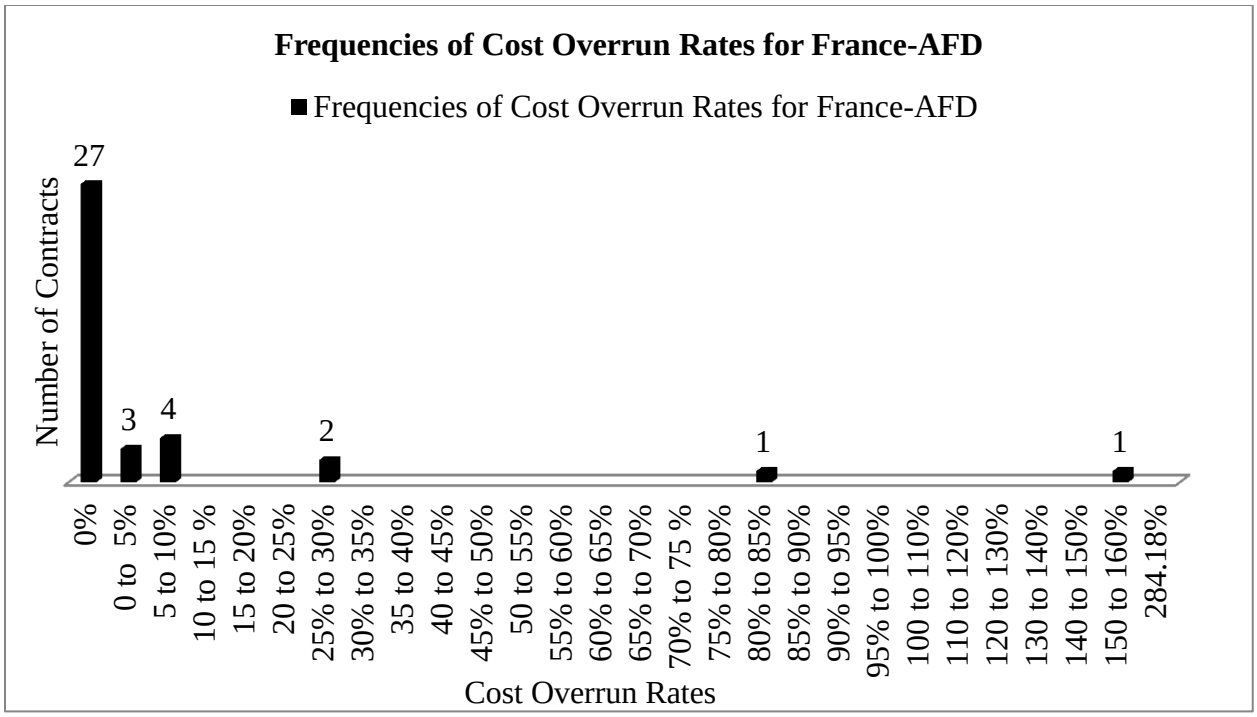

Figure 4.15 Frequency Distribution of Cost Overrun Rates –
Project Co-Funded by France – AFD (1994-2009)

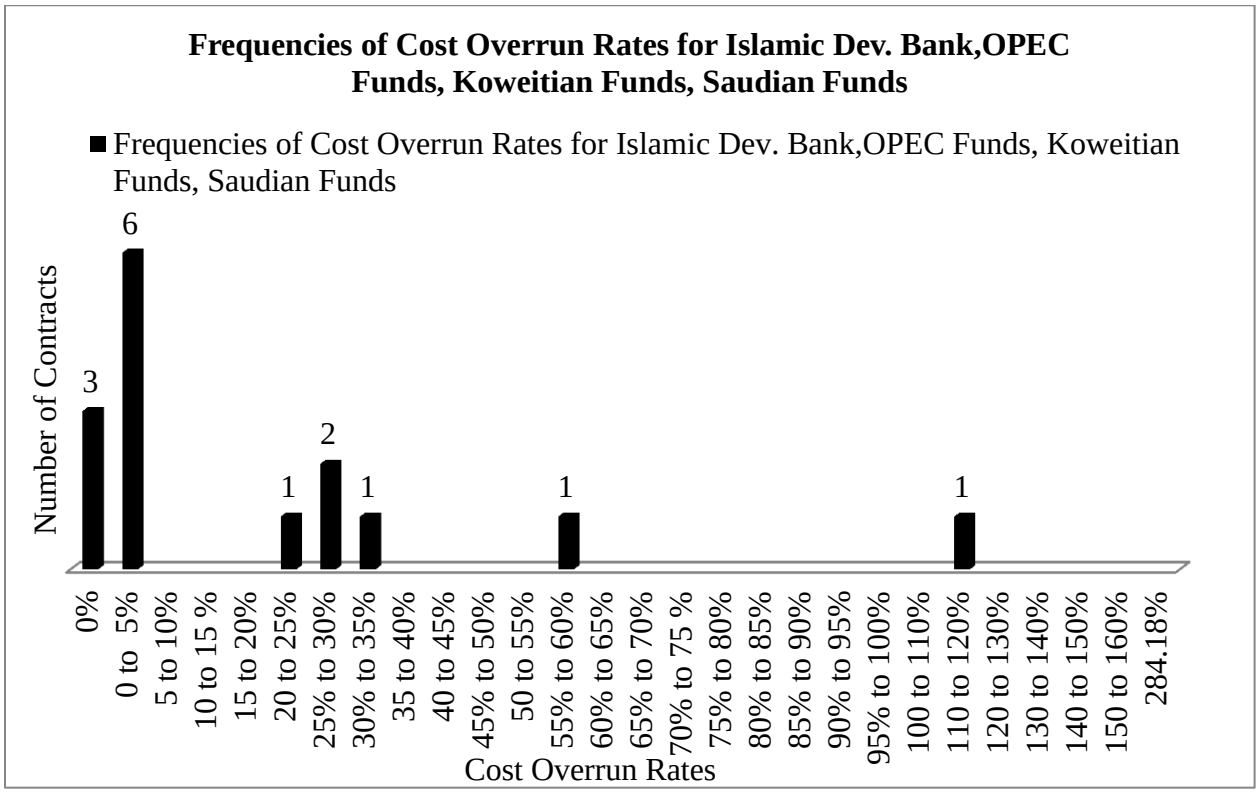

Figure 4.16 Frequency Distribution of Cost Overrun Rates – Project Co-Funded by Islamic Dev. Bank, OPEC Funds, Koweitian Funds, Saudian Funds (1994-2009)

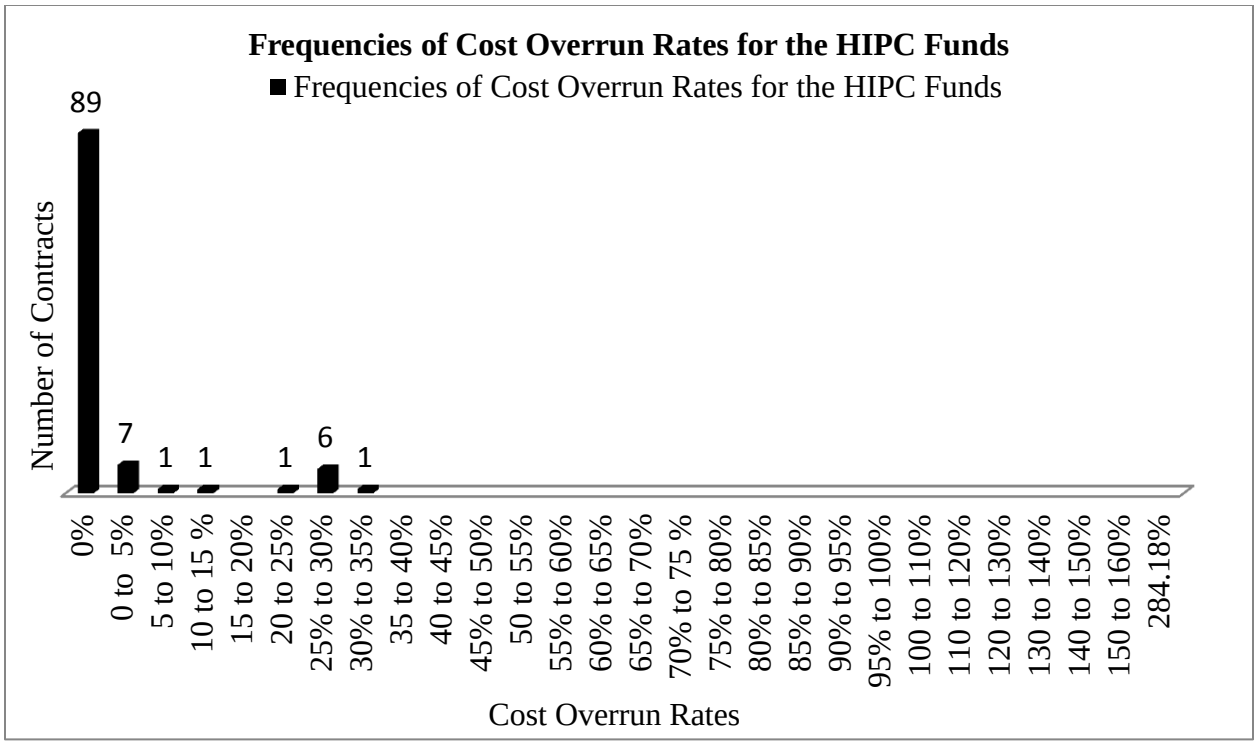

Figure 4.17 Frequency Distribution of Cost Overrun Rates – Project Co-Funded by HIPC Funds (1994-2009)

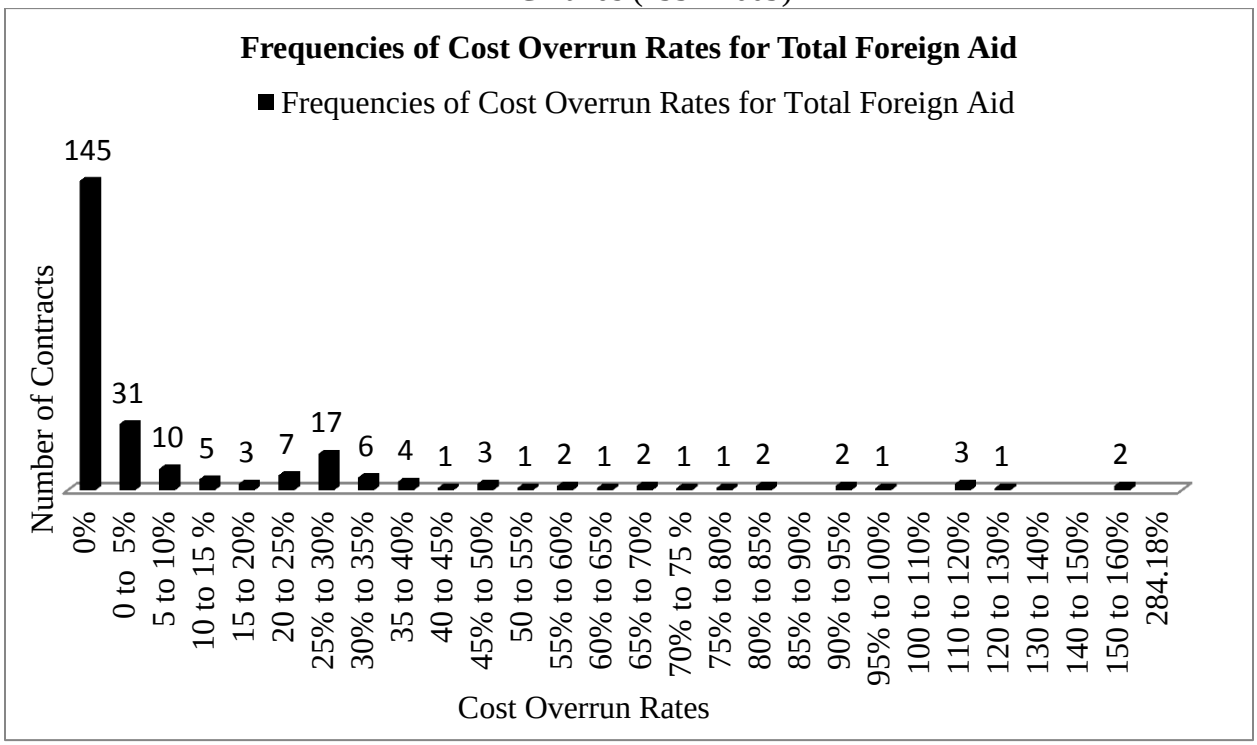

Figure 4.18 Frequency Distribution of Cost Overrun Rates – Project Co-Funded by Overall Foreign Aid (1994-2009)

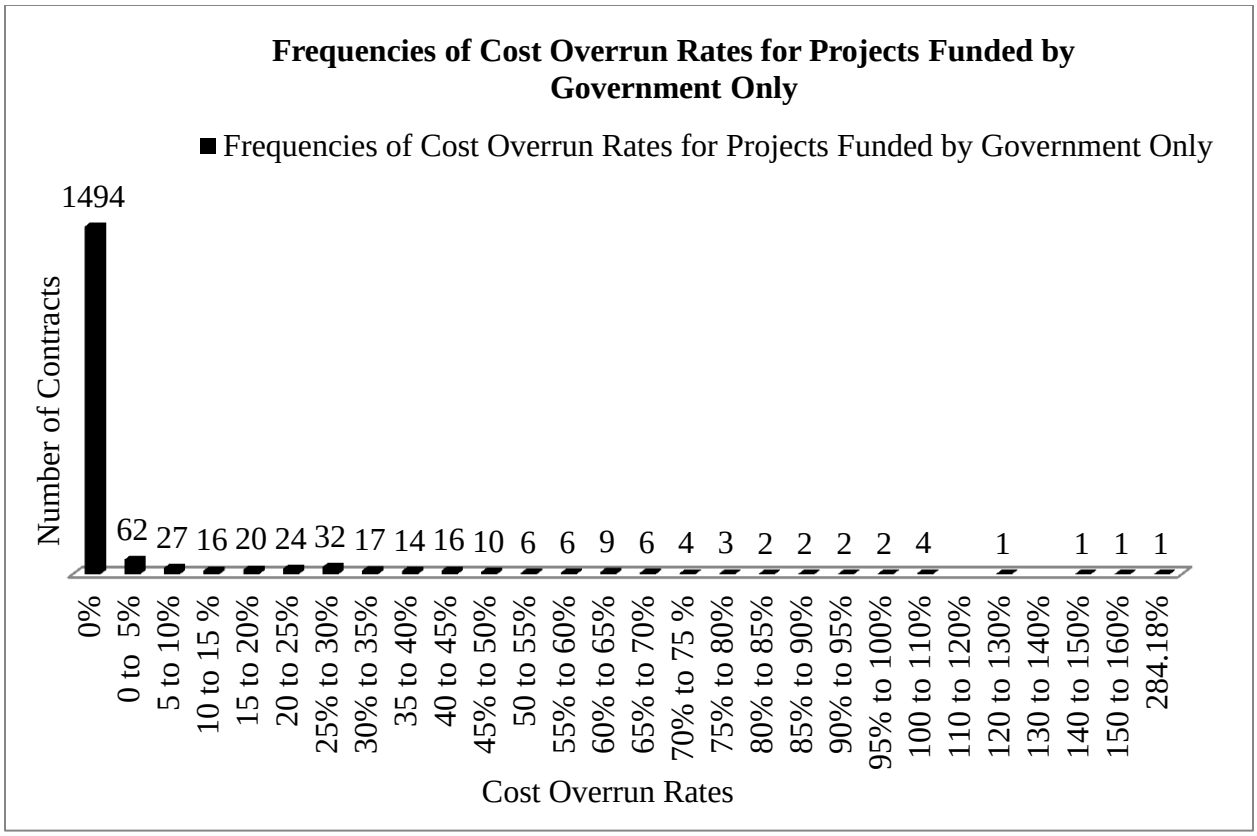

Figure 4.19 Frequency Distribution of Cost Overrun Rates –
Project Funded by Government Only (1994-2009)

4.3.4.2 Summary of Results for Cost Overrun Rates by Project Ownership

Projects funded by HIPC Funds had the lowest mean cost overrun rates, and the European Union co-funded projects had the highest. Overall, foreign aid projects had higher mean cost overrun rates than projects funded by government only. The related ratio of means was 2.60. There were a large number of both government and foreign aid projects in the dataset so that the computed means can be considered reliable.

Project Ownership	Cases	Mean (%)	Standard Deviation (%)
African Dev. Bank	11	13.57	20.66
Belgium	1	22.68	-
European Union	80	26.51	35.04
France-AFD	38	8.75	28.63
HIPC Funds	106	2.27	8.44
Islamic Dev. Bank(IDB),OPEC Funds, Koweitian Funds, Saudian Funds	15	18.9	30.7
Total Foreign Aid	251	12.42	26.62
Government Only	1782	4.77	16.47

Table 4.8 Means and Standard Deviations of Cost Overrun Rates by Project Ownership (1994-2009)

4.3.4.3 Frequency Distributions of Time Overrun Rates by Project Ownership

Contracts funded by Government only and HIPC contracts had the largest number of cases with zero time overruns. On the other extreme, European Union contracts had more time overruns compared to others. Frequency distributions of time overrun rates by project ownership are shown in Figures 4.20-4.26.

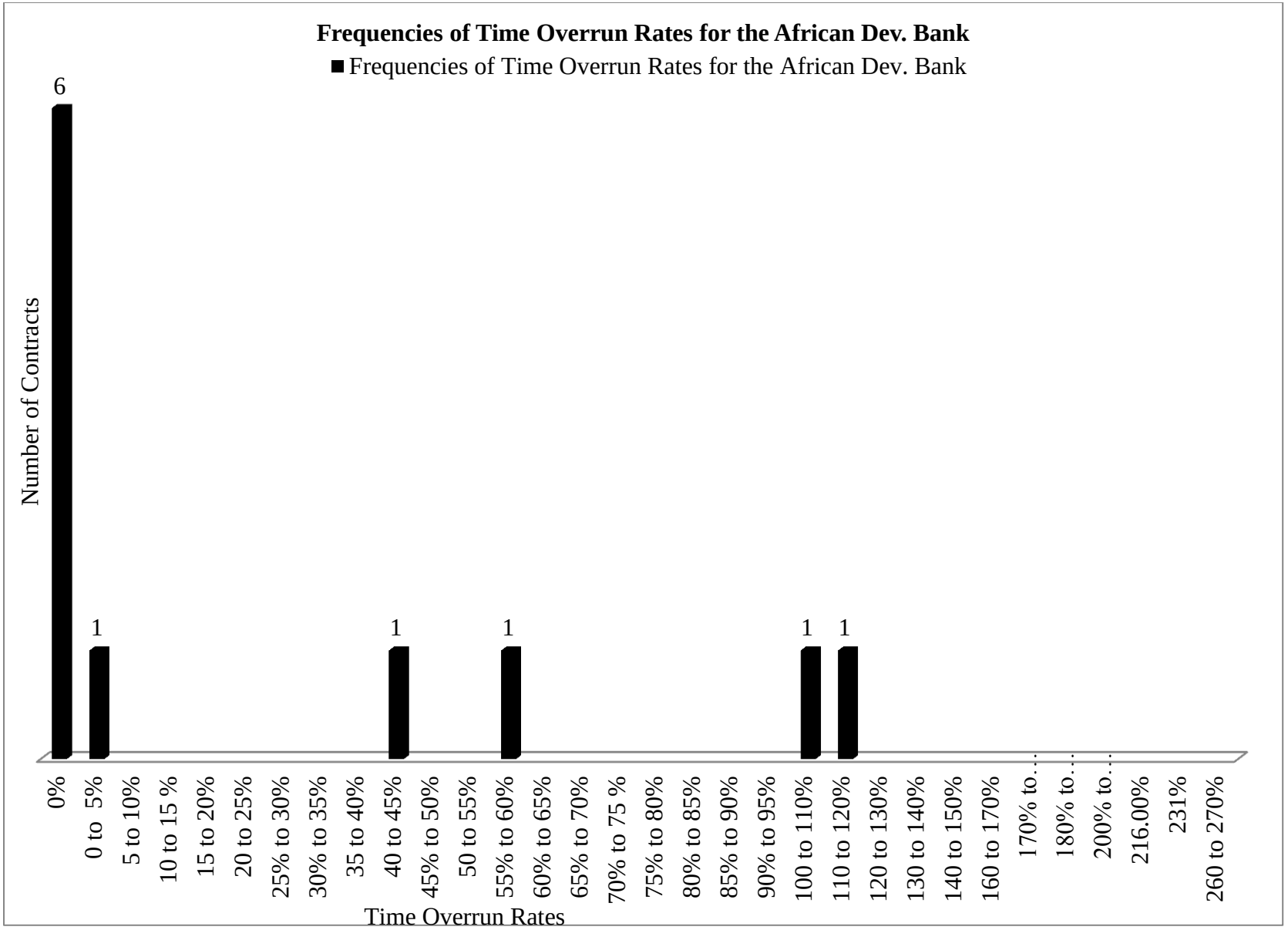

Figure 4.20 Frequency Distribution of Time Overrun Rates – African Dev. Bank Co-Funded Projects (1994-2009)

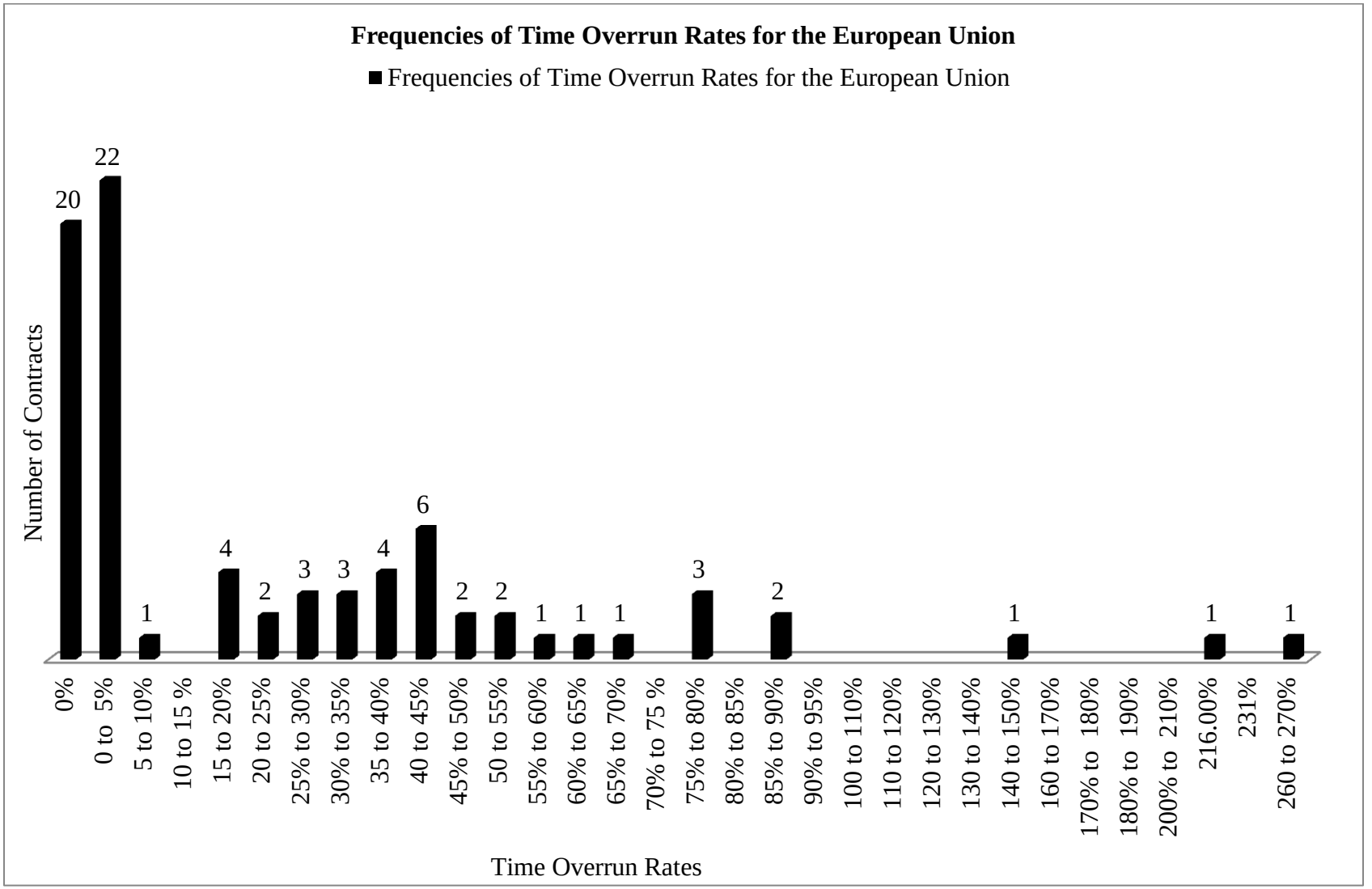

Figure 4.21 Frequency Distribution of Time Overrun Rates – European Union Co-Funded Projects (1994-2009)

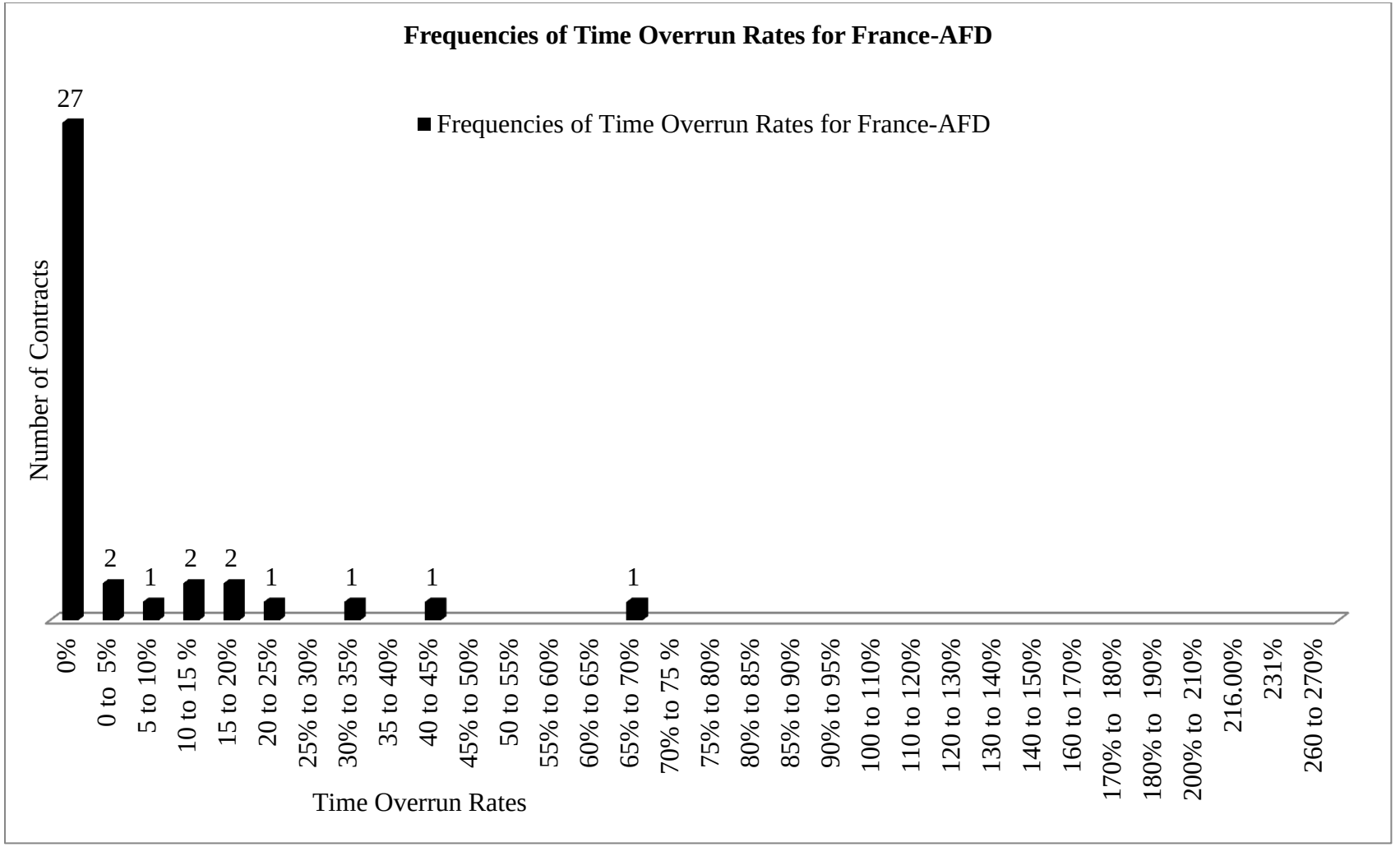

Figure 4.22 Frequency Distribution of Time Overrun Rates – France-AFD Co-Funded Projects (1994-2009)

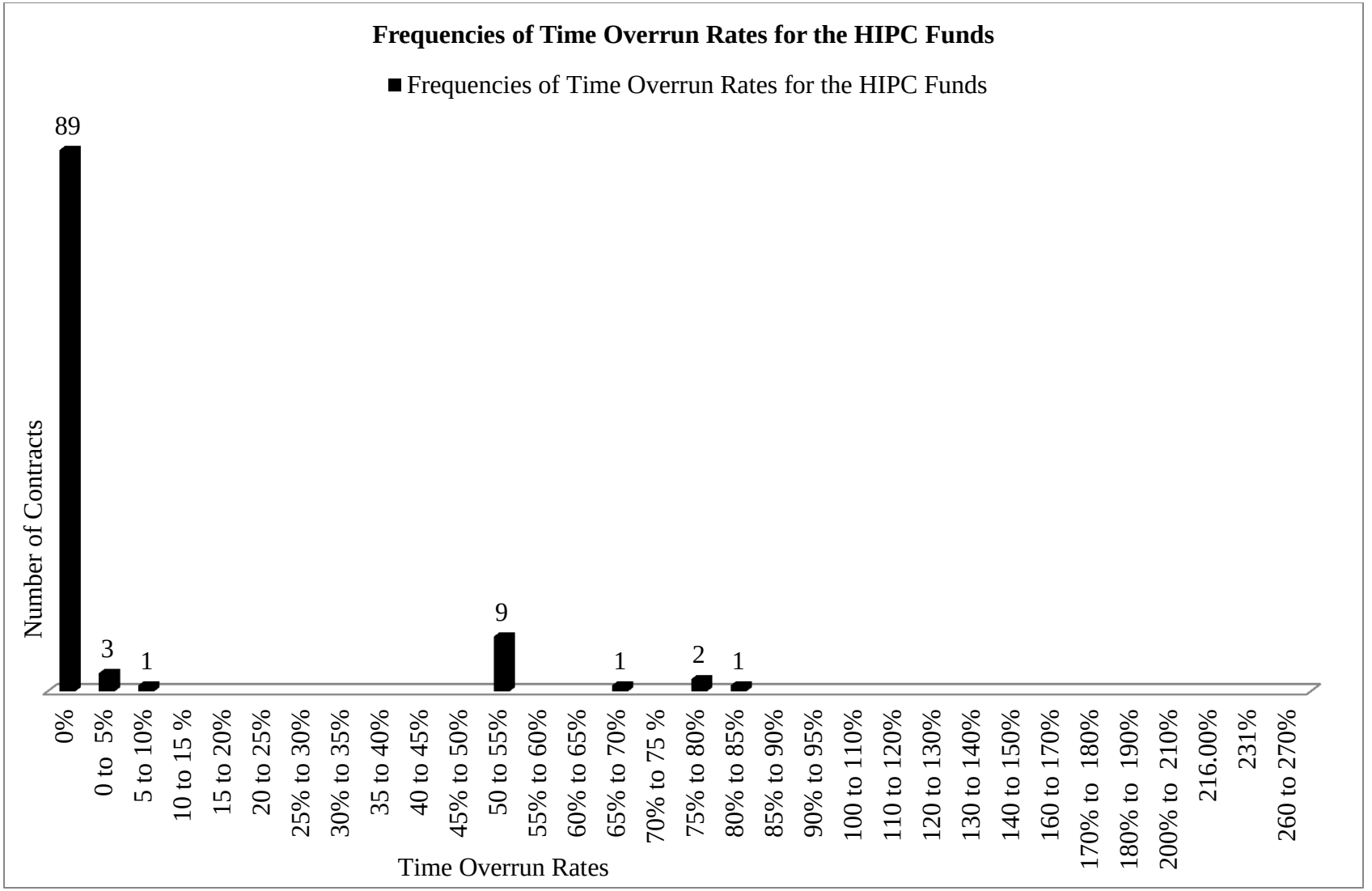

Figure 4.23 Frequency Distribution of Time Overrun Rates – HIPC Co-Funded Projects (1994-2009)

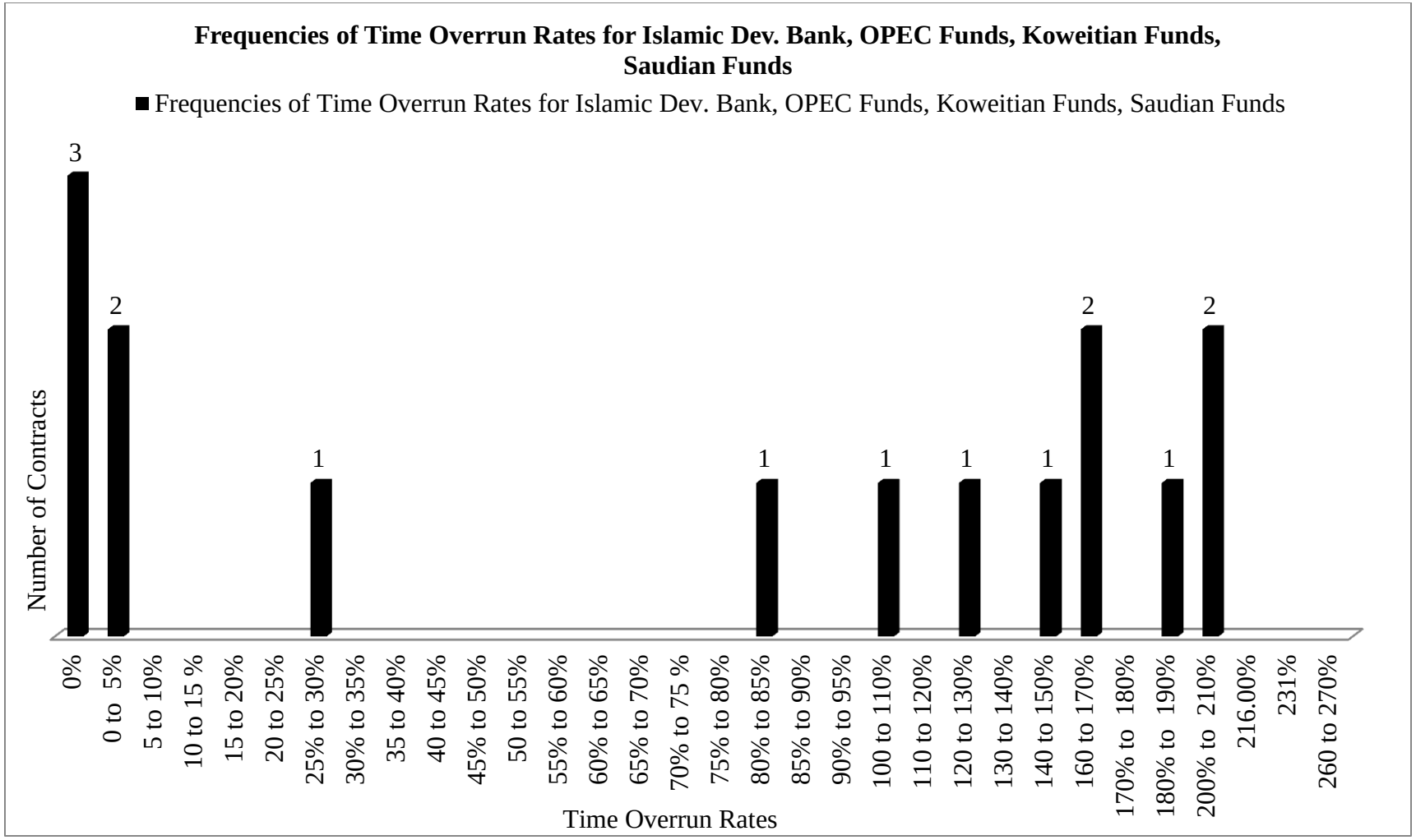

Figure 4.24 Frequency Distribution of Time Overrun Rates – Islamic Dev. Bank, OPEC Funds, Koweitian Funds, Saudian Funds Co-Funded Projects (1994-2009)

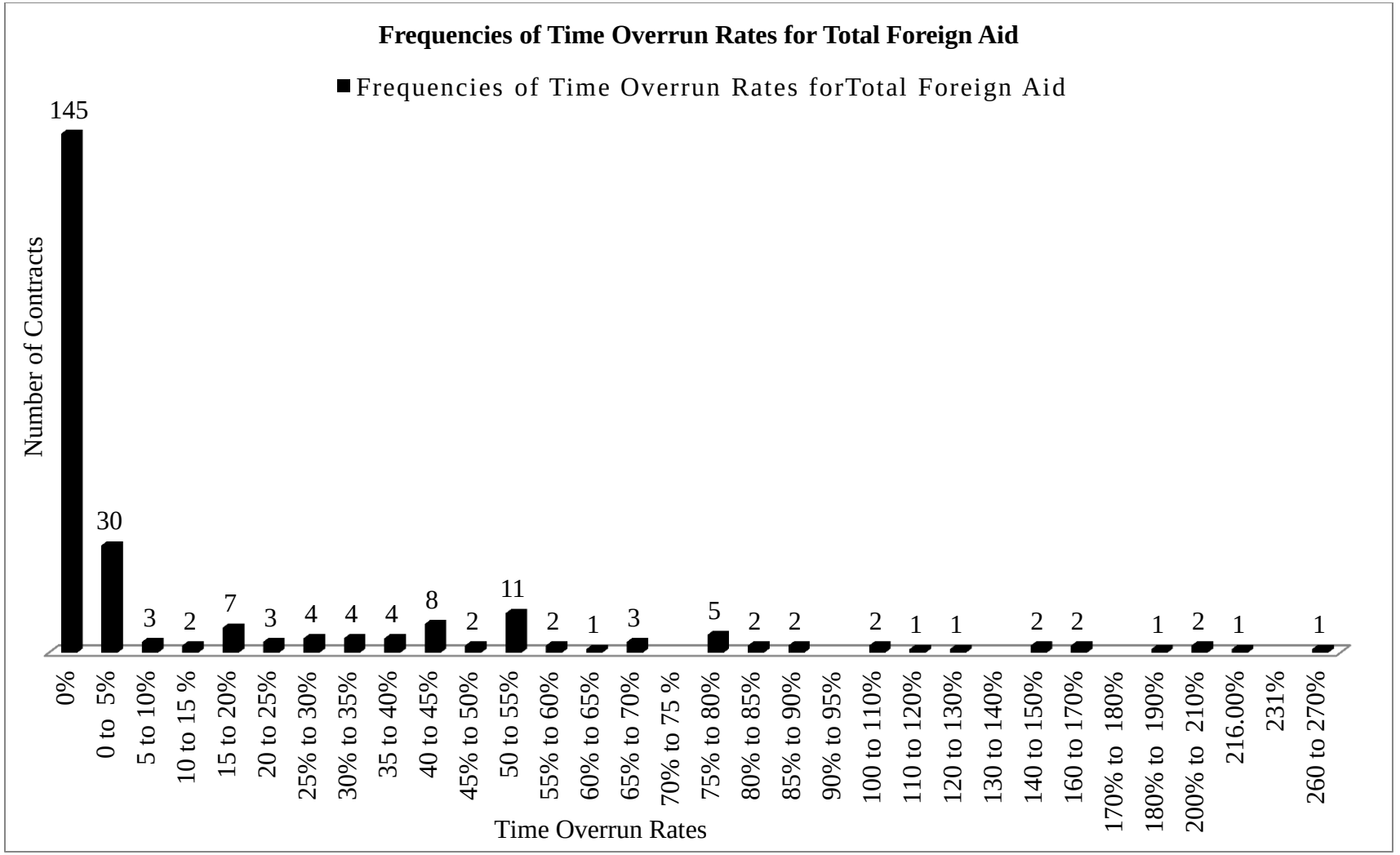

Figure 4.25 Frequency Distribution of Time Overrun Rates – Project Co-Funded by Overall Foreign Aid (1994-2009)

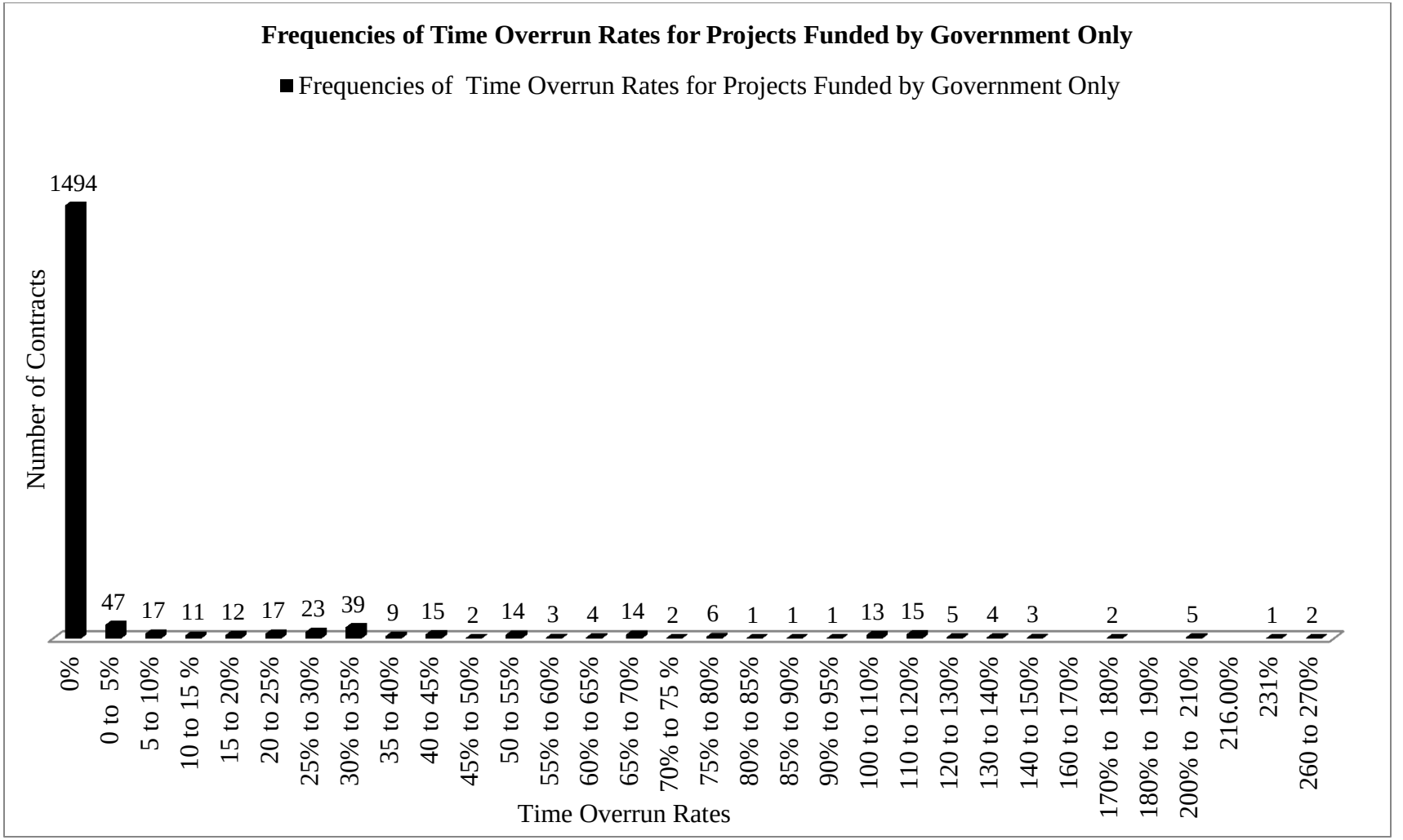

Figure 4.26 Frequency Distribution of Time Overrun Rates – Project Funded by Government Only (1994-2009)

4.3.4.4 Summary of Results for Time Overrun Rates by Project Ownership

Similarly to the analysis of contracts by project type, the mean time overrun rates were higher overall when compared to cost overrun rates. However, the trends were different; AFD projects had the lowest time overrun rates, and IDB related projects had the highest. Globally, foreign aid projects experienced larger time overrun rates compared to projects funded by Government only. The corresponding ratio of means is 2.56, which is close to the 2.60 ratio found above when comparing cost overrun rates for the two types of ownership.

Project Ownership	Cases	Mean (%)	Standard Deviation (%)
African Dev. Bank	11	28.53	43.72
Belgium	1	18.42	-
European Union	80	26.49	44.83
France-AFD	38	5.98	14.01
HIPC Funds	106	7.12	19.34
Islamic Dev. Bank(IDB),OPEC Funds, Koweitian Funds, Saudian Funds	15	93.30	82.12
Total Foreign Aid	251	19.26	41.40
Government Only	1782	7.54	25.90

Table 4.9 Means and Standard Deviations of Time Overrun Rates
by Project Ownership (1994-2009)

4.3.5 Project Size

Project size, measured in monetary value, may have an influence on cost overrun and time delay rates. This was the third assumption, which was tested by the researcher. Contracts were classified in six classes from the smallest amounts to the largest ones. Small size contracts, which had an amount less than 100,000,000 XAF constituted 64.20% of the number of contracts studied. The number of contracts in each group decreased gradually when project size increased. The largest contracts, which had an amount greater than five billion XAF, represented 0.67% of

the number of contracts studied. For each group, means and standard deviations were calculated, and linear regression was performed to find the relationship between project size, and cost and time overrun rates. Results are presented below.

4.3.5.1 Relationship between Project Size and Cost Overrun Rate

No clear relationship could be directly observed between the size of project, in monetary value and cost overrun rates as shown in Table 4.10. No trend was observed with correlation and statistical significance for all data. However, the general trend is that cost overrun rates decrease when project size increases: this relation was observed with statistical significance, for contract amounts between 100,000,000 XAF and 250,000,000 XAF. These results are presented in Table 4.10 and Figure 4.27. The low mean value for projects under 1000,000,000 XAF might be due to "mowing projects" which are not generally a part of heavy construction projects.

Because these results did not agree with the literature, which showed cost overruns increasing along with project size, the researcher conducted testing to determine the relationship between project size and cost overrun size, and to compare results to the literature.

Project Size (XAF)	Cases	Mean Cost Overrun Rate (%)	Standard Deviation	Linear Regression		
				X Coefficient	R Square	Level of Significance
Under 100,000,000	1538	2.70	14.05	-1.17E-09	0.0047	0.4742
100,000,000 – 250,000,000	349	11.79	26.12	-2.5E-09	0.0826	0.0024
250,000,000 – 700,000,000	293	6.93	16.54	5.57E-11	0.0010	0.7753
700,000,000– 2,000,000,000	164	6.24	13.92	-1.7E-11	0.0010	0.8113
2,000,000,000– 5,000,000,000	36	4.85	9.57	-1.262E-11	0.0072	0.7458
Over 5,000,000,000	16	9.17	15.25	5.32E-12	0.4980	0.1832
All	2396	4.85	16.89	-3.4E-12	0.0012	0.4940

Table 4.10 Project Size and Cost Overrun Rates– Means, Standard Deviations, and Linear Regressions (1994-2009)

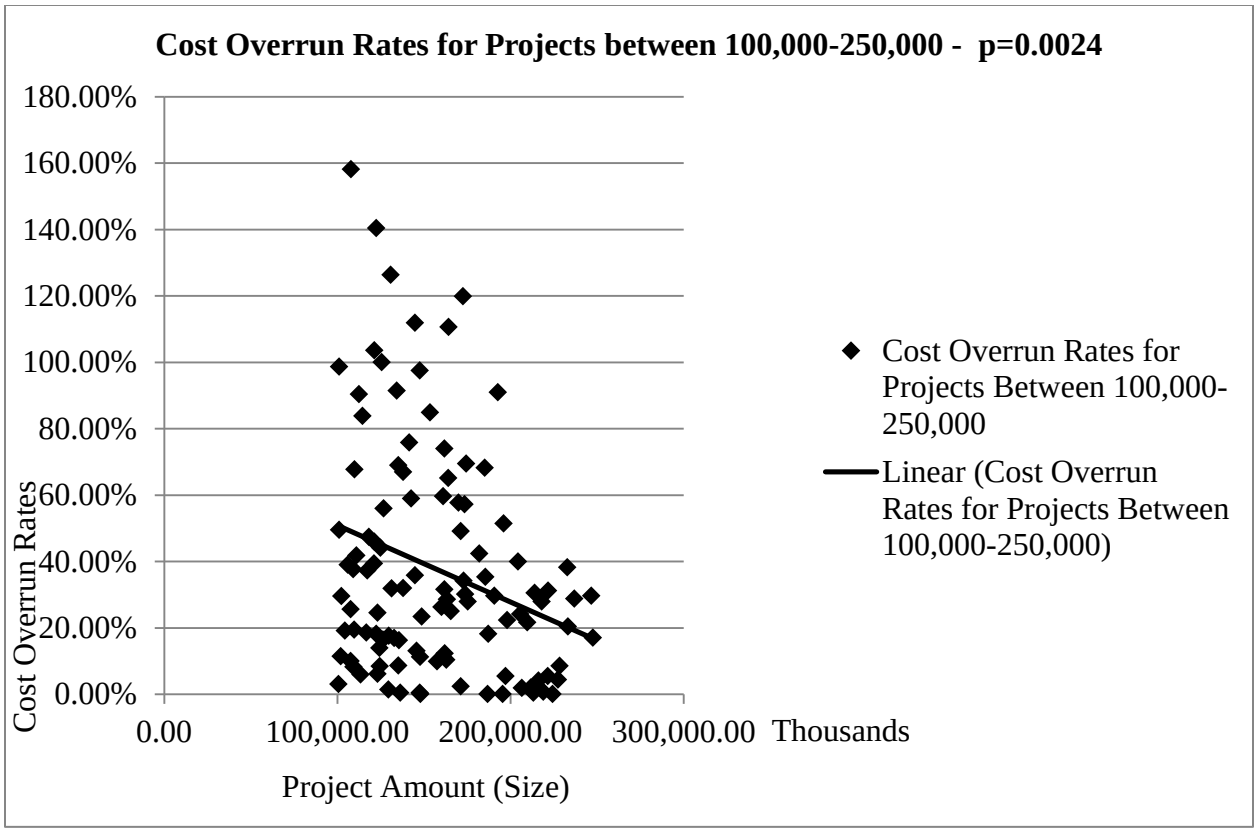

Figure 4.27 Scatter plot of the Relationship between
Project Size and Cost Overrun Rate (110 cases, 1994-2009)

4.3.5.2 Relationship between Project Size and Cost Overrun Size Expressed in Monetary Value

It was observed that means of the size of cost overruns increased when project size increased. Overall, linear regressions confirmed this relationship and were statistically significant, except for project sizes between 100,000,000 XAF and 250,000,000 XAF, which showed a different trend. However, this later group had the lowest significance level. It was therefore inferred that cost overrun size, expressed in monetary value, increased along with project size.

In conclusion, this analysis suggests that the cost overrun rate and the cost overrun size for a project are distinct, and the relationship between them will vary. Table 4.11 and Figure 4.28 summarize the analysis.

Project Size (XAF)	Cases	Mean Cost Overrun Size (XAF)	Standard Deviation	Linear Regression		
				X Coefficient	R Square	Level of Significance
Under 100,000,000	1538	1,565.00	8,083.27	0.3117	0.1042	0.0005
100,000,000 – 250,000,000	349	17,477.00	37,661.43	-0.0711	0.0035	0.5398
250,000,000 – 700,000,000	293	29,154.20	71,467.50	0.2620	0.1109	0.0015
700,000,000 – 2,000,000,000	164	65,488.61	160,973.25	0.1148	0.0298	0.1914
2,000,000,000– 5,000,000,000	36	151,602.40	300,598.10	0.1228	0.0746	0.2728
Over 5,000,000,000	16	2,433,592.5	6,578,859.00	0.4847	0.9930	1.847E-05
All	2396	30,126.53	560,780.10	0.4080	0.9383	2.815E-239

Table 4.11 Project Size and Cost Overrun Size–
Means, Standard Deviations, and Linear Regressions

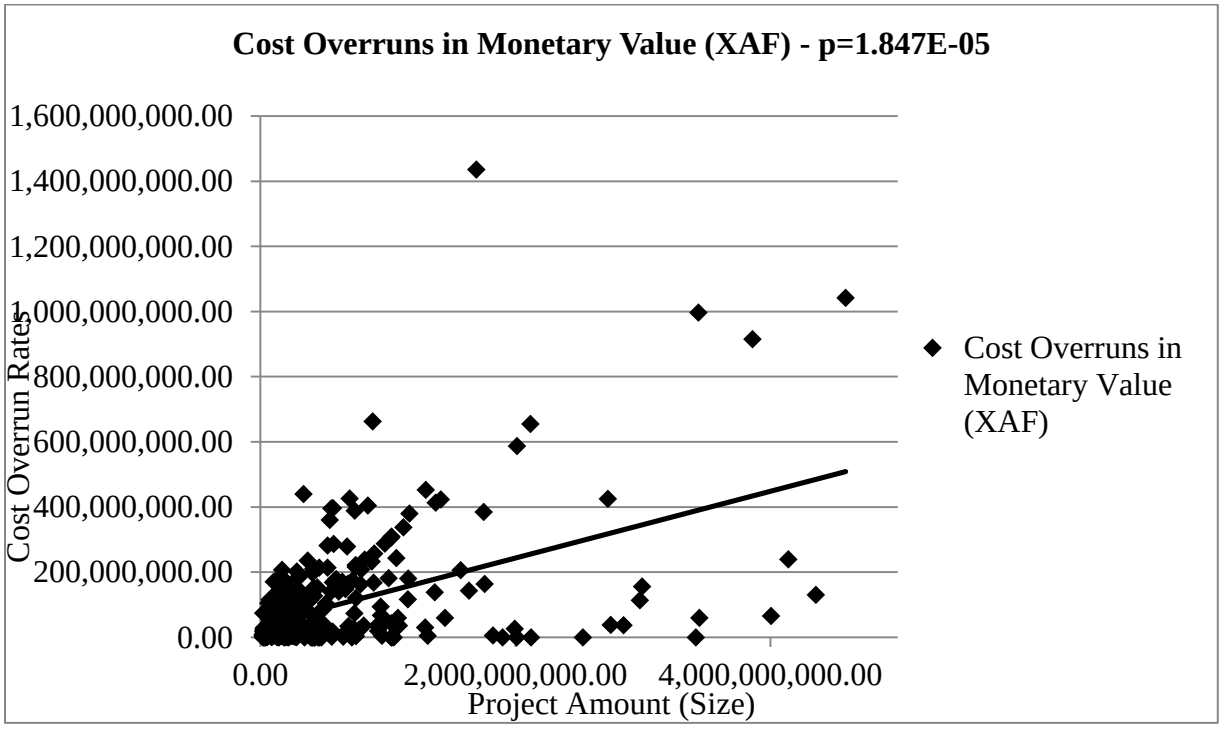

Figure 4.28 Project Size and Cost Overrun Size – Linear Regression (376 cases, 1994-2009)

4.3.5.3 Relationship between Project Size and Time Overrun Rate

The relationship between project size and time overrun rate was investigated. Means, standard deviations and linear regression were performed for each category of project size. However, there was no obvious inference from the analysis. Only the group of contracts between two and five billion XAF showed that time overrun rate decreased when project size increased, with statistical significance. The results are shown in Table 4.12 and Figure 4.29.

Project Size (XAF)	Cases	Mean Time Overrun Rate (%)	Standard Deviation	Linear Regression		
				X Coefficient	R square	Level of Significance
Under 100,000,000	1538	3.59	18.45	-2.5E-09	0.0128	0.2326
100,000,000 – 250,000,000	349	17.28	39.49	2.03E-09	0.0236	0.1090
250,000,000 – 700,000,000	293	13.32	32.01	-4.5E-10	0.0171	0.2246
700,000,000 – 2,000,000,000	164	9.51	24.17	7.69E-11	0.0058	0.5675
2,000,000,000– 5,000,000,000	36	23.93	51.90	-3.4E-10	0.1852	0.0746
Over 5,000,000,000	16	24.45	52.92	-8.6E-14	5.882E-06	0.9964
All	2396	7.62	26.47	1.4E-12	8.468E-05	0.8556

Table 4.12 Project Size and Time Overrun Rate –
Means, Standard Deviations, and Linear Regressions (1994-2009)

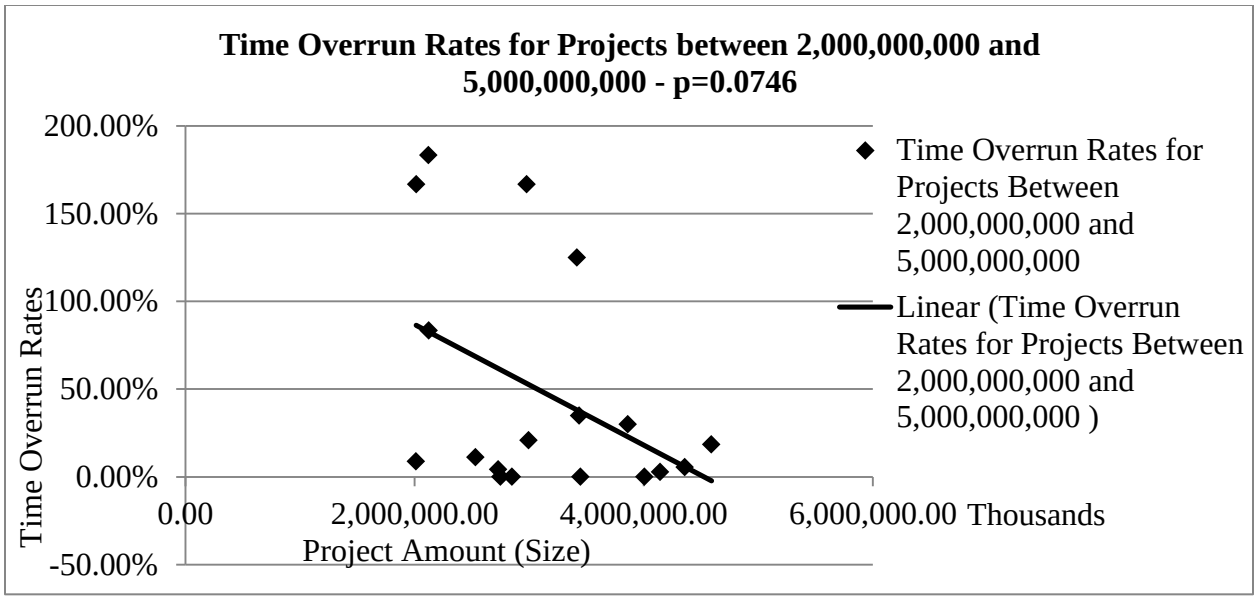

Figure 4.29 Scatter plot of the Relationship between Project Size and Time Overrun Rate for Contract Amounts between Two and Five Billion XAF (18 cases, 1994-2009)

4.3.6 Project Duration

The last project characteristic investigated in this study was project duration. For this analysis, contracts were broken down in five groups ranging from contracts with short durations, under six months, to contracts with durations greater than 36 months. Most of the projects in the database had durations less than twelve months. Only eleven contracts in the study had durations greater than 36 months.

4.3.6.1 Relationship between Project Duration and Cost Overrun Rate

The linear regression for all project durations suggests that cost overrun rates decrease when project durations increase, with statistical significance. However, the opposite trend is observed for project durations under six months, between six and twelve months and over 36 months; this trend was rejected because of the very poor associated level of significance. Details are shown in Table 4.13 below, and the scatter plot in Figure 4.30 illustrates the relationship between project duration and cost overrun rate for contract durations between 24 and 36 months.

Project Duration in Months	Cases	Mean Cost Overrun Rate (%)	Standard Deviation	X Coefficient	R Square	Level of Significance
Under 6 Months	676	3.26	17.06	0.010214	0.0008489	0.8251
6 Months - 12 Months	644	9.45	22.01	0.000193	7.158E-07	0.9907
12 Months - 24 Months	325	4.38	13.88	-0.01007	0.0068302	0.5642
24 Months - 36 Months	377	4.80	15.24	-0.01594	0.0542447	0.0320
Over 36 Months	11	10.97	16.51	0.002748	0.0091611	0.8569
All	2033	5.73	18.22	-0.00434	0.0273126	0.0010

Table 4.13 Cost Overrun Rates Classified by Project Duration-
Means, Standard Deviations, Linear Regressions (1994-2009)

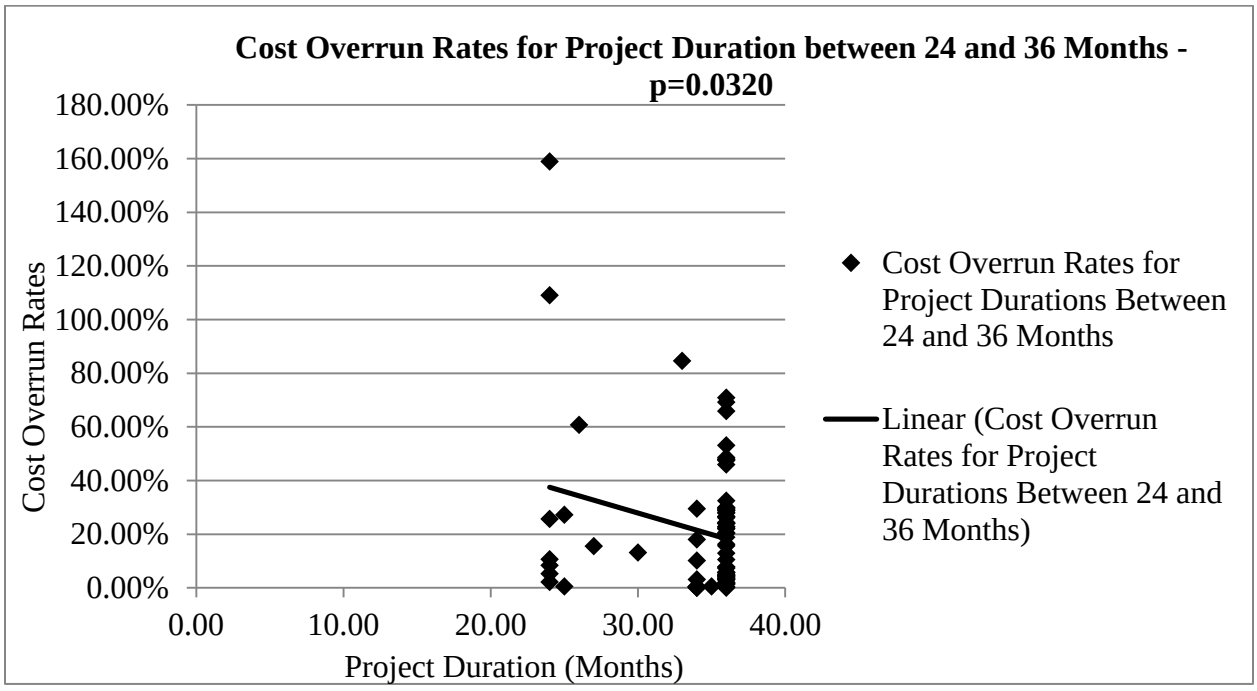

Figure 4.30 Scatter plot of the Relationship between Project Duration and Cost Overrun Rate for Contract Durations between 24 and 36 Months (85 cases, 1994-2009)

4.3.6.2 Relationship between Project Duration and Time Overrun Rate

It was observed that there was a strong relationship between project duration and time overrun rate, with high statistical significance. For all groups of project durations, the time overrun rate decreased when the project duration increased. Table 4.14 and Figure 4.31 below illustrate this relationship.

Project Duration in Months	Cases	Mean Time Overrun Rate (%)	Standard Deviation	X Coefficient	R Square	Level of Significance
Under 6 Months	676	6.47	25.87	-0.0620	0.0238	0.2388
6 Months - 12 Months	644	17.17	39.17	-0.0489	0.0150	0.0910
12 Months - 24 Months	325	3.86	13.33	-0.0856	0.0067	0.5681
24 Months - 36 Months	377	3.80	15.34	-0.0244	0.1043	0.0026
Over 36 Months	11	13.17	17.29	-0.0021	0.0060	0.8846
All	2033	8.98	28.53	-0.0155	0.1420	1.052E-14

Table 4.14 Time Overrun Rates Classified by Project Duration-
Means, Standard Deviations, Linear Regressions (1994-2009)

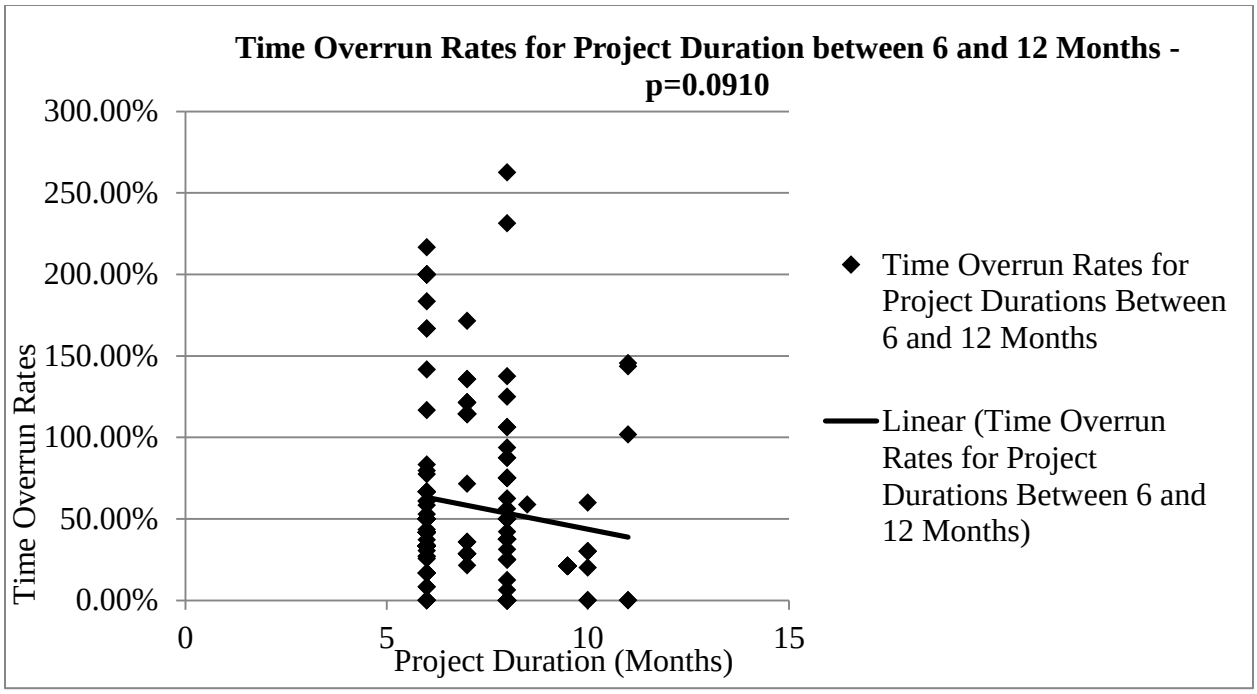

Figure 4.31 Scatter plot of the Relationship between Project Duration and Time Overrun Rate for Contract Durations between 6 and 12 Months (192 cases, 1994-2009)

4.3.7 Relationship between the Time Delay Rate and the Cost Overrun Rate

A regression analysis was performed to study the relationship between the time overrun rate as the dependent variable, and the cost overrun rate as the independent variable. A positive trend was observed with high significance: the cost overrun rate increased along with the time overrun rate. The p-value, p=5.99773E-06 showed a high significance for the relationship. The summary output of the linear regression is presented in Table 4.15 and Figure 4.32.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.22581
R Square	0.05099
Adjusted R Square	0.04857
Standard Error	0.31013
Observations	394

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.025665	2.02566497	21.061265	5.99773E-06
Residual	392	37.70242	0.09617964		
Total	393	39.728085			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.22866	0.0213758	10.6970181	1.328E-23	0.186631406	0.27068235	0.2	0.263900159
X Variable 1	0.14442	0.0314702	4.5892554	5.998E-06	0.08255326	0.20629618	0.1	0.196311188

Table 4.15 Linear Regression Results of the Relationship between Cost Overrun Rates and Time Overrun Rates

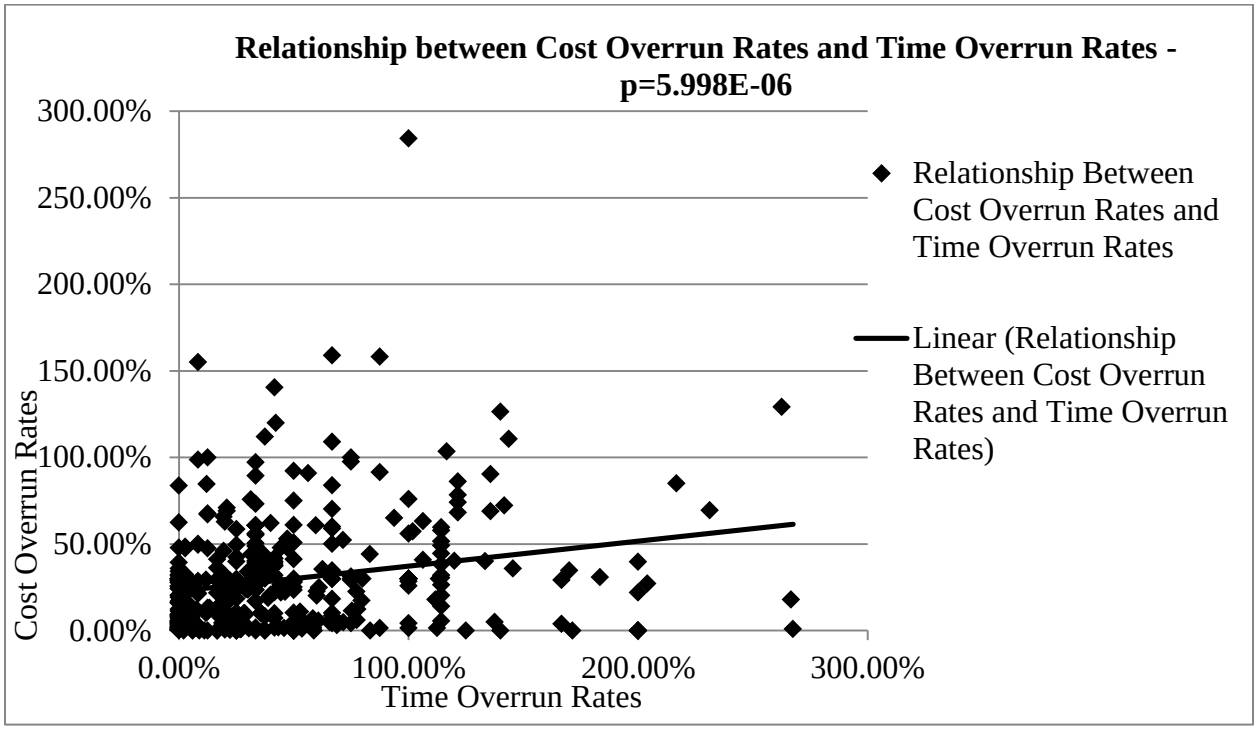

Figure 4.32 Illustration of the Relationship between the
Time Overrun Rate and the Cost Overrun Rate (394 cases, 1994-2009)

4.4 Summary Analysis of Cost Overruns

Section 4.3 presented a detailed analysis of cost overruns, studied for the contracts in the database. A summary analysis provided global results with contracts first aggregated by project type, and secondly by project ownership or project portfolio.

4.4.1 Summary of Cost Overruns by Project Type

For each project type, the overall cost overrun rate is the ratio between total cost overruns and total contract amounts for the period of study. Table 4.16 presents the results of this synthesis, which are also illustrated in Figure 4.32. Work supervision had the highest cost overrun rate, and mowing roadsides had the smallest.

Type	Total Amounts (XAF)	Total Cost Overruns (XAF)	Overall Cost Overrun Rates by Project Type for the Period of Study
Road Construction/Maintenance	545,472,244,192.00	57,294,182,778.00	10.50%
Work Supervision	48,700,487,193.00	12,237,193,407.00	25.13%
Bridges and Structures	41,394,727,818.00	560,974,087.00	1.36%
Design/Technical Studies, Technical Assistance	17,517,937,055.00	1,196,632,317.00	6.83%
Mowing Roadsides	14,700,432,431.00	168,701,672.00	1.15%

Table 4.16 Overall Cost Overruns by Project Type for the Period of Study (1994-2009)

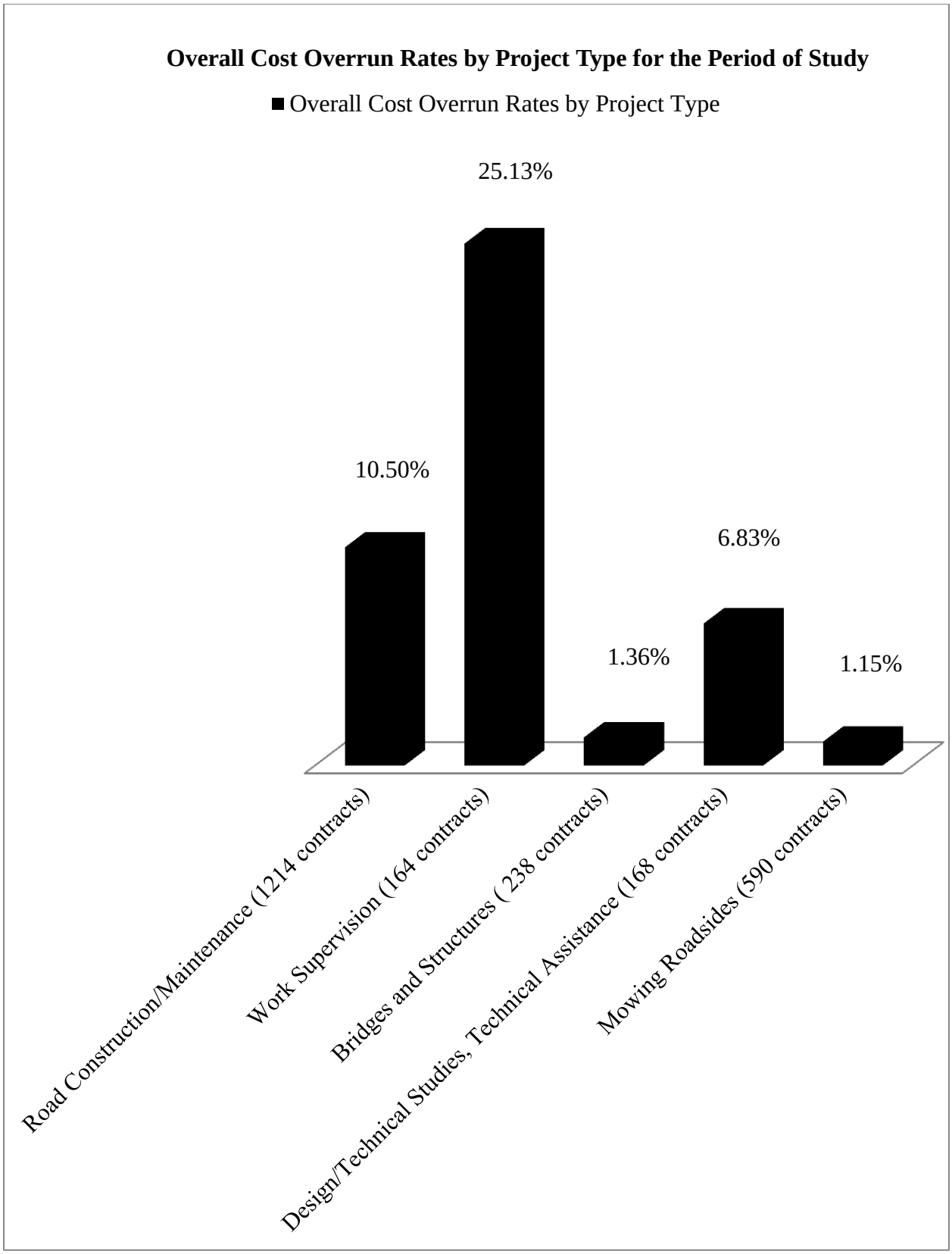

Figure 4.33 Overall Cost Overruns by Project Type for the Period of Study (1994-2009)

4.4.2 Summary of Cost Overruns by Project Portfolio

Table 4.17 and Figure 4.34 below summarize the cost overrun rates by project portfolio for the period of study. The Government project portfolio had the lowest percent cost overrun. The highest cost overrun rates were related to the African Development Bank and the European Union portfolios.

Portfolio Cost Overrun Rates			
Organization	**Total Contract Amounts**	**Total Cost Overruns**	**Portfolio Percent Cost Overruns**
European Union	111,517,937,606.00	32,874,738,136.00	29.48%
Government Only	310,890,418,836.00	17,582,747,825.24	5.66%
African Dev. Bank	16,443,708,799.00	5,371,590,630.00	32.67%
France-AFD	42,618,056,497.00	2,661,161,150.00	6.24%
Islamic Dev. Bank(IDB),OPEC Funds, Koweitian Funds, Saudian Funds	83,409,197,507.00	6,921,239,748.00	8.30%
HIPC Funds	32,697,173,970.00	3,003,433,571.00	9.19%
Belgium	4,591,066,091.00	1,041,149,412.00	22.68%

Table 4.17 Project Portfolio Cost Overruns (1994-2009)

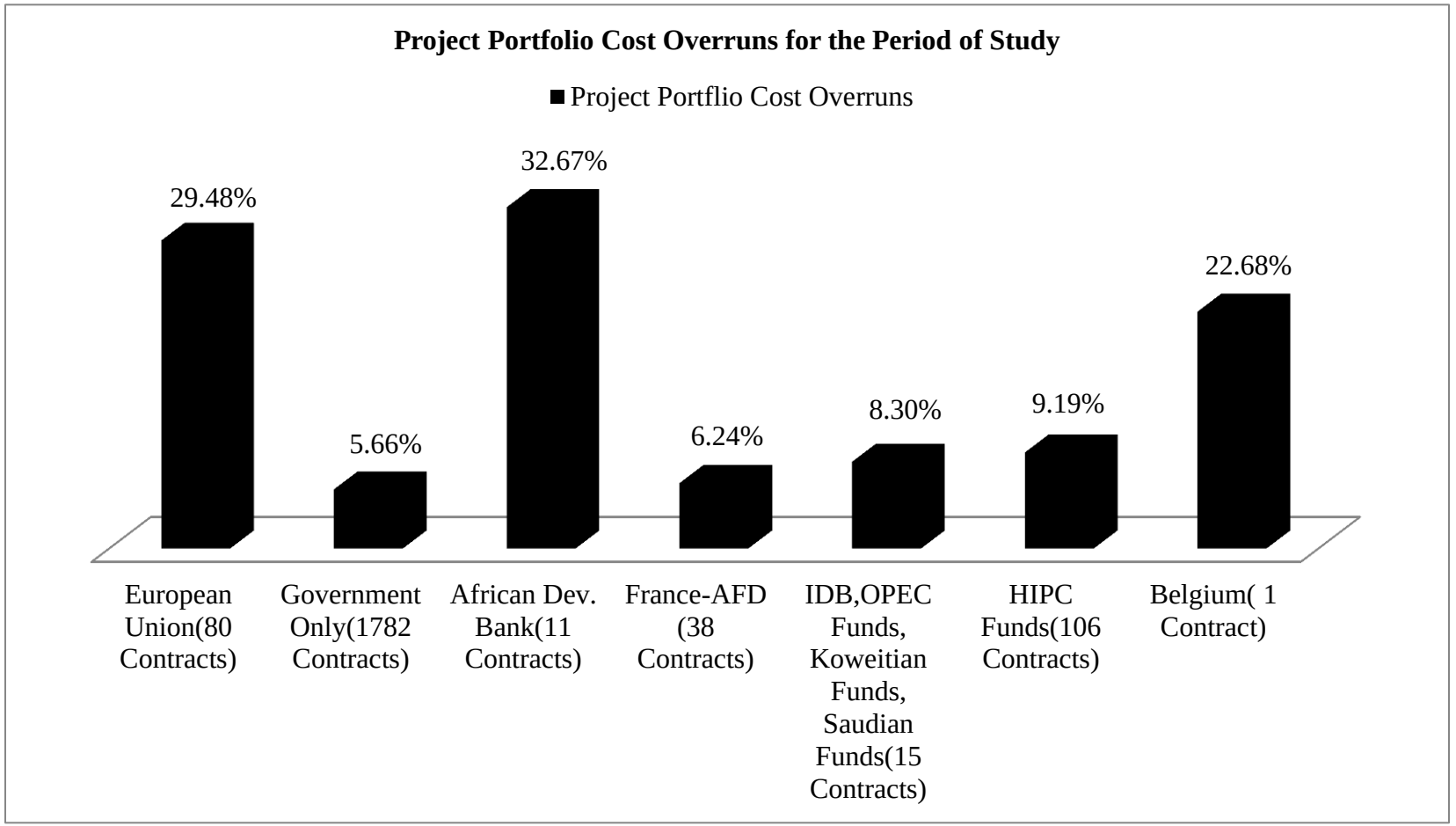

Figure 4.34 Portfolio Project Cost Overruns for the Period of Study (1994-2009)

4.4.3 Evolution of Cost Overruns During the Period of Study

Contracts were aggregated by project type, and cost overrun rates were broken down year by year to scrutinize the evolution of cost overrun rates for the period of study. Only years with cost overrun data were considered for this analysis. Table 4.18 and Figure 4.35 show the cost overrun rates by year and project type.

Year (Period)	1997-1999	99-2000	2001-02	2003	2004	2005	2006	2007-08
Overall Cost Overruns	6.69 %	8.29%	20.67%	19.90%	8.47%	8.93%	2.19%	2.84%
Work Supervision	69.63 %	33.87 %	34.92%	36.58%	3.11%	18.95 %	5.85%	13.33%
Road Construction and maintenance	2.52 %	7.14%	20.04%	27.21%	9.19%	8.98%	2.17%	2.80%
Bridges and Structures	-	41.40 %	1.01%	0.00%	8.84%	2.81%	0.05%	0.00%
Design/ Technical Studies, Technical Assistance	-	8.28%	11.08%	0.00%	14.99%	1.28%	0.00%	4.66%
Mowing Roadsides	-	2.06%	2.90%	0.00%	0.15%	0.42%	0.00%	-

Table 4.18 Evolution of Overall Project Cost Overruns for the Period of Study (1994-2009)

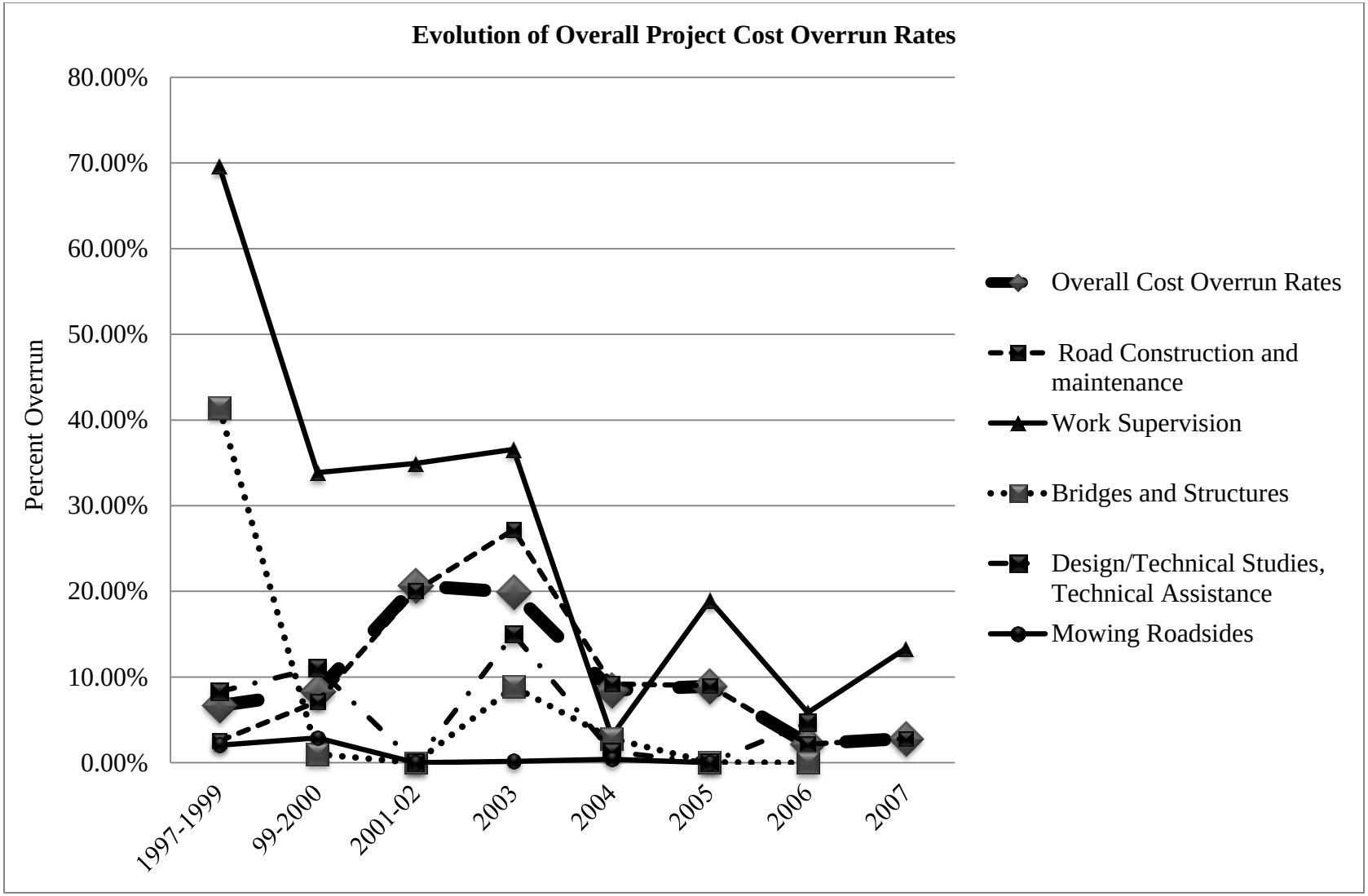

Figure 4.35 Comparison of Cost Overruns by Project Type over the Period of Study (1994-2009)

Many reasons could explain the variations observed year after year for cost overrun rates such as:

- Improvement in the management at MINTP
- Institutional reforms in Cameroon such as the adoption of a public contract code in 2004.

This new code limits cost overruns to 30% of the initial contract amount. Before 2004, higher cost overrun rates were observed. However, with the application of this new code fewer projects were implemented, because of lengthy processes.

4.5 Contractor Familiarity with the Ministry

No evidence could be found between contractor familiarity with the Ministry and change orders. To study if the more contractors worked with the ministry, the more they received change orders, a regression model was prepared. For each contractor with a change order impacting cost or time in the database, the number of years for which they received at least one change order was sought. It was found that the majority of contractors received one or more change orders during one year only. The quantity of change orders received ranged from one for most of the contractors to 25 for one of the consultant firms.

For constructors, 106 received their change order(s) in a single year for the lowest frequency, and one constructor received at least one change order per year, during eight years. Fourteen consultants received their change order(s), only in one year, and two consultants repeatedly received change order(s) for nine years. Table 4.19 and Figure 4.36 illustrate the results.

Number of Years at least one Change order was received over the period of Study	**1 Year**	**2 Years**	**3 Years**	**4 Years**	**5 Years**	**6 Years**	**7 Years**	**8 Years**	**9 Years**
Frequency of Constructors	106	44	9	7	2	5	2	1	0
Frequency of Consultants	14	4	4	3	1	0	0	0	2

Table 4.19 Frequency of Change Orders for Contractors

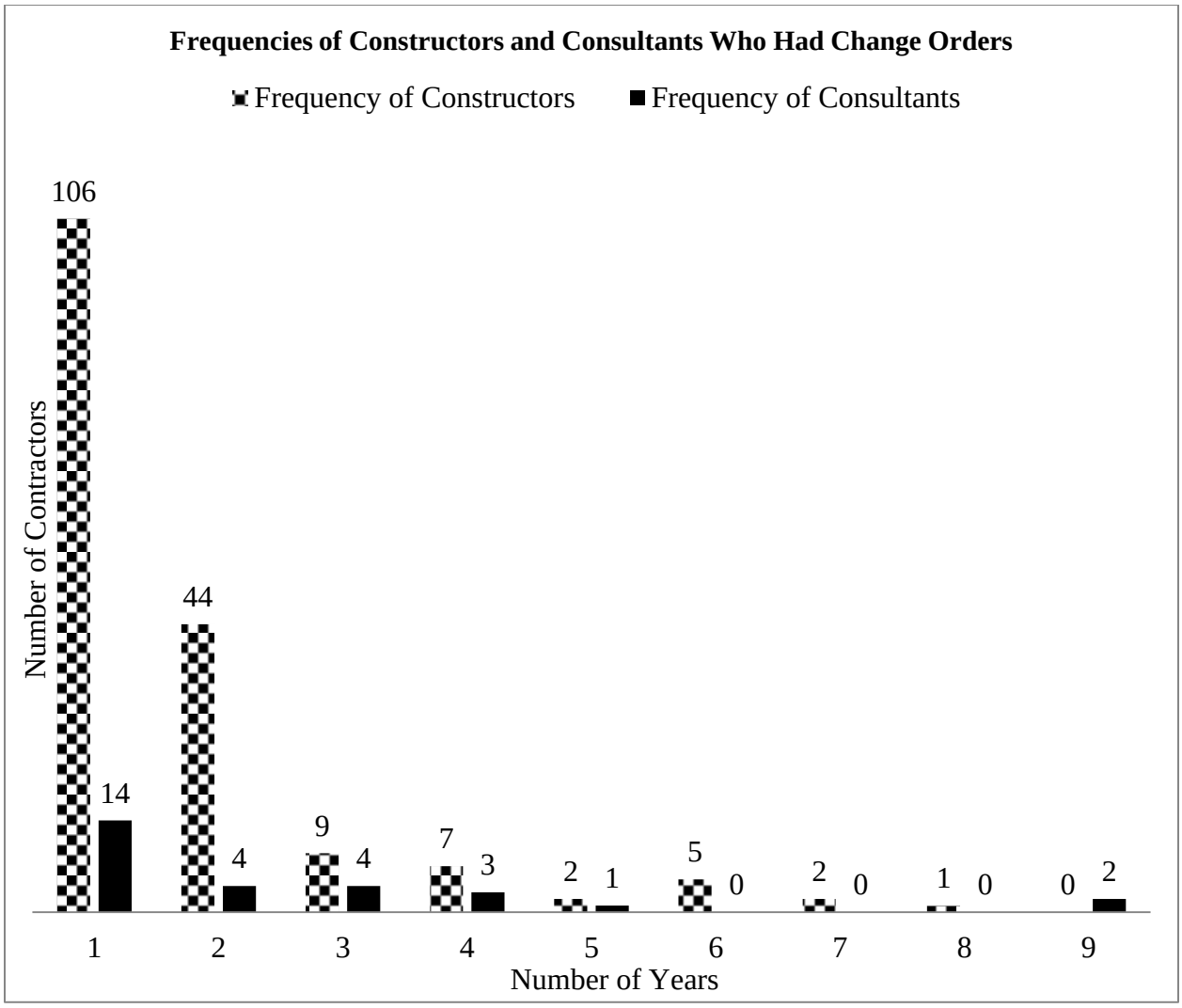

Figure 4.36 Frequencies of Constructors and Consultants with Change Orders and Number of Years

4.6 Comparison with Other Countries

Table 4.20 was developed and shown below in order to compare cost overrun rates obtained for Cameroon from the contract data analysis, and others in the world as indicated in the literature.

Region	Project type	Period covered by the study	Average cost overrun rate (%)*			Author(s)
Cameroon (This Research)	Road Construction/Maintenance	1997-2007	5.50(10.43)			Bella Akoa (This Research)
	Work Supervision		21.23(22.93)			
	Bridges and Structures		1.69(2.81)			
	Design/Technical Studies, Technical Assistance		4.13(6.39)			
	Mowing Roadsides		0.67(0.17)			
Europe	Rail	1927-1998	34.2			Flyvbjerg et al(2003)
	Fixed links		43.4			
	Roads		22.4			
North America	Rail		40.8			
	Fixed links		25.7			
	Roads		8.4			
USA (State of Washington)	**Highways:**	1985-1989				Hinze and Selstead (1991)
	New construction		9.23			
	Resurfacing		3.90			
	Bridge only		8.20			
	Safety Improvement		2.98			
South Korea		1985-2005	Min.	Avrg.	Max.	Jin-Kyung, L. (2008)
	Roads		<0 **	10.7	85	
	Rails		<0	47.64	65.34	
	Airports		16.2	60.4	64.5	
	Ports		8.3	36.3	182.5	
	(*) Time overrun rates are shown in parenthesis for Cameroon (**) <0 means cost underruns					

Table 4.20 Comparison between Cost Overrun Rates in Cameroon and Other Regions and Countries

Road construction and maintenance projects in Cameroon had a lower average cost overrun rate, when compared to North America and South Korea, which were all close to 10%. Bridges and structures in Cameroon had a low rate too, probably because most of the related projects were maintenance projects. Other studies did not present cost overruns for consultancy projects, which were considered in the case of Cameroon and had the highest cost overrun rate for work supervision. Chapter Six incorporates the results of the contract data analysis into recommendations and guidelines for measures to reduce cost and time overruns.

4.7 Chapter Summary

This study confirmed that cost overruns and time delays depend on many factors such as project type, project ownership, project size and project duration. In addition, cost overrun rates and time overall are related, the first increases along with the second.

Contractor familiarity with the ministry was not proven to be determinant for cost and time overruns. However, compared to other studies, the difference was that small projects had greater overrun percent rates or relative overrun values, compared to larger ones with various significance levels. Furthermore, in absolute values or in monetary amount, cost overruns increased with project size, with high significance. Odeck (2004) also found that small projects had more cost overruns compared to larger ones in Norway. However, Frisby (1989) found both cost and schedule overruns growing in percent and absolute values with project size.

Table 4.21 summarizes the results of Chapter 4. Project characteristics are ranked in descending order of cost overrun rates. Project characteristics with the largest overruns were given priority in establishing guidelines for reducing cost overruns and time delays.

Some key findings were that work supervision had the highest cost overrun rate, projects funded by donors experienced larger cost overrun rates. Small projects showed the lowest cost overrun rates, and large projects had larger cost overrun rates. Project amounts between 100,000,000 and 250,000,000 XAF had the highest cost overrun rates, and projects with the largest durations had the largest cost overrun rates.

Factors	Characteristics	Average Cost Overrun Rate (%)	Average Time Overrun Rate (%)
Project Type	Work Supervision	21.23	22.93
	Road Construction/Maintenance	5.50	10.43
	Design/Technical Studies, Technical Assistance	4.13	6.39
	Bridges & Structures	1.69	2.81
	Mowing Roadsides	0.67	0.17
Project Ownership	European Union	26.51	26.49
	Islamic Dev. Bank(IDB),OPEC Funds, Koweitian Funds, Saudian Funds	18.9	93.30
	African Dev. Bank	13.57	28.53
	France-AFD	8.75	5.98
	Government Only	4.77	7.54
	HIPC Funds	2.27	7.12
Project Size	Between 100,000,000 – 250,000,000 XAF	11.79	17.28
	Over 5,000,000,000XAF	9.17	24.45
	Between 250,000,000 – 700,000,000XAF	6.93	13.32
	Between 700,000,000 – 2,000,000,000XAF	6.24	9.51
	Between 2,000,000,000 – 5,000,000,000XAF	4.85	23.93
	Under 100,000,000	2.70	3.59
Project Duration	Over 36 Months	10.97	13.17
	Between 6 Months - 12 Months	9.45	17.17
	Between 24 Months - 36 Months	4.80	3.80
	Between 12 Months - 24 Months	4.38	3.86
	Under 6 Months	3.26	6.47

Table 4.21 Summary of Cost and Time Overrun Rates by Project Categories (1994-2009)

CHAPTER 5
SURVEY ANALYSIS

5.1 Introduction

A survey of the professionals who were involved in project development of the contracts analyzed in Chapter Four was conducted to help identify sources of cost overruns and time delays. Limited information in the contract files did not allow for determination of causes directly. This chapter reports the results of the survey.

5.2 Data Reporting

The survey was completed in 2011 in the city of Yaounde, Cameroon. Response rates for the survey are presented in table 5.1 below.

Number of Questionnaires Sent	100
Non Response	4
Incomplete Responses	12
Completed Questionnaires	84
Total Valid Responses	84
Overall Response Rate	84%

Table 5.1 Response Rate for the Survey

Valid responses were analyzed using the Statistical Package for the Social Sciences (SPSS). Response frequencies for each variable were determined. Examples of the SPSS frequency tables are presented in Appendix 5. To study the stratification of respondents, depending upon their sector and profession in the field of construction, a SPSS cross-tabulation analysis using both variables was performed and results are shown in Table 5.2.

Sector * Profession Cross-tabulation

			Profession				
			Accountant	Engineer	Manager	Other	Total
Sector(*)	Consul-tant	Count	0	7	1	1	9
		% within Sector	.0%	77.8%	11.1%	11.1%	100.0%
		% within Profession	.0%	11.9%	5.6%	33.3%	10.7%
		% of Total	.0%	8.3%	1.2%	1.2%	10.7%
	Cons-tructor	Count	0	6	3	0	9
		% within Sector	.0%	66.7%	33.3%	.0%	100.0%
		% within Profession	.0%	10.2%	16.7%	.0%	10.7%
		% of Total	.0%	7.1%	3.6%	.0%	10.7%
	Donor	Count	0	2	1	2	5
		% within Sector	.0%	40.0%	20.0%	40.0%	100.0%
		% within Profession	.0%	3.4%	5.6%	66.7%	6.0%
		% of Total	.0%	2.4%	1.2%	2.4%	6.0%
	Finance	Count	2	0	0	0	2
		% within Sector	100.0%	.0%	.0%	.0%	100.0%
		% within Profession	50.0%	.0%	.0%	.0%	2.4%
		% of Total	2.4%	.0%	.0%	.0%	2.4%
	Govern-ment	Count	2	44	13	0	59
		% within Sector	3.4%	74.6%	22.0%	.0%	100.0%
		% within Profession	50.0%	74.6%	72.2%	.0%	70.2%
		% of Total	2.4%	52.4%	15.5%	.0%	70.2%
	Total	Count	4	59	18	3	84
		% within Sector	4.8%	70.2%	21.4%	3.6%	100.0%
		% within Profession	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	4.8%	70.2%	21.4%	3.6%	100.0%

(*) Refer to Table 3.4 for the Definition of Variables

Table 5.2 Cross-tabulation of the Sector and Profession Variables

For the construction sector, the majority (22.2%) of respondents were government employees followed by constructors (10.7%), and consultants (10.7%). Engineers and managers constituted the largest professional segments surveyed at 70.2% and 21.4% respectively. These sectors and professions influenced the results because they made up a large number of the respondents.

5.3 Overall Responses

Respondent frequencies were reported for factors found in the literature to find its influence on cost overruns and time delays according to survey respondents (refer to Chapter 3 for a discussion of the factors). For the purpose of ranking, the respondent frequencies for "Strongly Agree" and "Agree" were summed for each factor. The score was used to classify the factors from the most critical, with the highest score, to the least critical, which recorded the lowest score. The most critical causes of cost overruns and time delays are shown in table 5.3 below; "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions" was identified most frequently (61 respondents) as a cause of cost overruns and time delays.

Factors	1- Strongly Agree	2- Agree	3- Neither	4- Disagree	5- Strongly Disagree	Respon-dents "Agreeing " & "Strongly Agreeing"
Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions.	29 (34.52%)	32 (38.10%)	12 (14.29%)	8 (9.52%)	3 (3.57%)*	**61**
Weak and insufficient technical studies	31 (36.90%)	28 (33.33%)	8 (9.52%)	16 (19.05%)	1 (1.19%)	**59**
Lack of Project Planning/Program-ming	22 (26.19%)	35 (41.67%)	10 (11.90%)	16 (19.05%)	1 (1.19%)	**57**
Underestimating of cost estimates and schedules/ Overestimating of Benefits	18 (21.43%)	39 (46.43%)	17 (20.24%)	8 (9.52%)	2 (2.38%)	**57**
Lack of Equipment	29 (34.52%)	26 (30.95%)	20 (23.81%)	6(7.14%)	3 (3.57%)	**55**
Bidding Procedures	27 (32.14%)	28 (33.33%)	13 (15.48%)	13 (15.48%)	3 (3.57%)	**55**
Duration of the Period of Bidding	26 (30.95%)	28 (33.33%)	14 (16.67%)	13 (15.48%)	3 (3.57%)	**54**
Material Price Fluctuation	19 (22.62%)	35 (41.67%)	14 (16.67%)	14 (16.67%)	2 (2.38%)	**54**
Negligence of Past Experiences	25 (29.76%)	28 (33.33%)	18 (21.43%)	13 (15.48%)	0 (0.00%)	**53**
The Lowest Bid Price System	28 (33.33%)	23 (27.38%)	14 (16.67%)	15 (17.86%)	4 (4.76%)	**51**

(*) Percentage of respondents

Table 5.3 Prioritization of Survey Factors by the Sum of Respondents Who “Strongly Agreed” and “Agreed”

Table 5.3 Prioritization of Survey Factors by the Sum of Respondents Who "Strongly Agreed" and "Agreed" (Cont'd)

Factors	1- Strongly Agree	2- Agree	3- Neither	4- Disagree	5- Strongly Disagree	Respon-dents "Agreeing" & "Strongly Agreeing"
Methods of Payment	23 (27.38%)	28 (33.33%)	15 (17.86%)	16 (19.05%)	2 (2.38%)	**51**
Inadequate Project Planning/Program-ming	15 (17.86%)	36 (42.86%)	14 (16.67%)	17 (20.24%)	2 (2.38%)	**51**
The Displacement of Existing Networks	11 (13.10%)	40 (47.62%)	22 (26.19%)	11 (13.10%)	0 (0.00%)	**51**
Poor project implementation strategies	17 (20.24%)	33 (39.29%)	18 (21.43%)	16 (19.05%)	0 (0.00%)	**50**
Changes in Scope of Contracts	10 (11.90%)	39 (46.43%)	16 (19.05%)	16 (19.05%)	3 (3.57%)	**49**
Poor Communication Among Contract Stakeholders	12 (14.29%)	35 (41.67%)	20 (23.81%)	15 (17.86%)	2 (2.38%)	**47**
Unreasonable adjustment of project cost by contractors	13 (15.48%)	33 (39.29%)	18 (21.43%)	19 (22.62%)	1 (1.19%)	**46**
Lack of Contract ex post Evaluation	12 (14.29%)	34 (40.48%)	21 (25.00%)	15 (17.86%)	2 (2.38%)	**46**
Weaknesses during the land takings process	8 (9.52%)	38 (45.24%)	25 (29.76%)	12 (14.29%)	1 (1.19%)	**46**
Supervisor and Contractor Claims and Disputes	14 (16.67%)	30 (35.71%)	19 (22.62%)	20 (23.81%)	1 (1.19%)	**44**
Construction Errors and On Site Testing Approval	6 (7.14%)	38 (45.24%)	24 (28.57%)	14 (16.67%)	2 (2.38%)	**44**

Table 5.3 Prioritization of Survey Factors by the Sum of Respondents Who "Strongly Agreed" and "Agreed" (Cont'd)

Factors	1- Strongly Agree	2- Agree	3- Neither	4- Disagree	5- Strongly Disagree	Respon-dents "Agreeing" & "Strongly Agreeing"
Many Stakeholders	12 (14.29%)	31 (36.90%)	19 (22.62%)	19(22.62 %)	3 (3.57%)	43
Weather Conditions	11 (13.10%)	32 (38.10%)	18 (21.43%)	21(25.00 %)	2 (2.38%)	43
Unethical Activities And Kickbacks	13 (15.48%)	28 (33.33%)	27 (32.14%)	14(16.67 %)	2 (2.38%)	**41**
No Action Taken After Contract Progress Reports	9 (10.71%)	32 (38.10%)	26 (30.95%)	11(13.10 %)	6 (7.14%)	**41**
Mistakes and discrepancies in documents	12 (14.29%)	25 (29.76%)	21 (25.00%)	24(28.57 %)	2 (2.38%)	**37**
Expropriation costs	10 (11.90%)	24 (28.57%)	29 (34.52%)	15(17.86 %)	6 (7.14%)	**34**
Shortages of Materials	7 (8.33%)	27 (32.14%)	19 (22.62%)	27(32.14 %)	4 (4.76%)	**34**
Mismanagement Due to Inexperienced Supervisors.	2 (2.38%)	32 (38.10%)	24 (28.57%)	23(27.38 %)	3 (3.57%)	**34**
Periods of Inspection and Testing After Contract Completion	9 (10.71%)	21 (25.00%)	31 (36.90%)	19(22.62 %)	4 (4.76%)	**30**
Political Tensions/Insecurity	8 (9.52%)	19 (22.62%)	14 (16.67%)	29(34.52 %)	14(16.67 %)	**27**
Equivocal/Unclear Contracts	3 (3.57%)	24 (28.57%)	20 (23.81%)	31(36.90 %)	6 (7.14%)	**27**
Building on unexpected archaeological sites	10 (11.90%)	13 (11.90%)	33 (39.29%)	22(26.19 %)	6 (7.14%)	**23**
Legal environmental requirements	4 (4.76%)	19 (22.62%)	27 (32.14%)	32(38.10 %)	2 (2.38%)	**23**

Cross-tabulations were performed to analyze the scoring for “Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions” by sector, and then by profession as shown below.

5.4 Cross-Tabulation between the Sector and the Factor “Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions”

Table 5.4 below shows that the factor “Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions” 72.6% of all respondents agreed (38.1%) and strongly agreed (34.5%) that this factor was a cause of cost overruns and time delays. This scoring was broken down by sectors as follows: 78% of respondents in government, 80% for donors, 88.8% for constructors, 33.3% for consultants, and 0% for respondents in the finance sector. The low result for the finance sector was probably due to the limited number of participants from this sector, only two respondents. Overall, it was inferred that all sectors agreed that this factor is a cause of cost overruns and time delays.

			Negligence_Site_visits					
			1: Strongly Agree	2: Agree	3: Neither	4: Disagree	5: Strongly Disagree	Total
Sector	Cons	Count	2	1	3	3	0	9
		% within Sector	22.2%	11.1%	33.3%	33.3%	.0%	100.0%
		% within Negligence_Site_visits	6.9%	3.1%	25.0%	37.5%	.0%	10.7%
		% of Total	2.4%	1.2%	3.6%	3.6%	.0%	10.7%
	Cont	Count	4	4	1	0	0	9
		% within Sector	44.4%	44.4%	11.1%	.0%	.0%	100.0%
		% within Negligence_Site_visits	13.8%	12.5%	8.3%	.0%	.0%	10.7%
		% of Total	4.8%	4.8%	1.2%	.0%	.0%	10.7%
	Dono	Count	2	2	1	0	0	5
		% within Sector	40.0%	40.0%	20.0%	.0%	.0%	100.0%
		% within Negligence_Site_visits	6.9%	6.3%	8.3%	.0%	.0%	6.0%
		% of Total	2.4%	2.4%	1.2%	.0%	.0%	6.0%
	Fina	Count	0	0	1	1	0	2
		% within Sector	.0%	.0%	50.0%	50.0%	.0%	100.0%
		% within Negligence_Site_visits	.0%	.0%	8.3%	12.5%	.0%	2.4%
		% of Total	.0%	.0%	1.2%	1.2%	.0%	2.4%
	Gove	Count	21	25	6	4	3	59
		% within Sector	35.6%	42.4%	10.2%	6.8%	5.1%	100.0%
		% within Negligence_Site_visits	72.4%	78.1%	50.0%	50.0%	100.0%	70.2%
		% of Total	25.0%	29.8%	7.1%	4.8%	3.6%	70.2%
	Total	Count	29	32	12	8	3	84
		% within Sector	34.5%	38.1%	14.3%	9.5%	3.6%	100.0%
		% within Negligence_Site_visits	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	34.5%	38.1%	14.3%	9.5%	3.6%	100.0%

Table 5.4 Cross-tabulation of the variable Sector and the Factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions"

Table 5.5 provides the Lambda and Goodman and Kruskal tau, for the cross-tabulation above; their weak values suggest a weak relationship between the two variables. The sector did not influence the responses for the "Negligence_Site_visits" variable.

			Value	Asymp. Std. Error[a]
Nominal by Nominal	Lambda	Symmetric	.039	.052
		Sector Dependent	.000	.000
		Negligence_Site_visits Dependent	.058	.077
	Goodman and Kruskal tau	Sector Dependent	.068	.039
		Negligence_Site_visits Dependent	.056	.021

a. Not assuming the null hypothesis.

Table 5.5 Directional Measures for the Cross-tabulation Between the Sector and the factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions"

5.5 Cross-Tabulation between Profession and the Factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions"

Among the respondents who strongly agreed and agreed that the factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions" was a cause of cost overruns and time delays, were 72.9% of engineers, 77.8% of managers, 50% of accountants, and 66.6% of others. The majority of all professions considered this factor to be critical for cost overruns and time delays. The cross-tabulation by profession is shown in Table 5.6.

			Negligence_Site_visits					
			1: Strongly Agree	2: Agree	3: Neither	4: Disagree	5: Strongly Disagree	Total
Profession	Acc	Count	2	0	1	1	0	4
		% within Profession	50.0%	.0%	25.0%	25.0%	.0%	100.0%
		% within Negligence_Site_visits	6.9%	.0%	8.3%	12.5%	.0%	4.8%
		% of Total	2.4%	.0%	1.2%	1.2%	.0%	4.8%
	Eng	Count	22	21	6	7	3	59
		% within Profession	37.3%	35.6%	10.2%	11.9%	5.1%	100.0%
		% within Negligence_Site_visits	75.9%	65.6%	50.0%	87.5%	100.0%	70.2%
		% of Total	26.2%	25.0%	7.1%	8.3%	3.6%	70.2%
	Man	Count	4	10	4	0	0	18
		% within Profession	22.2%	55.6%	22.2%	.0%	.0%	100.0%
		% within Negligence_Site_visits	13.8%	31.3%	33.3%	.0%	.0%	21.4%
		% of Total	4.8%	11.9%	4.8%	.0%	.0%	21.4%
	Oth	Count	1	1	1	0	0	3
		% within Profession	33.3%	33.3%	33.3%	.0%	.0%	100.0%
		% within Negligence_Site_visits	3.4%	3.1%	8.3%	.0%	.0%	3.6%
		% of Total	1.2%	1.2%	1.2%	.0%	.0%	3.6%
Total		Count	29	32	12	8	3	84
		% within Profession	34.5%	38.1%	14.3%	9.5%	3.6%	100.0%
		% within Negligence_Site_visits	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	34.5%	38.1%	14.3%	9.5%	3.6%	100.0%

Table 5.6 Cross-tabulation of the Profession and the Factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions"

The weakness of the Lambda and Goodman and Kruskal tau values in Table 5.7 below implied a poor association between the two variables of the cross-tabulation above. The profession did not influence the responses for the "Negligence_Site_Visits" variable.

			Value	Asymp. Std. Error[a]
Nominal by Nominal	Lambda	Symmetric	.039	.087
		Profession Dependent	.000	.000
		Negligence_Site_visits Dependent	.058	.128
	Goodman and Kruskal tau	Profession Dependent	.065	.034
		Negligence_Site_visits Dependent	.039	.020

a. Not assuming the null hypothesis

Table 5.7 Directional Measures for the Cross-tabulation Between the Variable Profession and the factor "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions"

5.6 Prioritization of Factors and Project Phases

Table 5.3 places factors in decreasing order. It also showed the factors, which seemed most critical as well as the less significant ones regarding cost overruns and time delays. Since scores were relatively close, it was difficult to determine which factors were important. Consequently, a supplementary table was developed to separate factors into quartiles as shown in table 5.8.

- First quartile, very high priority, for factors with respondent frequencies strongly agreeing and agreeing between 75% and 100%
- Second quartile, high priority, for factors with respondent frequencies strongly agreeing and agreeing between 50% and 75%
- Third quartile, low priority, similarly, for respondent frequencies between 25% and 50%
- Fourth quartile, very low priority, lastly for respondent frequencies lower than 25%

Based on this definition, there were no factors that fell in the first quartile.

Corresponding results are presented in table 5.8.

Frequency Respondents Strongly Agreeing and Agreeing	Priority	Corresponding Factors
Between 84 (100%) and 63 (75%)	Very High	None
Between 63(75%) and 42 (50%)	High	Negligence of Site Visits Before/During the Bidding Process-Unknown Site Conditions Weak and Insufficient Technical Studies Lack of Project Planning/Programming Underestimating of Cost Estimates and Schedules/ Overestimating of Benefits Lack of Equipment Bidding Procedures Duration of the Period of Bidding Material Price Fluctuation Negligence of Past Experiences The Lowest Bid Price System Methods of Payment Inadequate Project Planning/Programming The Displacement of Existing Networks Poor Project Implementation Strategies Changes in Scope of Contracts Poor Communication among Contract Stakeholders Unreasonable Adjustment of Project Cost by Contractors Lack of Contract ex post Evaluation Weaknesses during the Land Taking Process Supervisor and Contractor Claims and Disputes Construction Errors and On Site Testing Approval Many Stakeholders Weather Conditions

Table 5.8 Classification of Factors by Priority Groups

Table 5.8 Classification of Factors by Priority Groups (Cont'd)

Frequency Respondents Strongly Agreeing and Agreeing	Priority	Corresponding Factors
Between 42 (50%) and 21 (25%)	Low	Unethical Activities And Kickbacks No Action Taken After Contract Progress Reports Mistakes and discrepancies in documents Expropriation costs Shortages of Materials Mismanagement Due to Inexperienced Supervisors Periods of Inspection and Testing After Contract Completion Political Tensions/Insecurity Equivocal/Unclear Contracts Building on unexpected archaeological sites Legal environmental requirements
Between 21(25%) and 0 (0%)	Very Low	None

Based on Table 5.8, the researcher attempted to prioritize project phases. The objective was to classify project phases, according to their influence on cost overruns and time delays. Project phases with a high number of high priority factors were also considered critical for cost overruns and time delays. High priority factors were found in all project development phases, with the distribution presented in table 5.9. The bidding phase was the most critical, with all four factors classified in the high priority group. Project implementation, with 59% of high priority factors, seemed to be of slightly less concern for cost overruns and time delays.

Project Phase	Number of High Priority Factors	Total Number of Factors	Observations
Bidding Phase	4	4	All factors have high priority (100%)
Design Process	3	4	75% of factors are high priority
Planning and Programming	3	5	60% of factors are high priority
Project Implementation	10	17	59% of factors are high priority
Project Control and *ex post* Evaluation	2	4	50% of factors are high priority

Table 5.9 Prioritization of Project Phases

5.7 Respondent Comments on Causes and Improvements for Cost Overruns and Time Delays

The following comments were received from respondents, in the open-ended portion of the survey. Participants were asked to suggest solutions to cost overruns and time delays.
An author's translation for comments in French is italicized after each French response. These suggestions are considered in Chapter Six in discussion of guidelines developed in the study.

Respondent No	Verbatim Comments
1	1: Accidents on job sites
2	2:Financement des Travaux
	2: Funding of Work.
3	1: Deficit de personnel Experimenté
	1: Lack of experienced personnel
4	Réaliser des bonnes études préalablement au lancement de l'appel d'offres, Améliorer le système de passation des marchés, Mieux programmer la période de démarrage des travaux, Prendre des dispositions pour le déplacement des réseaux à temps.
	Conduct good studies before calling for bids, improve the public contract system, better scheduling of the beginning of work, displacement of networks on time
5	Main issues lie along procurements and implementation phases. Another concern is the selection of contractors who are not well equipped/qualified: false declarations of competencies.
6	Assouplir les procédures de passation des marches, Améliorer la qualité des études, Equiper ou renforcer l'équipement du pays en matériel des TP (engins de génie civil), réduire le nombre de parties prenantes au marché, renforcer les capacités de gestion administrative, technique et financière des entreprises locales.
	To ease the process of bidding contracts, improve the quality of design studies, providing the country with heavy construction equipment, fewer contract stakeholders, improve management, technical, and financial capabilities of local enterprises.
7	Par la maturation des projets.
	By a deep study of projects.
8	Disposer de bonnes études, Acceptation du projet par les riverains, Bonne sélection des acteurs (entreprise, BET contrôle…), Renforcement des capacités des services du maitre d'ouvrage vis-à-vis de la gestion des projets et la nécessité de réaliser la qualité dans les délais.
	Having good studies, the project should be adopted by riparians, good selection of the project team (constructor, work supervisor,…), improve owner capabilities for project management and the need to implement project of good quality on time.

Table 5.10 Comments from Survey Respondents

Table 5.10 Comments from Survey Respondents (Cont'd)

Respondent No	Verbatim Comments
9	S'assurer que des études sont bien faites avant le lancement des appel d'offres, S'assurer que le financement des travaux existe et conduira le projet à terme, Réduire autant que possible les intervenants dans les procédures de passation du marché, S'assurer que la mission de contrôle choisie sera à la hauteur de la tâche de même que l'entreprise en charge des travaux, Respecter les exigences des contrats et les plannings arrêtés.
	Verifying that design studies are available before call for bids, Verifying that funding is available until project close-out. Reduction of stakeholders during the bidding process, verifying that the chosen work supervisor will be capable to perform efficiently, as well as the chosen constructor, abide to contract requirements and planning established.
10	Pour réduire les surcouts et les projets hors délais, il faut: une programmation rigoureuse des travaux, à temps; Des études bien menées avec une interprétation de celles-ci; Des couts bien maitrises et reflétant la réalité du marché; Une bonne stratégie d'exécution des travaux avec prise de décision à temps; Une attribution des marches aux entreprises performantes et suivies.
	To diminish cost overruns and time delays, a strict scheduling of work, on time ; good design studies along with their good interpretation, mastering contract costs, a good project implementation strategy and timely decision making, contract award to successful enterprises are needed.
11	Pour réduire les surcouts et les projets hors délais: Démarrer les études à temps (Programmation), Commander les études approfondies, Réduire le nombre d'intervenants dans les procédures de passation.
	To reduce cost overruns and time delays, start design studies on time, order detailed design, reduce stakeholders on bidding processes.
12	Pour les grands projets, prévoir une assistance à la maitrise d'ouvrage, ou une maitrise d'ouvrage déléguée: trop de grands projets, surtout sur financements nationaux, sont mal conduits ou pas conduits du tout. Les projets d'entretien doivent être suivis par l'ingénieur du MINTP le plus proche du site: le subdivisionnaire ou le Délégué Régional. La centralisation à Yaounde n'est pas pertinente pour ce type de travaux. Programmation, passation de marche et supervision de la mission de contrôle en tant que représentant du maitre de l'ouvrage, le MINTP.
	For large projects the owner needs assistance, or needs to delegate a representative : many large projects, mainly those funded locally, are poorly or not managed at all. Maintenance projects should be followed up by the MINTP engineer closer to the site : the divisional or regional delegate. Yaounde's centralization is not pertinent for such work, programming, bidding the contract and supervising the work by a consultant, as MINTP's representative.

Table 5.10 Comments from Survey Respondents (Cont'd)

Respondent No	Verbatim Comments
13	Réhabilitation du MATGENIE, Plus d'objectivité dans le choix des entreprises et MDC, Diminuer les entreprises présentant des offres anormalement basses.
	Rehabilitation of MATGENIE (public company for heavy equipment), more objectivity in choosing constructors and contractors. Diminish enterprises with too low bids.
14	La réussite d'un projet est fortement liée à son cout et à ses délais d'exécution qui devraient être optimises au maximum. Connaissant les cycles d'un projet, il serait indiqué pour son exécution, et ce, de son instruction à son évaluation ex post, de mobiliser des ressources humaines bien outillées en matière de suivi-évaluation et en gestion des contrats.
	A successful project is strongly linked to its cost and implementation time which should be optimized to the maximum extent. Knowing project cycles, human resources skilled in contract administration and project management should be mobilized from project inception to post implementation.
15	The time between the feasibility studies and the award of contracts should not be too long.
16	Faire de bonnes études jusqu'à l'APD, Retenir des entreprises citoyennes pour l'exécution des travaux, Mettre en place une équipe de suivi de projet intègre et compétente, Gérer efficacement les expropriations et les déplacements de réseaux.
	Good design studies, awarding contracts to responsible contractors, putting in place a competent and transparent project team, efficiently manage expropriations and network displacements.
17	In Cameroon, we have to stress on the design of the project, ensure that technical studies and the cost of the project are well evaluated. With this, execution will be perfect but we also have to stress on maintenance, when the project is finished, everything has to be done to keep the project from degrading.
18	Améliorer la planification et la programmation, Approfondir les TDR des études afin de minimiser les risques de variation des quantités, Améliorer les conditions de travail des différents intervenants dans la chaine.
	Improve planning and programming, deepening studies terms of references to reduce quantity variations, improve stakeholders' work conditions.

Table 5.10 Comments from Survey Respondents (Cont'd)

Respondent No	Verbatim Comments
19	Passer les marchés d'études techniques en maitrise d'œuvre complète et fixer les dates dans les contrats.
	Bid a single contract for design and work supervision, and set up dates in contracts.
20	R.A.S.
	Nothing To Report
21	By objectivities in decisions taking by both parties involve.

5.8 Comparison with Other Countries

Table 5.11 was shown in Chapter Two and is repeated here for discussion of the results concerning Cameroon. The literature showed the design phase and site conditions were critical causes for project overruns in other countries. This research showed this in the case for Cameroon as well. The lack of planning was reported by other studies, and also was a common factor for cost overruns and time delays in Cameroon.

Author(s)/ Year	Country	Number of Respondents	Number of Factors Studied	Major Causes(or factors) of Cost Overrun/ Time Delay
Bella Akoa (2011)	Cameroon	84	34	1. Negligence of Site Visits Before/During the Bidding Process - Unknown Site Conditions 2. Weak and insufficient technical studies 3. Lack of Project Planning/Programming
Creedy et al. (2010)	Australia	8	37	1. Design and scope change 2. Insufficient investigations and latent conditions 3. Deficient documentation (specification and design)
Tumi et al. (2009)	Libya	N/A	43	1.Improper planning 2.Lack of effective communication 3.Design errors
Abd El-Razek et al. (2008);	Egypt	74	32	1. Financing by contractor during construction 2. Delays in contractor's payment by owner 3. Design changes by owner or his agent during construction
Le-Hoai et al. (2008)	Vietnam	87	21	1. Poor site management and supervision 2. Poor project management assistance 3. Financial difficulties of owner
Sambasivan and Soon (2007)	Malaysia	150	28	1. Improper planning 2. Site management 3. Inadequate contractor experience
Lo et al. (2006)	Hong Kong	151	30	1. Inadequate resources due to contractor lack of capital 2. Unforeseen ground conditions 3. Exceptionally low bids
Abdul-Rahman et al.(2006)	Malaysia	204	20	1. Additional work 2. Labor shortage and lack of skills 3. Poor planning and scheduling
Ajibade and Odeyinka (2006)	Nigeria	102	44	1. Contractors' financial difficulties 2. Clients' cash flow problems 3. Architects' incomplete drawings

Table 5.11 Comparison between Construction Professional Surveys

Table 5.11 Comparison between Construction Professional Surveys (Cont'd)

Author(s)/ Year	Country	Number of Respondents	Number of Factors Studied	Major Causes(or factors) of Cost Overrun/ Time Delay
Frimpong et al. (2003)	Ghana	72	26	1. Monthly payment difficulties from agencies for completed work 2. Poor contractor management 3. Material procurement
Mansfield et al. (1994)	Nigeria	37	23	1. Poor contract management 2. Financing and payment of completed work 3. Changes in site conditions
Okpala and Aniekwu (1988)	Nigeria	192	27	1.Shortage of materials 2.Finance and payment for completed works 3.Poor contract management
Merewitz, L. (1973)	U.S.A.	N/A	N/A	1. Price level increases 2. Scope changes 3. Unforeseen conditions and structural modifications

5.9 Chapter Summary

Chapter Five presented the results of the survey of construction professionals in Cameroon. Using SPSS software, statistical data analyses were performed. The factors identified as causes of cost overruns and time delays were classified by degree of importance, for further analysis. "Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions" was found to be the most frequently cited cause of cost overruns and time delays, and the bidding phase was the most critical. Comparing the survey results obtained in Cameroon to those in other countries, similarities were observed. Suggestions by survey participants for methods to improve cost and time overruns are used in the development of recommendations and guidelines presented in Chapter Six.

CHAPTER 6
DISCUSSION AND GUIDELINES FOR IMPROVEMENT

6.1 Overview

This research uses three principal sources of data in addition to the literature review, which included:

- The statistical analysis of cost overruns and time delays from contract data.
- The survey of construction professionals in Cameroon, which identified the causes of cost overruns and time delays.
- Documents obtained at MINTP during data collection. These documents presented in section 3.7 explain not only regulations used by the ministry, but also describe project development activities at MINTP for the years covered by this study. They contribute to the research because they present discussion of the MINTP organization, potential flaws in project management, detail on causes of change orders, and proposed measures to avoid project overruns in the future.

6.2 Discussion of the Contract Data Analysis

Contract data analysis showed that cost overruns and time delays were predominant for the following project sub-categories:

- Work supervision
- Foreign aid projects
- Small projects between 100,000,000 XAF and 250,000,000 XAF, and larger projects greater than 5,000,000,000 XAF
- Projects scheduled for more than 36 months

Work Supervision

The adoption of work supervision for highway and bridge construction or maintenance contracts at MINTP was problematic, considering the high project overrun rates recorded, compared to more complicated contracts such as those using heavy equipment. Adding to the complexity of contracting, work supervision was not only very expensive, but also inefficient for project management. Work supervision accounted for eight percent or about 61 billion XAF of contract expenditures during 1997-2007. If MINTP chose to administer contracts itself, such contract funds could have been used to pave more highways and build more bridges in Cameroon. Such situations were described by Schumacher (1973): "*Poor countries slip-and are pushed –into the adoption of production methods and consumption standards which destroys the possibilities of self-reliance and self-help. The results are unintentional neocolonialism and hopelessness for the poor*".

In addition, high wages and fringes were recorded in consultant contracts for work supervision. During MINTP project implementation, both construction and supervision contracts were linked such that cost overruns for the first contract would affect the second one, creating a multiplier effect. The same situation was observed for time delays. When constructors stopped work or were late for mobilization, work supervisors were still paid (MINTP, 2009b). Similarly, when work supervisors were not mobilized at scheduled contract start, constructors who were delayed received time extensions. Furthermore, small projects, which were frequent at MINTP, were said to have high work supervision costs (BCEOM, CEBTP, 1991).

In 2009, poor results were recorded at the ministry for road maintenance. However, the responsibility was shifted to work supervisors instead of constructors (Abomo, 2010).

This confusion between responsibilities did not only happen between constructors and supervisors; contract data analysis showed that a consultant in some instances had contracts providing both work supervision and technical assistance to MINTP for project management, meaning that the consultant was simultaneously contractor and owner representative on related projects. Such situations pose ethical problems.

Foreign Aid Projects

Contracts involving donors from outside countries were presumed by the researcher to be better prepared, better implemented, and would experience fewer project overruns compared to those funded only by MINTP because donors involved experts and specialists from developed countries. Unexpectedly, the results of this study showed the opposite; Seeking explanations for this finding, the researcher investigated foreign aid practices, specifically for Africa.

Foreign aid started after World War II, with the creation of multilateral agencies such as the World Bank, IMF and bilateral cooperation agencies supported by individual countries. Many successful projects were implemented with foreign aid in developing countries, and specifically infrastructure projects. Without foreign assistance, many countries could not achieve development goals: MINTP for instance could only fund about 50% of its highway and bridge projects, the rest came from donor contributions in the form of grants or loans. In general, assistance is provided through programme aid, technical assistance, and aid to build capacity of institutions in recipient countries (Ridell, 2007).

However, the balance-sheet of foreign aid is limited in the literature. For the past decades, foreign aid increased significantly in poor countries; meanwhile economic growth was declining in the same period (Easterly, 2006). Multiple causes contributed to this situation such as a lack of project planning and coordination (Van de Walle, 1996), political, strategic and commercial

interests of donors (Ridell, 2009), and governance issues from the recipient countries (Calderisi, 2006).

Hancock (1989) illustrated an example of a highway project in Somalia, externally funded and built in 1983 by an international contractor: the highway was only serviceable for five years, meanwhile that country had to pay the loan for that project until 2023. Brunel (1993) went further indicating that the French aid agency was squandering French resources. According to her, only 5% of French aid effectively contributed to development in assisted countries, the rest was distributed to French companies through fruitful contracts, and for an excessive technical assistance. Foreign aid policies need to be improved for win-win partnerships between donors and recipient countries.

Project Size

Poor technical studies (MINTP, 2007a, 2008c) and delays in bidding were cited in reports for causing cost and time overruns for large projects. According to these sources, bidding processes for large projects, which often involved foreign lenders, were lengthier and more complicated than those of medium and small size projects (Banque Mondiale 2005; MINTP, 2008b). At the point of notice to proceed for some contracts, design studies needed to be updated. In addition, the sub-contracting processes were limited such that at the ministry work was not divided into sub-contracts for more efficiency, as is typical in the U.S.

Project Duration

Project durations at MINTP were controlled by the ministry through notices to start or to stop the work; these durations seemed approximate in many contracts because they were based on bar charts without activities being clearly defined. Large durations were not necessarily linked to large projects. Small projects such as mowing projects were scheduled for three years, however

the work was actually completed during three to four months each year. Mowing projects showed smaller project overruns during the contract data analysis. Weaknesses during design studies also suggested little detail for durations, which may increase during project implementation.

6.3 Discussion of the Survey Results

According to the survey of construction professionals in Cameroon, the top six causes of cost overruns and time delays in highway and bridge projects were:

1. Negligence of Site Visits Before/During the Bidding Process-Unknown Site Conditions
2. Weak and Insufficient Technical Studies
3. Lack of Project Planning/Programming
4. Underestimating of Cost Estimates and Schedules/ Overestimating of Benefits
5. Lack of Equipment
6. Bidding Procedures

These six factors, as well as others, are discussed below.

6.3.1 Issues in Planning and Programming

From MINTP documents, transportation planning and planning in general seemed to be secondary activities within the ministry. The planning department was created in the mid-2000s, and seemed to have limited involvement in the activities of the ministry. Several units supervised programming activities within the ministry. However, no transportation improvement program was available at MINTP. Many projects were decided during budgetary sessions with parliamentarians (Njoh-Mouelle, 2001). Such unplanned projects were likely to experience large cost and time overruns. Project teams would face many unexpected situations, starting with

expropriations. That seemed to be the case for small contracts which had the highest project overrun rates.

6.3.2 Problems Relating to the Design Process

Project Implementation Strategies

After studying the documents collected at MINTP, including contract samples, it seemed that MINTP may have project implementation strategies that were not well suited to its socio economic situation.

Without having companies available to ensure its field duties, MINTP totally privatized its project implementation in the 1990s, and adopted work supervision by private parties for contract administration (World Bank, 2004) although it had personnel for such tasks. In addition, all contracts were awarded through a complicated and lengthy bidding system created in the same period: all the work was carried out and supervised by private parties (Banque Mondiale, 2005 ; MINTP, 2008b). By comparison in the United States, construction and consultant companies have existed for centuries and are competitive, along with use of force account for specific projects (Refer to thesis definition of force account in the glossary). As illustration, table 6.1 shows for the past five years, the value of force account projects by the Michigan Department of Transportation (MDOT).

Year	Amount (US$)
2009	18,936,762
2008	15,895,652
2007	24,033,713
2006	17,054,685
2005	2,664,971.00

Table 6.1 Amounts of MDOT Force Account Projects for Past Years (Source: www.michigan.gov)

Furthermore, table 6.2 shows the United States Department of Transportation had competition in contracting ranging from 61% to 82% of its projects from 2006 to 2008.

Year	Competition in Contracting
2008	82%
2007	76%
2006	61%

Table 6.2 Percent of US DOT Competition in Contracting for 2006-2008
(Source: www.recovery.gov)

These tables demonstrate that possibly, Cameroon has outsourced its public work activities, more than in the U.S., which is strange for a developing country.

Weak and Insufficient Technical Studies

Before work was implemented, studies were carried out from socio-economic analysis to detailed design. Contract analysis conducted during this research showed that the design process had a critical influence on cost and time overruns. Weak and Insufficient Technical Studies were found to be the second most common cause, cited in the survey of professionals. The scope of projects was defined by technical studies. In some instances, weak studies were not detailed enough to clearly allow the project team to build a project. Insufficient technical studies required more design effort from the project team during design, and cost projects extra time and money.

From the contract analysis, it was found that MINTP spent 2% of project resources from 1997 to 2007 for design and technical studies and technical assistance. Poor technical and design studies were described negatively. Wrong, incoherent, or irrational technical studies were dismissed many times at the beginning of construction or maintenance work (MINTP, 2007a ; MINTP, 2008c). In addition, the purposes of some change orders for work supervision were to

implement environmental studies during the work. However, environmental studies had to be carried out before project approval. The common practice for project development is to schedule project implementation only when environmental impact studies are approved.

Advanced cost and time management are needed to improve project performance. Instead of using simple bar charts which were found in the contract analysis conducted during this research. None of the contract specifications reviewed defined scheduling activities or networks; leading to weak technical studies. Design contracts should be improved, in order to hold design consultants accountable for their work.

6.3.3 Issues Found During Bidding Procedures

The bidding phase was found to be the most critical for cost overruns and time delays. The factors related to the bidding phase included bidding procedures, the duration of the period for bidding, the lowest bid price system, and unreasonable adjustment of project costs by contractors were cited as important causes in Chapter Five for their impact on project overruns. A final report by MINTP (MINTP, 2008b) for a study of problems related to bidding of public contracts at MINTP pointed out many issues which included: malfunctions between MINTP services and between MINTP and other public institutions involved in bidding processes, as well as problems related to public contract regulation. As a result, bidding processes wasted resources and time, and were detrimental to project implementation.

The public contract code of Cameroon adopted in 2004 shows many issues which were identified by the researcher, as indicated below:

- The project owner, who is the minister of MINTP, has no final decision in the bidding process. A specialized bidding board reviews bid awards and would possibly reverse the minister's decisions, adding more time to bidding procedures (MINTP, 2008b).

- The project owner awards contracts after propositions from an internal bidding board. The bidding board itself proposes contract awards after bid analysis by a separate board, designated as “sub-board for bid analysis”. In addition, the sub-board works under the scrutiny of an “independent observer” who is a consultant recruited by the authority for public contracts. For projects with external funding, the donor has to formally approve the awards: this last step can take months.
- The procedures above are used for all contracts, even for simple projects such as regular maintenance or the mowing of roadsides.

With such rules, the volume of work is so huge that MINTP created four bidding boards for its various types of contracts. In spite of that, bidding procedures take so long that site conditions have frequently changed or deteriorated by the time of contract implementation. Change orders are needed to solve such problems (MINTP, 2009a ; MINTP, 2008b).

Another noteworthy issue in the public contract code is that, it does not apply to international conventions between Cameroon and other countries or donors, as stated in its article four. The researcher believes such disposition unfair and inequitable to local contractors, and does not promote good governance. In general, lenders or donors funding projects also brought contractors from their countries. Not only was the pricing of such contracts high because of limited competition, but also international contractors received exemptions on taxes and customs duties to import equipment and buy materials for project implementation (MINTP, 2009a). This equipment was later used for other contracts awarded to those international companies in the country (MINTP, 2009a). Local contractors did not have such advantages and were automatically excluded from the bidding of large contracts which require an extended use of heavy equipment. Here again, limited competition leads to high pricing and cost escalation.

6.3.4 Comments on Project Implementation

"Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions", and "Lack of Equipment" were ranked as the first and fifth causes of project overruns in the survey of MINTP staff and partners.

Site visits are required for contractors during the bidding phase. Many change orders potentially flow lack of knowledge of site conditions by contractors such as changed plans, increased costs to account for added tasks, and changes in scope of work. Consultants who did not conduct site visits provided inadequate design studies. Similarly, due to remoteness of project sites, short bidding periods and limits on bidding expenses, constructors would rely solely on bidding documents for their offers. As previously written, these design documents were not always reliable.

In many cases, contractors were responsible to conduct site visits; however, change orders resulted from differences between bidding documents and actual conditions which could have been observed. Site conditions also changed significantly between the bidding phase and the contract award or notice to proceed, when actual bidding periods were longer than expected. Change orders were necessary to update contract documents for actual site conditions.

In addition, MINTP solved the issue of congestion of bidding boards from a large number of contracts for award, by bidding multi-annual contracts lasting for typically three years, for maintenance activities. However, change orders were sometimes needed for the last years because of changed site conditions. This was also the case for contracts, which were awarded several months or even a year ahead of the notice to proceed. To update contract quantities, MINTP adopted its contract procedures, to include an initial site visit by the project team, after

the notice to proceed for contractors. However, in the author's opinion, this practice needs to be abandoned because it usually modifies the initial contract quantities above acceptable limits, favoring irrational estimating by contractors during the bidding process, mindful that their estimates will be corrected and change orders executed, after they will receive the notice to proceed with work.

Lack of Equipment: Substantial project costs are due to the use of heavy equipment (Sears et Al., 2008). This was a crucial problem for MINTP, since this equipment had to be imported and the equipment was not affordable for most contractors. When privatization was adopted by the ministry in the early 1990s, all MINTP owned equipment, mostly depreciated, was sold to the new private companies or transferred to MATGENIE, the public agency for heavy equipment rental, which had economic difficulties since its inception. From 1995-2010, obsolete equipment frequently failed on job sites. In 2010, new equipment was purchased for MATGENIE.

Methods of Payment: Some change orders were due to contractor delays, because they were waiting for cash advances from the ministry (Groupe de la Banque Africaine de Développement, 2008). MINTP took financial risks, by allowing advances to contractors which were repaid without interest charges. Similarly, retainage could be replaced by a bond from a bank. This was another risk, due to the instability of contractors and banks. Furthermore, bonding agencies did not exist in Cameroon, so contract bonds were merely signed by banks.

Unethical Activities and Kickbacks: This factor was not perceived by the survey respondents as a source of cost overruns and time delays at MINTP, it was classified as "Low Priority". However Njoh-Mouelle (2001), a member of the Cameroon's parliament reported that in his region, a contractor was totally paid for work not even started on site, attempted to process two change orders on that fictitious project, while claiming a third change order for more "compensation".

Another concern was raised after scrutiny of MINTP's contracts, considering large disparities between the wages of constructors, consultants and government employees. For workers with similar qualifications, some earned up to ten times the salaries of others from the same employer (MINTP). This was unsustainable, and could lead the lower paid employees, mostly from government to look for compensation from private counterparts. It was an issue for ethics and good governance which could impact project costs because contractors would attempt to recover extra spending through change orders. These would be rapidly validated by agents who received kickbacks. For such problems, the President of the Republic of Cameroon, Paul Biya (1987) wrote:

> *" Since the building of our country is inevitably a collective task, an enormous task to which each citizen makes a contribution according to his means and abilities, it would be injustice of the highest order to institutionalize inequalities between effort and remuneration among workers. Such injustice existed and is still widespread in our society, leading to a great deal of frustration, complexes and eventually resignation …the salary gap between the private and semi-private sector and the public sector must be reduced considerably.…The lesson will be applied rigorously in both sectors since harmonized or equal pay will mean that the same skills, the same efficiency and the same output will be expected of everybody. Laxity and the shirking of duty by the post-colonial administration led to the popular conclusion that state employees were incompetent, inefficient and consequently deserved their low remuneration. I do not think that such shortcomings are inherent in government employees or that their case is a hopeless one. On the contrary, through a global policy based on social justice, we hope to eliminate such shortcomings as well as the presumed causes of salary and wage disparities. "*

6.3.5 Project Control and Post-implementation Problems

In developing countries, Government agencies may lack contract administration skills. At MINTP, some change orders seemed to be to the detriment of the ministry. Valid explanations were not found by the researcher, for change orders which looked inappropriate for their purpose (MINTP, 2007a). As examples, the following were found:

- Time extension and financial compensation through price updating, for contractors who deliberately delayed the work, demanding cash advances before starting to work
- Financial compensation to contractors for some shortage of materials, or for damages to the work due to contractor's negligence
- Financial compensation for diverse MINTP(owner) lateness in addition to time extensions

Appropriate project controls and contract terms would have helped to prevent such change orders.

Improvements were taken by the public contract authority to regulate price updating (SPM, 2011a) in order to limit costly change orders which occurred when projects were delayed for a long period. Overall, more improvements are needed: MINTP implemented project strategies which were already identified as costly and inefficient. Costs of the development project system seemed to largely surpass their benefits. Periodic *ex post* evaluation of the system would contribute to reduce cost and time overruns, for the interest of taxpayers.

6.3.6 Summary of Factors for the Suggestion of Guidelines

Table 6.3 was developed from the discussion above along with Chapter Five of this thesis, in an attempt to select important factors for the thesis recommendations.

Factors	Literature Evidence	Survey Data	MINTP Reports and Studies	Priority for Guidelines
Planning and Programming				
Lack of Project Planning/Programming	(Merewitz ,1973)	High	High (MINTP,2008b, 2009c)	Yes
Inadequate Project Planning/Programming	(Flyvbjerg, 2008)	High	Low (MINTP,2009a, 2007a)	No
Weaknesses during the land takings process	(Okole, 2009a)	High	Low (MINTP,2008b) , (MINTP,2009c, 2007a)	No
Expropriation costs	(Jergeas , 2009), (Anderson et al., 2008)	Low	Low (MINTP,2009c, 2007c)	No
Legal environmental requirements	(Jergeas , 2009), (Anderson et al., 2008)	Low	Low (MINTP,2009c)	No
Design Process				
Weak and insufficient technical studies	(Ajibade and Odeyinka,2006), (Anderson et al., 2007), (Creedy et al.,2010),(Cameroon-Tribune Archives, 2009)	High	High (MINTP,2009a, 2009b,2009c,2008b,2007a)	Yes
Underestimating of cost estimates and schedules/ Overestimating of Benefits	(Flyvbjerg et al., 2004)	High	High (MINTP,2009a, 2009b,2007a)	Yes
Poor project implementation strategies	(Jergeas, 2009), (Anderson et al, 2007), (Shane et al., 2009)	High	High (MINTP,2009a; PRC,2004)	Yes
Mistakes and discrepancies in documents	(Okpala and Aniekwu, 1998)	Low	Low, No Evidence	No

Table 6.3 Summary of Factors to Consider for Guidelines

Table 6.3 Summary of Factors to Consider for Guidelines (Cont'd)

Factors	Literature Evidence	Survey Data	MINTP Reports and Studies	Priority for Guidelines
Bidding Phase				
Bidding Procedures	MINTP Specific	High	Very High (MINTP, 2009a, 2008b)	Yes
Duration of the Period of Bidding	(Okpala and Aniekwu, 1998)	High	Very High (MINTP,2008b)	Yes
The Lowest Bid Price System	(Hinze and Selstead, 1991), (Jin-Kyung, 2008), (Lo et al., 2006), (Frimpong et al., 2003)	High	High (MINTP,2009a)	Yes
Unreasonable adjustment of project cost by contractors	(Jin-Kyung , 2008)	High	High (MINTP,2009a)	Yes
Project Implementation				
Negligence of Site Visits Before/During the Bidding Process-Unknown Site Conditions	(Pratt, 2004), (Sweet and Schneier, 2009), (Lo et al., 2006)	High	High (MINTP, 2009c, 2007a)	Yes
Mismanagement Due to Inexperienced Supervisors	(Merewitz ,1973), (Le-Hoai et al., 2008), (Mansfield et al., 1994), (Jergeas, 2009)	Low	Low (MINTP,2009c)	No
Supervisor and Contractor Claims and Disputes	(Abd El-Razek et al., 2008)	High	Low, No Evidence	No
Many Stakeholders	(Abd El-Razek et al., 2008)	High	High (MINTP,2008b)	Yes

Table 6.3 Summary of Factors to Consider for Guidelines (Cont'd)

Factors	**Literature Evidence**	**Survey Data**	**MINTP Reports and Studies**	**Priority for Guidelines**
Poor Communication Among Contract Stakeholders	(Tumi et al., 2009), (Le-Hoai et al., 2008), (Sambasivan and Soon, 2007), (Jergeas , 2009),	High	Low, No Evidence	No
Unethical Activities And Kickbacks	(Okpala and Aniekwu, 1998)	Low	High (MINTP,2009a)	No
Equivocal/Unclear Contracts	(Anderson et al , 2007), (Shane et al., 2009)	Low	Very High (MINTP,2009e, 2009f,2009h,2009i,2009j,2007a ,2007b,2005a,2005b,2005c, 2004)	Yes
Changes in Scope of Contracts	(Merewitz , 1973), (Anderson et al, 2007)	Low	High (MINTP,2007a)	No
The Displacement of Existing Networks	(Cameroon-Tribune Archives, 2009)	High	Low (MINTP,2009c)	No
Construction Errors and On Site Testing Approval	(Anderson et al, 2007), (Okpala and Aniekwu, 1998)	High	Low, No Evidence	No
Building on unexpected archaeological sites	(Lo et al., 2006), (Le-Hoai et al., 2008), (Abd El-Razek et al., 2008)	Low	Low (MINTP,2007a)	No
Shortages of Materials	(Okpala and Aniekwu, 1998), (Abd El-Razek et al., 2008);	Low	Low, No Evidence	No

Table 6.3 Summary of Factors to Consider for Guidelines (Cont'd)

Factors	**Literature Evidence**	**Survey Data**	**MINTP Reports and Studies**	**Priority for Guidelines**
Material Price Fluctuation	(Merewitz, 1973), (Le-Hoai et al., 2008), (Frimpong et al., 2003)	High	Low (MINTP,2007a)	No
Methods of Payment	(Okpala and Aniekwu, 1998)	High	Low (MINTP,2009a, 2009c)	No
Lack of Equipment	(Okpala and Aniekwu , 1998), (Abd El-Razek et al., 2008)	High	High (MINTP,2009a)	Yes
Weather Conditions	(Bramble and Callahan, 2000), (Abd El-Razek et al., 2008), (Le-Hoai et al., 2008), (Okpala and Aniekwu, 1998)	High	High (MINTP,2009a, 2009c)	Yes
Political Tensions/Insecurity	(Akinci and Fischer, 1998)	Low	Low (MINTP,2007a)	No
Project Control and *ex post* Evaluation				
No Action Taken After Contract Progress Reports	(Jin-Kyung, 2008)	Low	Low, No Evidence	No
Periods of Inspection and Testing After Contract Completion	(Okpala and Aniekwu, 1998), (Tumi et al., 2009), (Mansfield et al., 1994)	Low	Low (MINTP,2009c)	No
Lack of Contract *ex post* Evaluation	(Jin-Kyung, 2008)	High	Low, No Evidence	No
Negligence of Past Experiences	MINTP Specific	High	High (MINTP,2009a)	Yes

6.4 Guidelines

Chapter Four unveiled cost and time overruns in the project contract files, which undermined highway and bridge projects in Cameroon. The magnitude of this problem was also described in the same chapter. Next, Chapter Five discussed perceptions of causes of cost overruns and time delays from survey respondents for the case study organization. Additionally, causes identified in the literature or in MINTP reports were considered in identifying factors for development of guidelines. Recommendations or guidelines emerging from the research are presented below.

6.4.1 Guidelines from the Data Analysis

The previous discussion showed that optimizing time management at all project phases is fundamental in reducing impacts on costs of labor, equipment and materials. Guidelines are suggested for each factor of project overruns selected from Table 6.3.

Lack of Project Planning/Programming

In order to help MINTP improve the planning process, it is necessary to organize seminars on transportation planning. Progressively, planning should be implemented in the ministry and its importance emphasized. In April 2011, a new organization was adopted for MINTP; although it still has a planning division, environmental studies are carried out by another division (PRC, 2011). Socio-economic studies, preliminary design, and environmental studies are planning activities. Once projects receive environmental clearance, they are programmed and detailed design proceeds within programming units, along with expropriation studies which would be completed before work starts. The author also believes that the ministry's road plan needs updating, and a transportation improvement program adopted. However, detailed transportation planning is out of the scope of this study.

Weak and insufficient technical studies and Underestimating of cost estimates and schedules/ Overestimating of Benefits

- The introduction of cost conditions (Sweet and Schneier, 2009) in consultant contracts for technical studies, so that design professionals would produce more accurate cost estimates is proposed. In addition, these contracts could also include retainage and possible warranty provisions.
- To streamline cost estimating, labor costs could be standardized for all trades and equipment, so that the differences among bids would be determined by the costs of materials. Establishing prevailing wages would be an important step toward such standardization.
- Seminars on cost estimating and project scheduling would also allow design professionals to efficiently estimate costs and time needed to implement projects.
- Large projects should be scheduled through networks of activities.
- Sub-contracting should be developed.

Project Implementation Strategies

- MINTP should use its own forces first, to execute its main projects. Then, the remaining projects can be entrusted to private parties; force account should be restored. More efficiency can be attained through reducing procedures and hence corresponding spending for professionalism. Outside work supervision should not be used unless projects are very specialized so that experts are needed to provide solutions. Such projects should be large and include many constructors. Relieved from the burden of work supervision, consultants would therefore focus on technical studies, to significantly improve them. Similarly mowing projects, rural road maintenance, and unpaved road maintenance are proposed for force account which would not only increase the volume of projects, but would also reduce the burden on bidding boards and create jobs in rural

areas. Such measures would help in achieving timely project implementation. Adopting a project management approach for force account projects and training of MINTP personnel to improve contract administration are highly recommended. Increased accountability at MINTP is a pre-requisite for the success of such guidelines.

- An important innovation suggested for MINTP is to develop the subcontracting process, to start small, reduce costs and promote professionalism. A plan to develop public work subcontractors over the entire country is needed. The plan could cover a period of fifteen years.
- It is also suggested that MINTP stops delivering cash advances to contractors. Such financial activities should be reserved to banks, and the ministry employees should concentrate on technical questions. A plan should also be proposed for the development of bonding companies in Cameroon, able to carry out the work in lieu of their 'principal debtors".
- To reduce endless spending on costly and deteriorating unpaved roads, MINTP should think about a program of road pavement, based on savings from the cancellation of external work supervision and increased force account. Lastly, using its own forces would also mean relying on its own resources. This path was shown in 2010 when the government sold treasury bonds locally to fund infrastructure projects (Teke, 2011). If MINTP improves its project management, increased productivity will allow the development of more projects funded locally, and fewer projects would use outside donors.

<u>Biding Phase: Bidding Procedures, Duration of the Period of Bidding, The Lowest Bid Price System, Unreasonable adjustment of project cost by contractors</u>

It is proposed to revise the public contract code of Cameroon in several ways including:

- Introducing prevailing wages to reduce wages disparities such as in the U.S. (Fisk, 1997)

- Streamlining bidding procedures by cancelling the special boards and limiting the "independent observer" to a sample of projects per year, providing more responsibility to project owners (MINTP, 2008b)
- Award contracts to the lowest responsible and responsive bidder (Sweet and Schneier, 2009)
- Accounting for cancellation of external work supervision
- Use of force account for more efficient project delivery
- Including project start and end dates in contracts, as suggested in the survey responses
- Introducing a "time is of the essence" provision in contracts, to emphasize the importance of time. Liquidated damages could also be prescribed, in lieu of the current "late fee penalties" prescribed by the contract code.

When contractors are delayed by MINTP, or the project owner, the only possible compensation should be time extensions for completing the work (Wickwire et al., 2003). This would help protect public funds.

Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions

- Site visits by bidders should be mandatory during the bidding phase. For this purpose, more value should be given to site visits for the evaluation of bids. More than simple statements of site visit should be required. Pictures showing specific details of the site along with the date could be required for each bid. Forms can also be provided to bidders, who will confirm the locations and quantities of the job to be performed in comparison to the bidding documents.
- Cost conditions and requirements for retainage were previously proposed for design contracts. Such measures will help to insure that consultants provide technical studies, consistent with field conditions.

Many Stakeholders

Reducing the number of participants in project development would help reduce waste in cost and time. Specifically, the project owner should have more responsibility during bidding approval procedures as previously proposed. Reducing outside work supervision would reduce the confusion over work performance: the contractor instead of the work supervisor should be solely responsible for the quality of its work.

Equivocal/Unclear Contracts

Revisions to the public contract code and adoption of coherent project implementation strategies as previously suggested will provide MINTP with contracts with high standards. Such contracts could reduce possibilities for project overruns.

Lack of Equipment

Heavy equipment available in the country should be directed to paving projects and for important bridges. Labor intensive methods by local people would be preferable for unpaved roads, according to Schumacher's philosophy.

Weather Conditions

Appropriate time management is crucial to reduce the impact of weather conditions on project implementation. Except for exceptional weather, which occurs unexpectedly, project overruns due to weather conditions would be avoided if MINTP becomes successful in time management. The rainy season would not interfere with the scheduled work.

Lessons learned from Past Experiences

Acquiring information systems for project controls is suggested to help MINTP manage projects and keep track of records. Evaluating projects at post implementation would assist the ministry in focusing on the right directions and take advantage of lessons learned from past

experiences. Databases for storing and analyzing construction project cost and schedule information are necessary for MINTP and its partners.

6.4.2 Other Guidelines from the Literature

Remedies for reducing cost overrun and time delay factors from the literature presented in section 2.5 are discussed below for the case-study of MINTP. Project governance, reduction lists and lean methods, and foreign aid are considered.

- Project Governance: Increased Accountability

Good governance requires the development of projects for public interest, which follow the principles of merit and equal opportunity for all. The public needs to be aware of the processes of project development for achievement of transparency and increased accountability. Under the scrutiny of taxpayers, project teams should provide their best efforts to keep projects on budget and time. Whistleblowers, who are persons who report misconduct or mismanagement observed during the activities of a public agency, would help in improving project governance. Whistleblowers should be protected by public authorities and by laws protecting them from any sort of retaliation, such as in the U.S.

- Reduction lists and lean methods

One reason for lower project overrun rates in Cameroon compared to other countries could be the reduction of contract scope by project teams, when unexpected field conditions were observed during project implementation. However, such practices raise problems of fairness to bidders who were disqualified and favored irrational low bids, as well as reductions in project quality.

Lean methods would have a high impact in reducing project overruns in developing countries such as Cameroon; however, basic improvements in contract administration and project management in general are required.

- Foreign Aid

It was noted that external funding could be more beneficial to MINTP. Propositions to reform foreign aid in the literature were:

- An increased accountability of public funds in recipient countries
- The merging of donor programs for more coherence and uniqueness of procedures
- Improving donor-recipient relationships, with "discrete" donors not directly involving themselves in projects.

Overall, the philosophy of Schumacher (1973), which is still relevant, was found relevant for successful projects in developing countries, which would keep budget and time in scope. Suggested guidelines from Schumacher are summarized as follows:

- Building adapted, human scale systems, which can be understood and efficiently run by concerned people
- Encouraging the formation of workplaces employing large numbers of people, where they live
- Promoting simple methods of production from local materials
- Relative variations of wages and fringes within organizations should range between 1 to 7 between the lowest and highest ones, regardless of race, age, sex, function or experience.

In a few words, it is a matter of starting small, organizing, streamlining and standardizing processes. For the case study of Cameroon and similar developing countries, privatization may have gone too far, even further than the U.S. as shown in the discussion. Poor results observed

should not be a surprise. Schumacher's philosophy would suggest that only projects which are worth competition should be bid and only projects needing private work supervision should be supervised that way. In addition, the bidding systems should be simplified to allow timely project implementation. Doing so would save resources, and time would be used more efficiently to complete more successful projects.

6.5 Proof of Concepts

The guidelines and recommendations suggested in this study will have to be discussed and validated by the case study organization. The researcher has prepared suggestions for a "proof of concept" process which is included in Appendix 6. The suggested approach includes a survey or interview approach to gain feedback from MINTP staff of the accuracy and usefulness of the recommendations and barriers and opportunities for their implementation. Any "proof of concept" study should include appropriate Human Subjects Review procedures from the hosting organization. A sample of five to ten managers should be selected for this survey. A similar process can be undertaken in other agencies in developing countries, for the adoption of relevant thesis guidelines for their organizations. Due to reorganization processes being undertaken in MINTP during conclusions of the research, this was not possible during completion of the thesis.

6.6 Chapter Summary

The purpose of Chapter Six was to suggest guidelines developed from the research data analysis, the literature and documents collected from the ministry. Opportunities were identified, which could result in reducing change orders at MINTP. Foreign aid policies and practice were also discussed, because the highest volumes of project overruns were found in projects with foreign aid funds. Guidelines were proposed to correct flaws observed, which if implemented can help reduce cost overruns and time delays. These guidelines relate to all phases of project development and will further need to be validated by MINTP, or any other agency willing to adopt these guidelines. Although the guidelines specifically address MINTP projects, the

researcher strongly believes the analysis and guidelines likely have application in other developing nations. Further research could be conducted to test application of the guidelines in other nations.

CHAPTER 7
CONCLUSION

7.1 Introduction

The literature review showed that there was limited statistically sound research on cost overruns and time delays in construction projects in developing countries. This study attempted to fill gaps, through the case-study of highway and bridge projects in Cameroon. The study was both quantitative and qualitative in nature, providing cost and time overrun rates from contract data and an analysis of their causes through a survey of construction professionals in the case-study country. Literature review was conducted, research questions established, and data was collected and analyzed. Results were provided and guidelines suggested for improving cost and time performance of construction projects in Cameroon and they are believed by the researcher to apply in other developing nations.

7.2 Research Objectives

This thesis aimed to statistically describe cost overruns and time delays for highway and bridge projects in Cameroon, determine their major causes and suggest improvements to reduce project shortcomings. Contract data were collected in Cameroon for the period 1994-2009 and construction professionals surveyed in the same country.

Literature review was conducted to identify studies of cost overruns and time delays in construction projects. Studies were found which described surveys of professionals to determine the causes of cost overruns and time delays, and well as statistical studies of cost overrun rates, mainly for Europe and North America. The studies suggested remedies for cost and time overruns.

MS Excel was used to create electronic files for input of 5,000 contracts and change order references which was initially available in hard copy only. Contracts and change order references signed by MINTP during the period 1994-2009 were input, sorted, and then change orders were

attached to corresponding contracts. Data which was not related to highway and bridge projects was excluded for analysis. Statistical significance was sought during data analysis.

Similarly, SPSS and MS Excel were used to report and analyze survey data which was used to classify the causes of cost overruns and time delays in five categories using a Likert scale for project phases including: Planning and Programming, Design Process, Bidding Phase, Project Implementation, Project Control and *ex post* Evaluation. Data was codified to ease electronic reporting and statistical analysis. Frequency analysis and cross tabulations were performed to rank the causes and investigate the correlation among variables.

Detailed tables and figures were used to illustrate results found, and guidelines suggested to improve cost and time performance of highway and bridge projects in Cameroon. These guidelines likely have application in other countries, and this could be subject of further research.

7.3 Summary of the Research

For this research, a total of 3,868 contracts relating to highway and bridge projects and 700 related change orders were reported, out of which a sample of 394 with cost or time overruns were studied. It was determined that cost overruns and time delays varied with the type of project, project ownership or funding source, and project size.

Project Type

Five types of project were studied, including: Road Construction/Maintenance, Work Supervision, Bridges and Structures, Design/Technical Studies- Technical Assistance, and Mowing Roadsides. Work supervision had the highest average rate of cost overruns of 22.93% on average, followed by Road Construction/Maintenance with 10.43%.

Project Ownership

The main sources of project funding at MINTP were Cameroon's Government, African Development Bank, European Union, World Bank, France, Islamic Development Bank, OPEC Funds, Koweitian Funds, Saudian Funds, and HIPC Funds. Projects funded by the European Union had the highest cost overrun rate of 26.51% on average.

Project Size

The research suggested that cost overruns and time delays, in relative value or percentage, decreased when the project size increased. However, low significance was observed. Furthermore, the size of cost overruns, in monetary value increased with project size and high significance was observed in this latter case.

Project Duration

Time overrun rates decreased when project durations increased, with strong significance. The same result was observed for the relationship between project durations and cost overrun rates.

Contractor Familiarity with Agency

No correlation or model could be established during this study between contractor familiarity with MINTP and cost overruns, time delays or change orders.

Relationship between Cost Overrun Rates and Time Overrun Rates

It was found that cost overrun rates increased when time overrun rates increased.

Causes of Cost Overruns and Time Delays

Eighty four valid responses out of 100 initially sent to professionals in Cameroon were received, and analyzed. From the survey analysis, the following factors ranked highest as important causes of cost overruns and time delays in Cameroon:

1. Negligence of Site Visits Before/During the Bidding Process-Unknown Site Conditions
2. Weak and insufficient technical studies
3. Lack of Project Planning/Programming
4. Underestimating of cost estimates and schedules/ Overestimating of Benefits
5. Lack of Equipment
6. Bidding Procedures

Considering project development steps, the bidding phase was found to be most likely involved with project overruns.

This study neither confirmed expectations that cost overrun rates were higher in developing countries (Flyvbjerg et al., 2003b) nor that costs were overestimated and schedules were optimistic as indicated in the literature (Gamez and Touran, 2010). Instead, comparable and even lower cost and time overruns were found.

Also, this study suggests that project overrun rates and sizes should be differentiated, because they have different relationships with project size and project duration.

Guidelines

Results from contract data analysis, the survey, the literature and MINTP reports were discussed, and guidelines were suggested to reduce cost overruns and time delays for highway and bridge projects in developing countries, and specifically Cameroon.

Given the complexity observed in the project development processes, guidelines were aimed to streamline processes at MINTP and partnering agencies, and to adapt them to the socio-economical context of Cameroon. However, the researcher believes that these guidelines have application in other developing nations.

7.4 Further Research

After this study, further research is needed to address its limitations. Some interesting questions could be investigated, based on the contract files and survey responses. Seeking the impact of geographic regions in Cameroon on cost and time performance would provide more insight. In addition, road construction contracts and road maintenance contracts could be split and studied separately for more precision on their overruns. Similarly, government projects could be aggregated by budgetary items before study: procedures differ for the Road Fund and other government budgetary sources.

Furthermore, ranking the survey responses by profession and by sector would provide interesting findings.

Lastly, further studies examining construction project overrun rates and sizes for other developing countries and testing the validity of guidelines in other countries would provide more stepping stones towards the understanding of cost overruns and time delays in developing countries.

7.5 Chapter Summary

This chapter summarized the research and presented the findings from the data analysis. Areas for further research were also identified.

Lessons from Cameroon were used to suggest guidelines to streamline processes and to adapt them to a local context, for reducing cost overruns and time delays in highway and bridge projects.

APPENDICES

Appendix 1
Abstract in French

RESUME

SURCOUTS ET HORS-DELAIS DANS LES PROJETS D'INFRASTRUCTURES ROUTIERES ET DE PONTS DANS LES PAYS EN DEVELOPPEMENT - *EXPERIENCES DU CAMEROUN*

Par

Bertin Bella Akoa

La performance en termes de couts et délais est une préoccupation pour les responsables de projet de construction, particulièrement pour les projets de routes et de ponts à cause de l'incertitude caractérisant ces derniers. En dépit des innovations technologiques dans le management des projets, peu d'améliorations ont été enregistrées dans les performances en termes de couts et délais des projets de transport depuis quatre-vingt ans (Flyvbjerg, 2008).

Pour les pays en développement, des études statistiquement significatives décrivant les surcouts et hors-délais sont nécessaires, desquelles des solutions appropriées à ce problème seraient trouvées. Cette recherche a pour but de combler ce vide, à travers l'étude de cas du Ministère des Travaux Publics (MINTP) du Cameroun. La littérature scientifique sur les surcouts et hors-délais a été revue, des données de contrats chronologiques collectées, et une enquête scientifique administrée à des professionnels de la construction au Cameroun.

En résultat, il fut établit que les marchés de contrôle des travaux et les projets financés par l'aide au développement avaient enregistré les taux les plus élevés de surcouts. Aussi, les projets les plus larges disposaient des plus volumineux surcouts. Les taux de surcouts ou hors-délais décroissaient quand les montants ou les durées de projet augmentaient. La négligence des visites de sites pendant les études techniques et pendant la passation des marchés de travaux était la principale cause de surcouts et hors-délais pour le MINTP. Les causes de surcouts et hors-délais ont été trouvées au niveau de toutes les phases de développement des projets, particulièrement au niveau de l'étape de la passation des marchés.

Appendix 2
Socio-Economic Facts of Cameroon

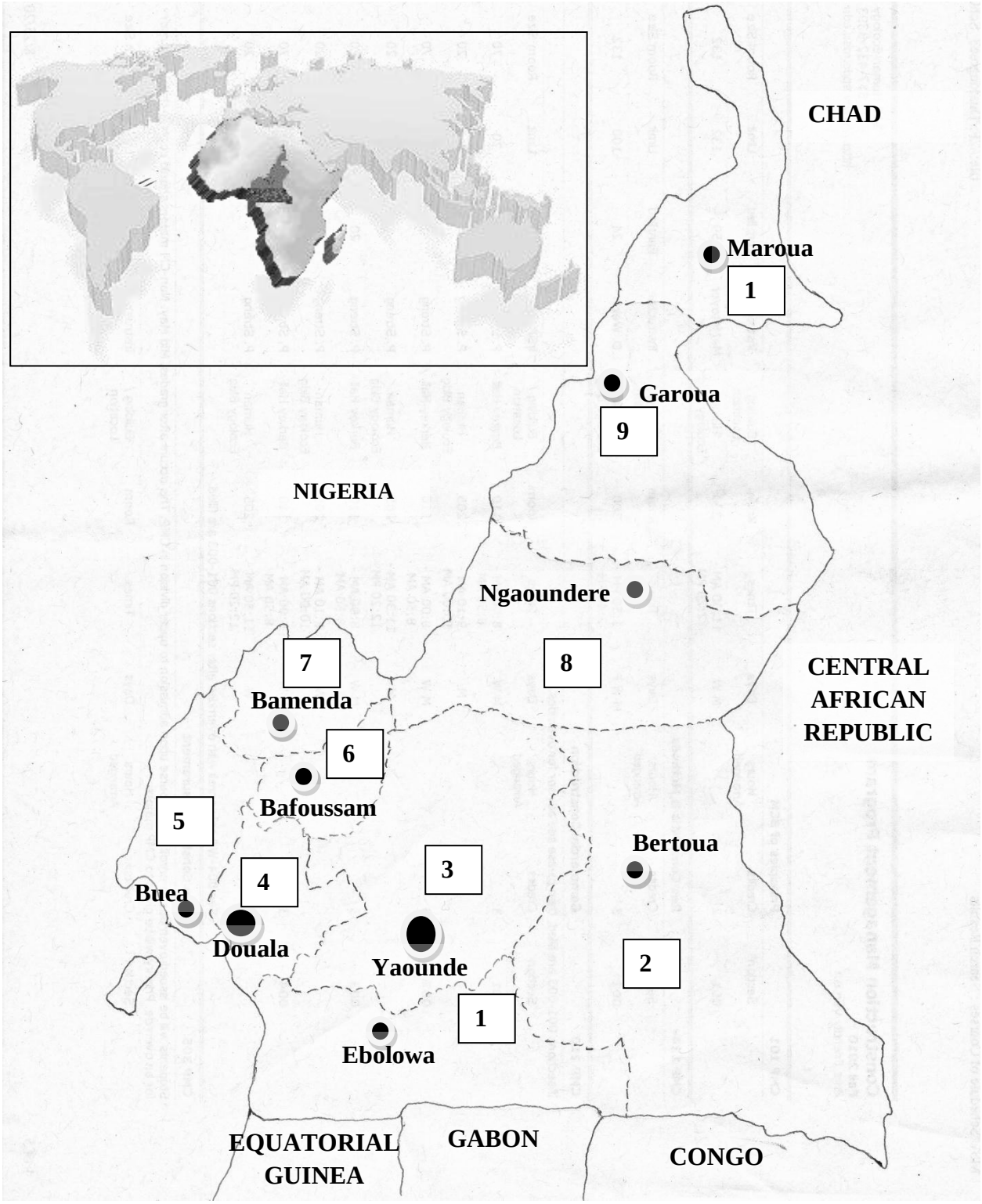

Figure A2.1 Map of Cameroon and Socio Economic Facts (Derived from http://www.prc.cm/index_fr.php?link=b , Accessed 10/28/2010)

Legend:

-------- Region's Limit

Regional City

Large City

(10) Far Northern Region
Population: 2,553,389 inhbt
Area: 34,263 km2
Number of Divisions: 06
Population Density: 74.52 inhbt/km2
Road Network: 5,384 km

(9) North Region
Population: 1,145,038 inhbt
Area: 66,090 km2
Number of Divisions: 04
Population Density: 17.33 inhbt/km2
Road Network: 4,787 km

(7) North West Region
Population: 1,702,559 inhbt
Area: 17,300 km2
Number of Divisions: 07
Population Density: 98.41 inhbt/km2
Road Network: 4,504 km

(8) Adamaoua Region
Population: 681,362 inhbt
Area: 63,701 km2
Number of Divisions: 05
Population Density: 10.7 inhbt/km2
Road Network: 4,255 km

(5) South West Region
Population: 1,153,125 inhbt
Area: 25,410 km2
Number of Divisions: 06
Population Density: 45.38 inhbt/km2
Road Network: 2,991 km

(3) Center Region
Population: 2,272,259 inhbt
Area: 68,953 km2
Number of Divisions: 10
Population Density: 32.96 inhbt/km2
Road Network: 11,036 km
Capital City : Yaounde

(6) West Region
Population: 1,843,518 inhbt
Area: 13,892 km2
Number of Divisions: 08
Population Density: 132.7 inhbt/km2
Road Network: 4,391 km

(2) East Region
Population: 711,651
Area: 109,002 km2
Number of Divisions: 04
Population Density: 6.53 inhbt/km2
Road Network: 4,974 km

(4) Littoral Region
Population: 1,861,463inhbt
Area: 20, 248 km2
Number of Divisions: 04
Population Density: 91.93 inhbt/km2
Road Network: 2,979 km

(1) South Region
Population: 514,336 inhbt
Area: 47,191 km2
Number of Divisions: 04
Population Density: 10.9 inhbt/km2
Road Network: 4,501 km

Appendix 3
Survey Form - English Version

Michigan State University
School of Planning, Design and Construction
Construction Management Program

PARTICIPANT CONSENT FORM
Construction Professionals

COST OVERRUNS AND TIME DELAYS IN HIGHWAY AND BRIDGE PROJECTS IN DEVELOPING COUNTRIES-
EXPERIENCES FROM CAMEROON

Principal Investigator: Tim Mrozowski
Secondary Investigator: Bertin Bella Akoa

Survey

The School of Planning, Design and Construction at Michigan State University is conducting research to evaluate cost overrun and time delay of highway and bridge projects in developing countries. Cost and time performances of projects are indicators of efficiency in project development. This research aims to improve cost and time performances of highway and bridge projects in developing countries, and specifically in the case-study of Cameroon.

As a participant in this research, you are being asked to complete a survey questionnaire, relating to your experience in cost overrun and time delay issues in highway and bridge infrastructure projects in Cameroon. You must be at least 18 years old to participate in this research. Your participation in this research project is completely voluntary. You have the right to say no. If you are uncomfortable, you may change your mind at any time and withdraw from the survey. You may choose not to answer specific questions or to stop participating at any time. Whether you choose to participate or not will have no effect on your grade or evaluation. Your privacy will be protected to the maximum extent allowable by law. Your name and title will not be asked during this survey and will not be used in any publication. The estimated time to complete this survey is approximately 15 minutes. As a participant, you may request a copy of this consent letter for your records.

This research project is not funded. The researchers are employed by Michigan State University and the data collected will be used for a graduate Master's thesis.

If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact:

***Tim Mrozowski**, A.I.A., LEED® AP*
Professor of Construction Management, School of Planning, Design and Construction, Michigan State University, 102B H.E. Bldg., East Lansing, MI-48824, USA, Email: mrozowsk@egr.msu.edu, Phone number : +1 517.353.0781.

Bertin Bella Akoa
Graduate Student, Construction Management Program
School of Planning, Design and Construction, Michigan State University, 112 H.E. Bldg., East Lansing, MI-48824, USA. Email: akoabert@msu.edu, Phone numbers: +1 517.505.8618, in Cameroon: 99.94.41.73

If you have questions or concerns about your rights as a research participant, please feel free to contact:

Judy McMillan, CIP
IRB Director, Michigan State University, 205B Olds Hall, MI-48824, USA. Email: mcmill12@ora.msu.edu, Phone number: 517-432-4502

You indicate your voluntary agreement to participate by completing and returning this survey.

- Please, Check your Profession

☐ Manager

☐ Engineer

☐ Accountant

☐ Other, Specify_____

- Your Sector in the Construction Industry

☐ Government

☐ Contractor

☐ Consultant

☐ Finance

☐ Donor

☐ Other,

Specify_____

Please, Circle your Answer to Each Question	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
The causes of cost overruns and time delays in highway and bridge infrastructure projects in Cameroon are:					
Planning and Programming					
Lack of Project Planning/Programming	1	2	3	4	5
Inadequate Project Planning/Programming	1	2	3	4	5
Weaknesses during the land takings process	1	2	3	4	5
Expropriation costs	1	2	3	4	5
Legal environmental requirements	1	2	3	4	5
Design Process					
Weak and insufficient technical studies	1	2	3	4	5
Underestimating of cost estimates and schedules/ Overestimating of Benefits	1	2	3	4	5
Poor project implementation strategies	1	2	3	4	5
Mistakes and discrepancies in documents	1	2	3	4	5
Bidding Phase					
Bidding Procedures	1	2	3	4	5
Duration of the Period of Bidding	1	2	3	4	5
The Lowest Bid Price System:	1	2	3	4	5
Unreasonable adjustment of project cost by contractors	1	2	3	4	5
Project Implementation					
Negligence of Site Visits Before/During the Bidding Process- Unknown Site Conditions.	1	2	3	4	5
Mismanagement Due to Inexperienced Supervisors.	1	2	3	4	5
Supervisor and Contractor Claims and Disputes	1	2	3	4	5
Many Stakeholders	1	2	3	4	5
Poor Communication Among Contract Stakeholders	1	2	3	4	5
Unethical Activities And Kickbacks	1	2	3	4	5
Equivocal/Unclear Contracts	1	2	3	4	5
Changes in Scope of Contracts	1	2	3	4	5
The Displacement of Existing Networks	1	2	3	4	5
Construction Errors and On Site Testing Approval	1	2	3	4	5
Building on unexpected archaeological sites	1	2	3	4	5
Shortages of Materials	1	2	3	4	5
Material Price Fluctuation	1	2	3	4	5
Methods of Payment	1	2	3	4	5
Lack of Equipment	1	2	3	4	5
Weather Conditions	1	2	3	4	5

Political Tensions/Insecurity	1	2	3	4	5
Project Control and *ex post* Evaluation					
No Action Taken After Contract Progress Reports	1	2	3	4	5
Periods of Inspection and Testing After Contract Completion	1	2	3	4	5
Lack of Contract *ex post* Evaluation	1	2	3	4	5
Negligence of Past Experiences	1	2	3	4	5
Comments and Others: How can cost overruns and time delays be reduced?					

Appendix 4
Survey Form - French Version

Michigan State University

School of Planning, Design and Construction
Construction Management Program

FORMULAIRE DE CONSENTEMENT DU PARTICIPANT
Professionnels de la Construction

SURCOUTS ET HORS-DELAIS DANS LES PROJETS D'INFRASTRUCTURE ROUTIERE ET DE PONT DANS LES PAYS EN DEVELOPPEMENT- ***EXPERIENCES DU CAMEROUN***

Enquêteur Principal: Tim Mrozowski
Enquêteur Secondaire: Bertin Bella Akoa

Enquête Scientifique

L'Ecole de Planification, Design et Construction du Michigan State University aux Etats-Unis d'Amérique conduit une recherche pour évaluer les surcoûts et hors-délais dans les projets routiers et de ponts des pays en développement. Les performances en termes de temps et de coût des projets sont des indicateurs d'efficacité dans le développement des projets. Le but de cette recherche est d'améliorer les performances de coût et de temps des projets routiers et de ponts dans les pays en développement, et spécifiquement dans le cas du Cameroun.

En tant que participant à cette recherche, Il vous est demandé de compléter un questionnaire relatif à votre expérience dans les problèmes de surcoûts et de délais dans les projets routiers et de ponts du Cameroun. Vous devez avoir au moins 18 ans pour participer à cette recherche. La participation à ce projet de recherche est complètement volontaire. Vous avez le droit de dire non. Vous pouvez changer d'avis à tout moment et vous retirer de l'enquête. Vous pouvez choisir de ne pas répondre à des questions spécifiques ou d'arrêter votre participation à n'importe quel moment. Que vous y participiez ou non n'affectera en rien votre évaluation. Votre confidentialité sera protégée au maximum possible admissible par la loi. Vos noms et titres ne seront pas demandés pendant cette enquête et ne seront divulgués dans aucune publication. Compléter ce questionnaire prendra environ 15 minutes. En tant que participant, vous pouvez demander une copie de ce formulaire de consentement.

Ce projet de recherche n'est pas financé. Les chercheurs sont employés par Michigan State University et les données collectées seront utilisées pour une thèse de masters.

Si vous avez des inquiétudes ou des questions à propos de cette étude, tels que des problèmes d'ordre scientifique, comment participer à n'importe laquelle des parties, ou pour reporter une offense, prière de contacter:

***Tim Mrozowski**, A.I.A., LEED® AP*
Professor of Construction Management, School of Planning, Design and Construction, Michigan State University, 102B H.E. Bldg., East Lansing, MI-48824, USA, Courriel: mrozowsk@egr.msu.edu, Télephone: +1 517.353.0781.

Bertin Bella Akoa
Graduate Student, Construction Management Program
School of Planning, Design and Construction, Michigan State University, 112 H.E. Bldg., East Lansing, MI-48824, USA. Courriel: akoabert@msu.edu, Télephone: +1 517.505.8618, au Cameroon: 99.94.41.73

Si vous avez des questions ou des inquiétudes à propos de vos droits en tant que participant à cette recherche, s'il vous plaît, soyez libre de contacter:

Judy McMillan, CIP
IRB Director, Michigan State University, 205B Olds Hall, MI-48824, USA. Courriel: mcmill12@ora.msu.edu, Télephone: 517-432-4502
Vous indiquez votre accord volontaire de participer à cette étude en complétant et en retournant ce questionnaire.

- SVP, Cochez Votre Profession

☐ Coordination/Direction

☐ Ingénieur/Cadre Technique

☐ Comptable /Cadre Financier

☐ Autre, Précisez_____

- Votre secteur dans l'industrie routière :

☐ Administration

☐ Entrepreneur

☐ Consultant

☐ Finance

☐ Bailleur de Fonds,

☐ Autre, Précisez_____

SVP, Encerclez Votre Réponse à Chaque Question	Entièrement d' Accord	D' Accord	Indécis	Pas d'Accord	Entièrement Pas d'Accord
Les causes de surcoûts et hors délais dans les projets d'infrastructures routières et de ponts au Cameroun sont :					
Planification et Programmation					
Insuffisance de Planification/Programmation des projets	1	2	3	4	5
Planification/Programmation des projets non adéquats	1	2	3	4	5
Insuffisances Pendant les Processus d'Expropriation	1	2	3	4	5
Coût des Expropriations	1	2	3	4	5
Exigences des textes sur la Protection de l'environnement	1	2	3	4	5
Etudes Techniques					
Faiblesse et insuffisance des études techniques	1	2	3	4	5
Sous-évaluation des coûts et calendriers d'activités/Surestimation des bénéfices.	1	2	3	4	5
Faibles stratégies d'exécution des projets	1	2	3	4	5
Erreurs et incohérences dans les documents d'exécution	1	2	3	4	5
Passation des Marchés					
Procédures de passation de marchés	1	2	3	4	5
Période de la Passation des marchés	1	2	3	4	5
Le système du moins disant	1	2	3	4	5
Ajustement des coûts de projets non raisonnable par les entreprises.	1	2	3	4	5
Réalisation des Travaux :					
Négligence des Visites de Site Avant/Pendant la Passation des marchés: Conditions des sites de projets inconnues.	1	2	3	4	5
Inexpérience des missions de contrôle	1	2	3	4	5
Plaintes et Disputes des entreprises et missions de contrôle	1	2	3	4	5
Plusieurs Parties Prenantes	1	2	3	4	5
Faible communication entre les parties prenantes des contrats	1	2	3	4	5
Activités non éthiques et "retours d'ascenseur"	1	2	3	4	5
Contrats Equivoques/Flous	1	2	3	4	5
Changements dans l'étendue des contrats	1	2	3	4	5
Déplacement des réseaux existants	1	2	3	4	5
Erreurs d'Exécution et tests/approbation des travaux sur site	1	2	3	4	5

Travaux sur des sites archéologiques inattendus	1	2	3	4	5
Manque des matériaux	1	2	3	4	5
Variation des prix des matériaux	1	2	3	4	5
Méthodes de paiement	1	2	3	4	5
Manque d'Engins	1	2	3	4	5
Conditions Météorologiques	1	2	3	4	5
Tensions Politiques / Insécurité	1	2	3	4	5
Suivi et Evaluation *ex post* des projets					
Aucune Action entreprise après les rapports sur l'évolution des contrats	1	2	3	4	5
Période de Contrôle et d'Essai après la réception provisoire des travaux	1	2	3	4	5
Absence d'Evaluation *ex post* des Travaux	1	2	3	4	5
Négligence des Expériences Antérieures	1	2	3	4	5
Commentaires et Autres: Comment réduire les surcoûts et les projets hors délais ?					

Appendix 5
Cost and Time Overruns – Details of Regression Analyses

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.068308111
R Square	0.004665998
Adjusted R Square	-0.004382493
Standard Error	0.382866589
Observations	112

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.075589824	0.07559	0.515666	0.474218786
Residual	110	16.12455075	0.146587		
Total	111	16.20014057			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.438238792	0.10392793	4.216757	5.11E-05	0.232278028	0.6442	0.265841	0.610637
19104089	-1.1706E-09	1.63013E-09	-0.7181	0.474219	-4.40114E-09	2.06E-09	-3.9E-09	1.53E-09

Table A5.1 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size under 100,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.287399
R Square	0.082598
Adjusted R Square	0.074025
Standard Error	0.334771
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.079672	1.079672	9.633761	0.002444
Residual	107	11.99167	0.112072		
Total	108	13.07135			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.769275	0.130287	5.904455	4.23E-08	0.510996	1.027554	0.5531	0.98545
1.01E+08	-2.5E-09	7.95E-10	-3.10383	0.002444	-4E-09	-8.9E-10	-3.8E-09	-1.1E-09

Table A5.2 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size between 100,000,000-250,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.031039
R Square	0.000963
Adjusted R Square	-0.01079
Standard Error	0.234026
Observations	87

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.004489217	0.004489217	0.081967384	0.775345
Residual	85	4.65530841	0.054768334		
Total	86	4.659797627			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.210172	0.084888649	2.475858118	0.01527549	0.041391	0.378954	0.069	0.351340249
2.51E+08	5.57E-11	1.94684E-10	0.286299466	0.775345406	-3.3E-10	4.43E-10	-3E-10	3.79493E-10

Table A5.3 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size between 250,000,000-700,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.032041
R Square	0.001027
Adjusted R Square	-0.01681
Standard Error	0.180853
Observations	58

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001882	0.001882	0.057550141	0.811286765
Residual	56	1.831633	0.032708		
Total	57	1.833515			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.184266	0.080016	2.302858	0.025024891	0.023974266	0.344558242	0.050437143	0.318095366
7.01E+08	-1.7E-11	7.05E-11	-0.2399	0.811286765	-1.58224E-10	1.24381E-10	-1.34897E-10	1.01053E-10

Table A5.4 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size between 700,000,000-2,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.08494241
R Square	0.007215213
Adjusted R Square	-0.058970439
Standard Error	0.122200616
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001627916	0.001627916	0.10901476	0.745835
Residual	15	0.223994858	0.014932991		
Total	16	0.225622774			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.143127857	0.125759514	1.138107582	0.272927911	-0.12492	0.411178	-0.07733	0.363590618
2012608420	-1.26199E-11	3.82221E-11	-0.330173833	0.745834912	-9.4E-11	6.88E-11	-8E-11	5.43853E-11

Table A5.5 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size between 2,000,000,000- 5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.705445253
R Square	0.497653005
Adjusted R Square	0.330204007
Standard Error	0.133523903
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.05298612	0.05298612	2.971968	0.183188
Residual	3	0.053485898	0.017828633		
Total	4	0.106472018			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.157263853	0.08819686	1.783100363	0.17258	-0.12342	0.437946	-0.050295412	0.364823
5414904080	5.31817E-12	3.08489E-12	1.723939572	0.183188	-4.5E-12	1.51E-11	-1.94171E-12	1.26E-11

Table A5.6 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - Project Size over 5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.034602242
R Square	0.001197315
Adjusted R Square	-0.001357167
Standard Error	0.318215119
Observations	393

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.047462121	0.047462	0.468711	0.493986186
Residual	391	39.59299691	0.101261		
Total	392	39.64045903			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.298852578	0.016460313	18.15595	7.26E-54	0.266490785	0.331214	0.271713	0.325992
23616872	-3.36812E-12	4.91966E-12	-0.68463	0.493986	-1.30404E-11	6.3E-12	-1.1E-11	4.74E-12

Table A5.7 Correlation - Significance for the Relationship between Project Size and Cost Overrun Rate - All Project Sizes

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.322819225
R Square	0.104212252
Adjusted R Square	0.096142092
Standard Error	20671371.98
Observations	113

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5.51792E+15	5.52E+15	12.91328	0.0004879
Residual	111	4.74309E+16	4.27E+14		
Total	112	5.29488E+16			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	2779051.115	5507325.087	0.50461	0.614833	-8134081.197	13692183	-6355934	11914036
X Variable 1	0.311677885	0.086733659	3.593506	0.000488	0.13980935	0.483546	0.167813	0.455543

Table A5.8 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size under 100,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.059083
R Square	0.003491
Adjusted R Square	-0.00574
Standard Error	49166870
Observations	110

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.15E+14	9.15E+14	0.378329	0.539793
Residual	108	2.61E+17	2.42E+15		
Total	109	2.62E+17			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	66712844	18903538	3.529119	0.000614	29242751	1.04E+08	35350264	98075424
X Variable 1	-0.07114	0.115657	-0.61508	0.539793	-0.30039	0.158113	-0.26302	0.120746

Table A5.9 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size between 100,000,000-250,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.332976
R Square	0.110873
Adjusted R Square	0.100535
Standard Error	97063396
Observations	88

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.01035E+17	1.01035E+17	10.72412747	0.001525
Residual	86	8.10232E+17	9.4213E+15		
Total	87	9.11267E+17			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	-1.2E+07	34749422.91	-0.332798124	0.740096577	-8.1E+07	57515024	-7E+07	46215597.04
X Variable 1	0.261978	0.079998916	3.274771361	0.001524862	0.102946	0.421011	0.129	0.394997593

Table A5.10 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size between 250,000,000-700,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.1725
R Square	0.029756
Adjusted R Square	0.012734
Standard Error	2.25E+08
Observations	59

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8.84E+16	8.84E+16	1.74811842	0.191394734
Residual	57	2.88E+18	5.06E+16		
Total	58	2.97E+18			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	58482417	97928435	0.597195	0.552741883	-137615890.8	254580724.5	-105256754.7	222221588.5
X Variable 1	0.114741	0.086783	1.322164	0.191394734	-0.059038432	0.288520638	0.030362225	0.259844431

Table A5.11 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size between 700,000,000-2,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.273113514
R Square	0.074590991
Adjusted R Square	0.016752928
Standard Error	367507700.6
Observations	18

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.74183E+17	1.74183E+17	1.289652306	0.272837
Residual	16	2.16099E+18	1.35062E+17		
Total	17	2.33517E+18			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	-81421634.5	349591998.7	-0.232904743	0.818788658	-8.2E+08	6.6E+08	-6.9E+08	528925329.5
X Variable 1	0.122816231	0.108148237	1.135628595	0.272837476	-0.10645	0.35208	-0.066	0.311630473

Table A5.12 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size between 2,000,000,000-5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996488674
R Square	0.992989678
Adjusted R Square	0.991237098
Standard Error	927915252.3
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4.87847E+20	4.88E+20	566.5872	1.85E-05
Residual	4	3.44411E+18	8.61E+17		
Total	5	4.91291E+20			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	-2445621113	533305235.8	-4.58578	0.010139	-3.9E+09	-964928401.3	-3.6E+09	-1.3E+09
X Variable 1	0.48465726	0.020361105	23.80309	1.85E-05	0.428126	0.541188749	0.441251	0.528064

Table A5.13 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size over 5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.96868324
R Square	0.938347219
Adjusted R Square	0.938189942
Standard Error	341640434.2
Observations	394

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.96363E+20	6.96E+20	5966.188	2.8151E-239
Residual	392	4.57535E+19	1.17E+17		
Total	393	7.42116E+20			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	-118241778.7	17648512.91	-6.69982	7.27E-11	-152939357.1	-8.4E+07	-1.5E+08	-8.9E+07
X Variable 1	0.407948748	0.005281498	77.24111	2.8E-239	0.397565143	0.418332	0.399241	0.416657

Table A5.14 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - All Project Sizes

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.113201
R Square	0.012815
Adjusted R Square	0.003921
Standard Error	0.493304
Observations	113

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.350637	0.350637	1.440881	0.232552
Residual	111	27.01176	0.243349		
Total	112	27.3624			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.636005	0.131428	4.839208	4.24E-06	0.375573	0.896438	0.418007	0.854004
X Variable 1	-2.5E-09	2.07E-09	-1.20037	0.232552	-6.6E-09	1.62E-09	-5.9E-09	9.49E-10

Table A5.15 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate - Project Size under 100,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.153642
R Square	0.023606
Adjusted R Square	0.014565
Standard Error	0.534748
Observations	110

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.746649	0.746649	2.611071	0.109038
Residual	108	30.88316	0.285955		
Total	109	31.62981			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.22644	0.205598	1.10137	0.273184	-0.18109	0.633971	-0.11467	0.567545
X Variable 1	2.03E-09	1.26E-09	1.615881	0.109038	-4.6E-10	4.53E-09	-5.4E-11	4.12E-09

Table A5.16 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate - Project Size between 100,000,000-250,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.130775
R Square	0.017102
Adjusted R Square	0.005673
Standard Error	0.451198
Observations	88

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.30463	0.30463	1.496371	0.224572
Residual	86	17.50783	0.203579		
Total	87	17.81246			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.632046	0.161532	3.912815	0.000182	0.31093	0.953161	0.363455	0.900636
X Variable 1	-4.5E-10	3.72E-10	-1.22326	0.224572	-1.2E-09	2.84E-10	-1.1E-09	1.63E-10

Table A5.17 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate - Project Size between 250,000,000-700,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.075947
R Square	0.005768
Adjusted R Square	-0.01167
Standard Error	0.346506
Observations	59

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.039704	0.039704	0.330682	0.567521
Residual	57	6.843802	0.120067		
Total	58	6.883506			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.181459	0.150867	1.202778	0.234035	-0.12065	0.483565	-0.07079	0.433713
X Variable 1	7.69E-11	1.34E-10	0.575049	0.567521	-1.9E-10	3.45E-10	-1.5E-10	3E-10

Table A5.18 Correlation - Significance for the Relationship between Project Size and Cost Overrun Size - Project Size between 700,000,000-2,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.430368
R Square	0.185217
Adjusted R Square	0.134293
Standard Error	0.612391
Observations	18

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.364004089	1.364004	3.637121	0.074622
Residual	16	6.000367976	0.375023		
Total	17	7.364372066			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	1.554991	0.582537639	2.669339	0.016793	0.320066	2.789915	0.537948	2.572033496
X Variable 1	-3.4E-10	1.80211E-10	-1.90712	0.074622	-7.3E-10	3.83E-11	-6.6E-10	-2.90573E-11

Table A5.19 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate- Project Size between 2,000,000,000-5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.002425
R Square	5.88E-06
Adjusted R Square	-0.24999
Standard Error	0.807158
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.53E-05	1.53E-05	2.35E-05	0.996362
Residual	4	2.606013	0.651503		
Total	5	2.606029			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.653563	0.463902	1.408839	0.231667	-0.63443	1.941559917	-0.3354	1.64253
X Variable 1	-8.6E-14	1.77E-11	-0.00485	0.996362	-4.9E-11	4.90886E-11	-3.8E-11	3.77E-11

Table A5.20 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate - Project Size over 5,000,000,000 XAF

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.009202
R Square	8.47E-05
Adjusted R Square	-0.00247
Standard Error	0.497715
Observations	394

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.008224	0.008224	0.033199	0.855516
Residual	392	97.10638	0.24772		
Total	393	97.11461			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.462517	0.025711	17.98903	3.5E-53	0.411968	0.513065	0.420126	0.504908
X Variable 1	1.4E-12	7.69E-12	0.182205	0.855516	-1.4E-11	1.65E-11	-1.1E-11	1.41E-11

Table A5.21 Correlation - Significance for the Relationship between Project Size and Time Overrun Rate - All Project Sizes

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.029136
R Square	0.000849
Adjusted R Square	-0.01638
Standard Error	0.459847
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.01042	0.01042	0.049277	0.825105
Residual	58	12.26463	0.211459		
Total	59	12.27505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.328187	0.185626	1.767999	0.082321	-0.04338	0.699759	0.017903	0.638471
X Variable 1	0.010214	0.046013	0.221985	0.825105	-0.08189	0.102319	-0.0667	0.087127

Table A5.22 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration under 6 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.000846
R Square	7.16E-07
Adjusted R Square	-0.00526
Standard Error	0.304409
Observations	192

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.26E-05	1.26E-05	0.000136	0.990708
Residual	190	17.60635	0.092665		
Total	191	17.60636			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.31573	0.120307	2.62437	0.009387	0.078421	0.553039	0.116873	0.514587
X Variable 1	0.000193	0.016565	0.011662	0.990708	-0.03248	0.032868	-0.02719	0.027574

Table A5.23 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration between 6 Months - 12 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.082645
R Square	0.00683
Adjusted R Square	-0.01344
Standard Error	0.242178
Observations	51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.019764	0.019764	0.336982	0.564237
Residual	49	2.873855	0.05865		
Total	50	2.893619			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.408532	0.225446	1.81211	0.076099	-0.04452	0.861582	0.030561	0.786504
X Variable 1	-0.01007	0.017354	-0.5805	0.564237	-0.04495	0.0248	-0.03917	0.019021

Table A5.24 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration between 12 Months - 24 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.232905
R Square	0.054245
Adjusted R Square	0.04285
Standard Error	0.255902
Observations	85

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.311749	0.311749	4.760544	0.031947
Residual	83	5.435339	0.065486		
Total	84	5.747088			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.756906	0.250816	3.01778	0.003381	0.258044	1.255768	0.339695	1.174118
X Variable 1	-0.01594	0.007304	-2.18187	0.031947	-0.03046	-0.00141	-0.02809	-0.00379

Table A5.25 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration between 24 Months - 36 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.095714
R Square	0.009161
Adjusted R Square	-0.23855
Standard Error	0.200452
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001486	0.001486	0.036983	0.856868
Residual	4	0.160724	0.040181		
Total	5	0.16221			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.07786	0.64577	0.12057	0.909846	-1.71508	1.870805	-1.29882	1.454543
X Variable 1	0.002748	0.014288	0.19231	0.856868	-0.03692	0.042417	-0.02771	0.033207

Table A5.26 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration over 36 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.165265
R Square	0.027313
Adjusted R Square	0.024831
Standard Error	0.313973
Observations	394

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.085077	1.085077	11.00717	0.000992
Residual	392	38.64301	0.098579		
Total	393	39.72809			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.355423	0.023985	14.81858	9.19E-40	0.308268	0.402579	0.315878	0.394969
X Variable 1	-0.00434	0.001309	-3.31771	0.000992	-0.00692	-0.00177	-0.0065	-0.00219

Table A5.27 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - All Project Durations

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.154424
R Square	0.023847
Adjusted R Square	0.007017
Standard Error	0.520506
Observations	60

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.383878	0.383878	1.41691	0.238762
Residual	58	15.71371	0.270926		
Total	59	16.09759			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.966158	0.210112	4.598289	2.36E-05	0.545572	1.386744	0.614944	1.317372
X Variable 1	-0.062	0.052083	-1.19034	0.238762	-0.16625	0.042259	-0.14906	0.025063

Table A5.28 Correlation - Significance for the Relationship between Project Duration and Time Overrun Rate - Project Duration under 6 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.122327
R Square	0.014964
Adjusted R Square	0.009779
Standard Error	0.528897
Observations	192

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.807396	0.807396	2.886315	0.090972
Residual	190	53.14917	0.279732		
Total	191	53.95656			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.92514	0.209028	4.425915	1.62E-05	0.512826	1.337454	0.579635	1.270645
X Variable 1	-0.0489	0.028781	-1.69892	0.090972	-0.10567	0.007875	-0.09647	-0.00132

Table A5.29 Correlation - Significance for the Relationship between Project Duration and Time Overrun Rate - Project Duration between 6 Months - 12 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.081822
R Square	0.006695
Adjusted R Square	-0.01358
Standard Error	0.253168
Observations	51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.021167	0.021167	0.330255	0.568138
Residual	49	3.140605	0.064094		
Total	50	3.161772			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.269608	0.054615	4.936523	9.61E-06	0.159855	0.37936	0.178043	0.361172
X Variable 1	-0.08553	0.148829	-0.57468	0.568138	-0.38461	0.213554	-0.33505	0.163991

Table A5.30 Correlation - Significance for the Relationship between Project Duration and Time Overrun Rate - Project Duration between 12 Months - 24 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.322939
R Square	0.10429
Adjusted R Square	0.093498
Standard Error	0.274437
Observations	85

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.727845	0.727845	9.663904	0.002574
Residual	83	6.251217	0.075316		
Total	84	6.979063			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.999483	0.268982	3.715796	0.000366	0.464488	1.534478	0.552053	1.446913
X Variable 1	-0.02435	0.007833	-3.10868	0.002574	-0.03993	-0.00877	-0.03738	-0.01132

Table A5.31 Correlation - Significance for the Relationship between Project Duration and Time Overrun Rate - Project Duration between 24 Months - 36 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.077119
R Square	0.005947
Adjusted R Square	-0.24257
Standard Error	0.186561
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.000833	0.000833	0.023932	0.884551
Residual	4	0.13922	0.034805		
Total	5	0.140052			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.333678	0.601018	0.555189	0.608349	-1.33501	2.002371	-0.9476	1.614956
X Variable 1	-0.00206	0.013298	-0.1547	0.884551	-0.03898	0.034863	-0.03041	0.026291

Table A5.32 Correlation - Significance for the Relationship between Project Duration and Cost Overrun Rate - Project Duration over 36 Months

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.376352
R Square	0.141641
Adjusted R Square	0.139451
Standard Error	0.461141
Observations	394

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	13.75541	13.75541	64.68537	1.05E-14
Residual	392	83.3592	0.212651		
Total	393	97.11461			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	0.676533	0.035227	19.20472	2.06E-58	0.607274	0.745791	0.618451	0.734614
X Variable 1	-0.01547	0.001923	-8.04272	1.05E-14	-0.01925	-0.01169	-0.01864	-0.0123

Table A5.33 Correlation - Significance for the Relationship between Project Duration and Time Overrun Rate - All Project Durations

Appendix 6
Survey Analysis Results –Frequencies

Valid Responses

Statistics

		Profession	Sector	Lack_Pl_Prog	Inad_Plan_Prog	Weakness_Takings
N	Valid	84	84	84	84	84
	Missing	0	0	0	0	0

		Expropriation_Costs	legal_Envir_Req	Weak_Tech_Stud	Underestimating_Cost_over_benf	Poor_Impl_Stratg
N	Valid	84	84	84	84	84
	Missing	0	0	0	0	0

Table A6.1 SPSS Output – Overview of Valid Responses

Frequency Tables

Profession

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Acc	4	4.8	4.8	4.8
	Eng	59	70.2	70.2	75.0
	Man	18	21.4	21.4	96.4
	Oth	3	3.6	3.6	100.0
	Total	84	100.0	100.0	

Table A6.2 SPSS Output – Frequencies for the Variable "Profession"

Sector

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cons	9	10.7	10.7	10.7
	Cont	9	10.7	10.7	21.4
	Dono	5	6.0	6.0	27.4
	Fina	2	2.4	2.4	29.8
	Gove	59	70.2	70.2	100.0
	Total	84	100.0	100.0	

Table A6.3 SPSS Output – Frequencies for the Variable "Sector"

Lack_Pl_Prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	22	26.2	26.2	26.2
	2	35	41.7	41.7	67.9
	3	10	11.9	11.9	79.8
	4	16	19.0	19.0	98.8
	5	1	1.2	1.2	100.0
	Total	84	100.0	100.0	

Table A6.4 SPSS Output – Frequencies for the Variable "Lack of Project Planning/Programming"

Inad_Plan_Prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	17.9	17.9	17.9
	2	36	42.9	42.9	60.7
	3	14	16.7	16.7	77.4
	4	17	20.2	20.2	97.6
	5	2	2.4	2.4	100.0
	Total	84	100.0	100.0	

Table A6.5 SPSS Output – Frequencies for the Variable "Inadequate Project Planning Programming"

Weakness_Takings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	9.5	9.5	9.5
	2	38	45.2	45.2	54.8
	3	25	29.8	29.8	84.5
	4	12	14.3	14.3	98.8
	5	1	1.2	1.2	100.0
	Total	84	100.0	100.0	

Table A6.6 SPSS Output – Frequencies for the Variable "Weaknesses during the Land Taking Process"

Appendix 7
“Proof of Concepts” Package - Suggestions

Proof of Concept-Validating Results

Introduction

Generally, when thesis research leads to suggested recommendations, guidelines or frameworks, those suggestions should be tested in the context of the real world. The process of testing suggestions is sometimes referred to as "Proof of Concept" or validation. Efforts to evaluate proposed recommendations, frameworks or guidelines often use follow-up interviews, surveys, questionnaires or focus groups to obtain feedback about the accuracy, usefulness, effectiveness of recommendations or barriers and opportunities to their implementation. Once feedback is obtained the researcher can then consider the feedback and decide whether to add, delete or modify any original recommendations, guidelines or frameworks.

Due to reorganization occurring in MINTP during completion of the research on cost and time overruns, it was not possible to conduct these "Proof of Concept" efforts. In the thesis the researcher indicates that the recommendations suggested in this study should be discussed and validated by the case study organization and suggests a sample of five to ten managers be selected for obtaining feedback. The researcher also suggests a similar process can be undertaken in developing countries' other agencies, for the adoption of relevant thesis recommendations for their organizations.

"Proof of concept" efforts should be conducted with qualified individuals who have the experience and background with the subject, including the recommendations, guidelines, or frameworks, being evaluated, to be effective.

"Proof of Concept" components should include:

1. An introductory background statement which summarizes the research sufficiently to provide enough background to the respondent or interviewee so that they can effectively evaluate the recommendations, guidelines or frameworks
2. Clear statement of the guidelines
3. A human subjects' review from a qualified institutional review board to ensure proper protections are in place for anyone who participates
4. A consent statement with proper protections from the sponsoring agency
5. Selection of qualified subjects for effective review
6. The survey instrument or questionnaire
7. Processes to administer, collect and analyze the data

Since the "Proof of Concept" process was not conducted during this research. Any Human Subjects' review process should be from the Human Subjects Institutional Review Board of any subsequent sponsoring agency.

Suggested Proof of Concept Components

1. Consent form and Human Subjects Protections

   The MINTP should prepare a consent form and appropriate protections for participating respondents.

2. Background statement such as the following:

   Research was conducted which targeted reducing cost overruns and time delays in construction projects in developing countries. The research led to guidelines and recommendations for measures which may help to reduce these overruns. Toward this end you are being asked to review the guidelines and recommendations to gain your view of their usefulness, appropriateness, identification of barriers, or opportunities for their implementation and suggestions for improvement.

3. Listing of key recommendations:

   R1 *Organize and conduct seminars on transportation planning to help MINTP improve the planning process*

   R2 *Update MINTP's road plan, and adoption of a transportation improvement program*

   R3 *Increase accountability at MINTP project managers*

   R4 *Introduce cost conditions in consultant contracts for technical studies*

   R5 *Include provisions for retainage and warranties in consultant contracts*

   R6 *Standardize labor rates for all trades and equipment, so that the differences among bids would be determined by the costs of materials*

   R7 *Organize and conduct seminars on cost estimating and project scheduling*

   R8 *Formalize scheduling of large projects through use of networks of activities*

   R9 *Develop the use of sub-contracting for projects*

   R10 *Use of force account utilizing the owner's own forces for routine projects*

   R11 *Adopt a project management approach for force account projects*

   R12 *Provide training of MINTP personnel to improve contract administration*

R13 *Use force account for mowing projects, rural road maintenance, and unpaved road maintenance*

R14 *Use outside work supervision only for projects which are very specialized or large and when the benefits warrant its cost*

4. To test the recommendations include the following, similar but not limited to survey or interview questions.

   Suggested Questions

   1. *How well do you understand these recommendations for measures to help reduce cost and time overruns on MITPP projects? (Cite specific recommendations.)*

   2. *Which recommendations would be most helpful in helping to reduce cost and time overruns on projects? Explain.*

   3. *Which recommendations would be least helpful in helping to reduce cost and time overruns on projects? Explain.*

   4. *What are the barriers for implementation of these recommendations during project closeout in your organization? (Please refer to specific recommendations) Explain.*

   5. *What organizational factors may influence implementation of these recommendations?*

   6. *How helpful are these recommendations for your organization?*

   7. *Rank the importance of recommendations in helping to reduce cost and time Overruns*

      - *Very helpful*
      - *Very helpful*
      - *Less helpful*
      - *Not very helpful*

   8. *Do you have any additional suggestions for improvement?*

Appendix 8
Glossary

Glossary

Change Order: A change order is defined as a formal change to a contract which usually includes an increase in work scope and in cost. The time scheduled to perform the work can also be modified (O'Brien, 1998).

Contract Administration: It relates to the conduct of the project-related parties to a contract such as relations with the contractor, communications, procedures, authority, duties of all the parties, construction operations, coordination, planning and scheduling, payments, change orders, disputes and claims, project closeout, final cleanup, administrative closeout. (Fisk, 1997)

Cost Condition: A stipulated statement in a design contract, to hold the design firm responsible of the accuracy of the predicted cost of a project.

Cost Overrun: Also called "cost escalation," it is the difference in cost between the final contract cost and the contract award amount (Jahren and Ashe, 1990). In the long term, "cost overrun" refers to the general increase of contract costs.

Constructor: Someone or a business entity who can physically build a facility or a manufacturer who fabricates ordered objects (Pritchett, 2006).

Consultant: The architect or engineer, in general, who perform design or design related services (Pritchett, 2006).

Contractor: "A business entity that enters into contracts to provide goods or services to another party" (Pritchett, 2006).

Donor or lender: Organization making loans or donate funds to other parties.

Faulty Execution: Inability of agency's or owner's representatives to take appropriate decisions for the implementation of the project, or to effectively coordinate the work (Jahren and Ashe, 1990).

Force-account system: A method of construction where the owner acts as a constructor, instead of hiring a professional contractor to perform the work (Sears et al., 2008).

Optimism Bias: Tendency to expect the best about project outcomes in the decision-making process, lowering cost estimates which would later result in higher actual costs than planned (Flyvbjerg et al., 2002).

Plan: Adopted statement of policy, represented as text, maps, and graphics, used to guide public and private actions impacting on the future. It helps decision makers to take informed decisions which influence the long-range social, economic, and physical growth of a community (Anderson L. T. et al., 2006).

Program: A set of projects to be implemented in a specified period, generally five years with determined funding(s).

Project: An undertaking to construct a specific enhancement at a determined location or locations (Anderson et al., 2008).

Right-of-Way: A linear corridor of land, generally taken from private owners, and destined to transportation infrastructure such as roads, railways and other facilities (Anderson et al., 2008).

Scope Creep: Increase of project costs due to the tendency to accumulate many minor scope changes (Shane et al., 2009).

Time Delay: Time period during which some part of the construction project has been extended beyond the initial time, or the incident affecting the performance of an activity of the project (Bramble and Callahan, 2000). For this study, time delay or time overrun is the total time extension received by a contractor, compared to the initial contract duration.

BIBLIOGRAPHY

Bibliography

Abd El-Razek, M. E., Bassioni, H. A., Mobarak, A. M. (2008) *Causes of Delay in Building Construction Projects in Egypt.* Journal of Construction Engineering and Management. ASCE. Vol 134, No 11, 831-841.

Abdul-Rahman, H., Berawi, M. A., Berawi, A. R., Mohammed, O., Othman, M., Yahya, I. A. (2006) *Delay Mitigation in the Malaysian Construction Industry.* Journal of Construction Engineering and Management. ASCE. Vol 132, No 2, 125-133.

Abomo, P. (2010) *La Mauvaise Exécution Des Marchés Plombe L'entretien Routier,* http://www.cameroon-tribune.cm/index.php?option=com_content&view=article&id=61848:la-mauvaise-executions-des-marches-plombe-lentretie-routier&catid=2:economie&Itemid=3, Accessed on Nov 3 2010

Ajibade, A.; Odeyinka, H. (2006). *Construction Delays and their Causative Factors in Nigeria.* Journal of Construction Engineering and Management. ASCE, 132 (7) 667-677.

Anderson, L. T., Klein, W. R., Meck, S. "Plan Making" in APA (2006), *Planning and Urban Design Standards*, John Wiley and Sons, Inc. Hoboken, NJ.

Anderson,S.;Moleenar,K.; Schexnayder,C..(2007)-*NCHRP Report 574: Guidance for Cost Estimation and Management for Highways Projects During Planning, Programming, and Preconstruction.* National Cooperative Highway Research Program-TRB, pp. 13-17

Anderson,S.;Moleenar,K.; Schexnayder,C..(2008)-*NCHRP Web-Only Document 132: Right-Of-Way Methods and Tools to Control Project Cost Escalation*. National Cooperative Highway Research Program-TRB, pp. 06-17

Ang, A. H-S.; Tang, W. H. (1975) *Probability Concepts in Engineering Planning and Design. Vol. 1 , Basic Principles.* John Wiley & Sons, New York.

Ayyub, B. M.; McCuen, R. H. (2003) *Probability, Statistics, and Reliability for Engineers and Scientists.* 2nd Edition. Chapman & Hall/CRC, Washington, D.C.

Banque Mondiale (2005) *Rapport Analytique du Système de Passation des Marchés Publics au Cameroun, Volume 1.* Operational Quality and Knowledge Services, Région Afrique, France.

BCEOM, CEBTP (1991) *Les Routes Dans les Zones Tropicales et Désertiques. Politique et Economie Routière, Tome 1* Ministère de la Coopération et du Développement, France.

Bainkong, G. (2009) *Civil Works Infrastructure: ARMP/LABOGENIE Partner For Efficiency*. www.cameroon-tribune.net , Accessed on 11/01/2009, http://www.cameroon-tribune.net/article.php?lang=Fr&oled=j30102009&idart=58362&olarch=

Bernstein, S.; Berstein, R. (1999) *Elements of Statistics II: Inferential Statistics.* Mc Graw-Hill, New York.

Biya, P. (1987) *Communal Liberalism.* Macmillan Publishers Ltd, London, Great Britain.

Bordat, C.; McCullouch, B.; Labi, S.; Sinha, K. C. (2004) *An Analysis of Cost Overruns and Time Delays of INDOT Projects.* Joint Transportation Research Program.Purdue University.

Bramble, B. B.; Callahan, M. T. (2000) *Construction Delay Claims 3rd Edition*. Aspen Law and Business, New York.

Brunel, S. (1993) *Le Gaspillage de l'Aide Publique.* Editions du Deuil, Paris, France.

Calderisi, R. (2006) *The Trouble With Africa-Why Foreign Aid Isn't Working.* Palgrave Macmillan, New York.

Cameroon-Tribune Archives: Economie, Edition du 17/07/2009. www.cameroon-tribune.net, Accessed on 11/01/2009, http://www.cameroon-tribune.net/article.php?lang=Fr&oled=j30102009&idart=58362&olarch=

Creedy, G. D., Skitmore, M., Wong, J. K. W. (2010) *Evaluation of Risk Factors Leading to Cost Overrun in Delivery of Highway Construction Projects.* Journal of Construction Engineering and Management.ASCE, Vol. 136 (5) 528-537.

Cameroon Radio & Television-CRTV.(2010a). Accessed on 03/11/2010, http://www.crtv.cm/cont/radio/radio_sola_fr.php?idField=3583&table=radio2

Cameroon Radio & Television-CRTV. (2010b). Accessed on 03/11/2010, http://www.crtv.cm/cont/radio/radio_sola_fr.php?idField=3582&table=radio2

Cameroon Radio & Television-CRTV. (2010c). Accessed on 03/12/2010, http://www.crtv.cm/cont/radio/radio_sola_fr.php?idField=3584&table=radio2

Cui, Y., Olsson, N. O. E. (2009*) Project Flexibility in Practice : An Empirical Study of Reduction Lists in Large Governmental Projects* International Journal of Project Management, 27, 447-455.

Easterly, W. (2006) *The White's Man Burden – Why the West's Efforts to Aid the Rest Have Done so Much Ill and So Little Good.* The Penguin Press, New York.

Fink, A.; Kosecoff, J. (1998) *How to Conduct Surveys A Step-by-Step Guide* 2nd Edition, Sage Publications, London.

Fisk, E. (1997) *Construction Project Administration* Fifth Edition Prentice Hall, Columbus, OH

Flyvbjerg, B. (2008) *Public Planning on Mega-Projects: Overestimation of Demand and Underestimation of Costs* in Priemus, H., Flyvbjerg, B., Wee, B.V. (Eds.) *Decision Making on Mega-Projects*. Edward Elgar, Northampton,MA , pp. 120-144

Flyvbjerg, B., COWI (2004) *Procedures for Dealing with Optimism Bias in Transport Plannning*, The British Department of Transport, Report No 58924, Is. No 1

Flyvbjerg, B., Holm,M. K. S., Buhl, S. L. (2004) *What Causes Cost Overrun in Transport Infrastructure Projects?* Transport Reviews, Vol.24, No 1, 3-18.

Flyvbjerg, B., Bruzelius, N., Rothengatter, V. (2003a) *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge University Press, New York.

Flyvbjerg, B., Holm, M. K. S., Buhl, S. L. (2003b) *How Common and How Large are Cost Overruns in Transport Infrastructure Projects?* Transport Reviews, Vol.23, No 1, 71-88.

Flyvbjerg, B., Holm,M. K. S., Buhl, S. L. (2002) *Cost Underestimation in Public Works Projects: Error or Lie?* Journal of the American Planning Association, 68 (3)

Fowler, F. J. (1995) *Improving Survey Questions, Design and Evaluation*. Vol. 38, Sage Publications, London.

Frimpong, Y., Oluwoye, J., Crawford, L. (2003) *Causes of Delay and Cost Overruns in Construction of Groundwater Projects in a Developing Countries, Ghana as a Case Study.* International Journal of Project Management, 21, 321-326.

Frisby, T. (1989) Preconstruction Phase, in: Kimmons, R. L., Loweree, J. H.(Eds) *Project Management: A Reference for Professionals.* Marcel Dekker, Inc., New York and Basel. 265-275.

Gamez, E. A., Touran, A. (2010) *A Quantitative Analysis of the Performance of Transportation Projects in Developing Countries.* Transport Reviews, Vol. 30, No. 3, 361-387.

Groupe de la Banque Africaine de Développement (2008) *République du Cameroun, Rapport d'Achèvement, Aménagement Routier Dans les Provinces de l'Ouest, du Littoral et du Sud*. Departement Infrastructures (OINF)

Hancock, G. (1989) *Lords of Poverty-The Power, Prestige, and Corruption of the International Aid Business.* The Atlantic Monthly Press, New York.

Hinze, J.; Selstead, G. A. (1991) *Analysis of WSDOT Construction Cost Overruns*. Washington State Department of Transportation, Report No WA-RD 218.1, Olympia, WA.

Http://www.cameroon-tribune.cm/index.php?option=com_content&view=article&id=61848:la-mauvaise-executions-des-marches-plombe-lentretie-routier&catid=2:economie&Itemid=3 Accessed on Nov 3 2010

Http://www.michigan.gov/mdot/0,1607,7-151-9625_25885_40414---,00.html, Accessed on June 05 2011

Http://www.recovery.gov/Opportunities/Pages/Federal_Contracts.aspx, Accessed on July 15 2009

Jahren, C. T., Ashe, A. M. (1990) *Predictors of Cost Overrun Rates.* Journal of Construction Engineering and Management, 116(3) 548-552.

Jergeas , G. F.; Ruwanpura, J. (2009). *Why Cost and Schedule Overruns on Mega Oil Sands Projects?* Practice Periodical on Structural Design and Construction. ASCE, Posted ahead of print 22 May 2009.

Jin-Kyung, L. (2008). *Cost Overrun and Cause in Korean Social Overhead Capital Projects: Roads, Rails, Airports, and Ports*. Journal of Urban Planning and Development. ASCE. 134(2) 59-62.

Kebadiretse, F. (2010) *Minister Chides Chinese Contractors*, MMEGI , Vol. 27,No 65, Issued May 3 2010. Derived from http://www.mmegi.bw/index.php?sid=4&aid=2090&dir=2010/May/Monday3 , Accessed on May 3, 2010.

Le-Hoai, L., Lee, Y. D., Lee, J. Y. (2008) *Delay and Cost Overruns in Vietnam Large Construction Projects: A Comparison with Other Selected Countries.* KSCE Journal of Civil Engineering. Vol 12, Is. 6, 367-377.

Lo, T. Y., Fung, I. W. H., Tung, K. C. F. (2006) *Construction Delays in Hong Kong Civil Engineering Projects.* Journal of Construction Engineering and Management, Vol. 132, No. 6, 636-649.

Mansfield, N. R., Ugwu, O. O., Doran, T. (1994) *Causes of Delay and Cost Overruns in Nigeria Construction Projects.* International Journal of Project Management, Vol. 12, Is. 4, 254-260.

Merewitz, L. (1973) *Cost Overruns in Public Works* .Reprinted from *Benefit Cost and Policy Analysis 1972*. Ed. William Niskanen et al, Aldine Publishers, Chicago.

Ministère de la Coopération (1994) L'Assistance Technique Française (1960-2000). La Documentation Française, Paris, France.

MINTP (2009a) *Etudes en Vue de l'Obtention des Coûts des Différents Standards des Travaux Routiers, des Etudes et Contrôle au Cameroun, Rapport Final Définitif de Synthèse.* Egis Cameroun, Republic of Cameroon, Ministry of Public Works.

MINTP (2009b) *Rapport Trimestriel No 8 Programmes Routiers 9^{e} FED – C2D, Mission d'Assistance Technique Conjointe*. DHV, Republic of Cameroon, Ministry of Public Works.

MINTP (2009c) *Travaux d'Entretien Routier, Financement Fonds Routier, Etat d'avancement des Travaux au 30 Novembre 2009*. Republic of Cameroon, Ministry of Public Works.

MINTP (2009e) *Marché No 0465/M/MINTP/CPM-TN/2009 du 26 Octobre 2009 Pour les Travaux de Construction d'un Pont sur la Rivière Lokomo y Compris ses Accès.* Republic of Cameroon, Ministry of Public Works.

MINTP (2009f) *Marché No 409/M/MINTP/CPM-A/2009 du 17 Septembre 2009 Pour l'Etude d'Impact Socio-Economique des Projets de Rehabilitation et/ou d'Ouverture des Routes Rurales.* Republic of Cameroon, Ministry of Public Works.

MINTP (2009g) *Marché No 191/M/MINTP/CPM-ER/2009 du 07 Mai 2009 Pour la Collecte des Données Destinées á la Banque des Données Routières des Réseaux Bitumé et en Terre Prioritaires, Programme Triennal 2008-2010.* Republic of Cameroon, Ministry of Public Works.

MINTP (2009h) *Marché No 169/M/MINTP/CPM-TN/2009 du 16 Avril 2009 Pour les Etudes en Vue de la Construction du Pont et de ses Accès sur le Mayo Deo.* Republic of Cameroon, Ministry of Public Works.

MINTP (2009i) *Marché No 0153/M/MINTP/CPM-TN/2009 du 30 Mars 2009 Pour l'Exécution des Travaux d'Aménagement d'Une Déviation de Deux Cent Quatre Vingt Six Mètres Linéaires (286 ml) en Vue du Rétablissement de la Circulation dans la Zone de Glissement de Terrain au Lieu-dit Kekem sur la Route Nationale No 5.* Republic of Cameroon, Ministry of Public Works.

MINTP (2009j) *Marché No 084/M/MINTP/CPM-ER/2008 du 04 mars 2009 Pour le Contrôle Technique des Travaux d'Entretien des Routes en Terre du Réseau Prioritaire National, Programme Triennal 2008-2010, Lot No 10-SU.* Republic of Cameroon, Ministry of Public Works.

MINTP (2008a) *Annuaire Statistique du Secteur des BTP Année 2007*. Republic of Cameroon, Ministry of Public Works.

MINTP (2008b) *Etude sur l'Analyse des Problèmes liés à la Passation des Marchés Publics au Ministère des Travaux Publics*. J. O. International Consulting Sarl, Republic of Cameroon, Ministry of Public Works.

MINTP (2008c) *Rapport Mensuel No 39, Mission de Contrôle et de Surveillance-Travaux de la Route Ayos-Bonis Lot No 1 : Ayos-Abong Mbang, Marché No 0056/MINTP/CPM-TN/2004,* Republic of Cameroon, Ministry of Public Works.

MINTP (2007a) *Rapport Final, Contrôle des Travaux d'Aménagement de la Route N'Gaoundéré-Touboro-Frontière Tchad*, Groupement Louis Berger SA/AIC Progetti, Republic of Cameroon, Ministry of Public Works.

MINTP (2007b) *Marché No 0106/M/MINTP/CPM-ER/2007 du 12 Novembre 2007 Pour l'Exécution des Travaux d'Entretien Courant et/ou Périodique de Certaines Routes en Terre du Réseau Prioritaire Dans le Réseau Nord, Programme Triennal 2008-2010.* Republic of Cameroon, Ministry of Public Works.

MINTP (2006) *Marché No 0257/M/MINTP/CPM-TN/2006 du 09 Novembre 2006 Pour l'Exécution des Travaux de Réhabilitation des Ponts en Béton Armé ou Béton Précontraint.* Republic of Cameroon, Ministry of Public Works.

MINTP (2005a) *Lettre-Commande No 0265/LC/MINTP/CPM-ER/2005 du 17 Février 2005 Pour la Réalisation des Opérations de Comptage Routier sur le Réseau Routier National Prioritaire du Cameroun.* Republic of Cameroon, Ministry of Public Works.

MINTP (2005b) *Marché No 0178/M/MINTP/CPM-ER/2005 du 25 Février 2005 Pour l'Exécution des Travaux de Réfection de Certains Ouvrages d'Art du Réseau Routier Prioritaire.* Republic of Cameroon, Ministry of Public Works.

MINTP (2005c) *Marché No 0139/M/MINTP/CPM-ER/2005 du 17 Février 2005 Pour l'Exécution des Travaux de Cantonnage sur les Routes Revêtues du Réseau Prioritaire.* Republic of Cameroon, Ministry of Public Works.

MINTP (2004) *Marché No 009/M/MINTP/CPM-TN/2004 du 12 Février 2004 Pour les Travaux de Reconstruction de Certaines Routes Rurales dans les Provinces de l'Adamaoua, de l'Est et du Sud-ouest.* Republic of Cameroon, Ministry of Public Works.

MINTP (2000) *PER FED II, Assistance Technique pour la Gestion des Caisses d'Avance Pilote du Programme d'Entretien Routier, Etat Mensuel No 4.* Republic of Cameroon, Ministry of Public Works.

Moser, C. A.; Kalton, G. (1972) *Survey Methods in Social Investigation.* 2nd Edition, Basic Books, Inc. New York

Mrozowski, T. and Project Team. (2004) *Summary Report: Development of a Change Order Management Process for Use on Construction Projects at Michigan State University.* Michigan State University.

Naoum, S. G. (1994). *Critical Analysis of Time and Cost of Management and Traditional Contracts*. Journal of Construction Engineering and Management. ASCE, 120 (4) 687-705.

Nemanich, D.; O'Rourke, D. (1975) *A Manual for the Coding of Survey Data.* Kendall/Hunt Publishing Company, Dubuque, Iowa.

Njoh-Mouelle, E. (2001) *Député de la Nation.* Presses de l'UCAC., Yaoundé, Cameroon.

O'Brien, J. J. (1998) *Construction Change Orders* . McGraw-Hill, New York.

Odeck, J. (2004) *Cost Overruns in Road Construction-What are Their Sizes and Determinants?* Transport Policy, 11, 43-53.

Okole, S. O. (2009a). *Le Bitumage de l'Axe Yaoundé-Olama s'Achève.* www.cameroon-tribune.net, Accessed on 11/01/2009, http://www.cameroon-tribune.net/article.php?lang=Fr&oled=j30102009&idart=58362&olarch=

Okole, S. O. (2009b). *Reprise des Travaux de Construction de la Route Ayos-Abong-Mbang-Bonis* . www.cameroon-tribune.net, Accessed on 11/01/2009, http://www.cameroon-tribune.net/article.php?lang=Fr&oled=j30102009&idart=58362&olarch=

Okole, S. O. (2009c). *Aménagement des Routes : Vers une Maitrise des Couts*. in Cameroon-Tribune 04/24/2009. SOPECAM Editions, Yaounde, Cameroon. P. 5

Okpala, D. C.; Aniekwu, A. N. (1988) .*Causes of High Costs of Construction in Nigeria.* Journal of Construction Engineering and Management. ASCE, 114 (2) 233-244.

Patty, R. M., Denton, M., A. (2010) *The End of Project Overruns- Lean and Beyond for Engineering, Procurement and Construction.* Universal-Publishers, Boca Raton, Florida.

Pratt, David (2004). *Fundamentals of Construction Estimating*. Delmar Learning, pp. 29-31

Papacostas, C. S., Prevedouros, P. D. (2001). *Transportation Engineering and Planning*. 3rd Edition, Prentice Hall.

Presidency of the Republic of Cameroon(PRC), (2011). Décret *N° 2011/110 du 29 Avril* 2011 *Portant Organisation du Ministère des Travaux Publics.* Republic of Cameroon.

Presidency of the Republic of Cameroon(PRC), (2004). *Décret No 2004/275 du24 Septembre 2004 Portant Code des Marchés Publics.* Republic of Cameroon.

Pritchett, M. (2006) *CCC/CCE Certification Study Guide* 3rd Edition, AACE International, Morgantown,WV

Rice, John, A. (2007) *Mathematical Statistics and Data Analysis.* 3rd Edition, Thomson Brooks/Cole.

Ridell, R. (2007) *Does Foreign Aid Really Work?* Oxford University Press, New York.

Sambasivan,M.; Soon,Y. (2006). *Causes and Effects of Delays in Malaysian Construction Industry*. International Journal of Project Management. 25, 517-526

Saunders, M.; Lewis, P.; Thornhill,A. (2000) *Research Methods for Business Students.* 2nd Edition, Prentice Hall, New York.

Schumacher, E. (1973) *Small is Beautiful; Economics as If People Mattered.* Harper & Row, New York.

Sears, S.; Sears, G.; Clough, R. (2008) *Construction Project Management*.5th Edition, John Wiley & Sons, Inc., Hoboken, NJ.

Sekaran, U. (2000) *Research Methods for Business, a Skill-Building Approach*. 3rd Edition. John Wiley & Sons, Inc.

Services du Premier Ministre (SPM) du Cameroun (2011a) *Circulaire N° 003/CAB/PM du 31 Janvier 2011 Précisant les Modalités de Gestion des Changements des Conditions Economiques des Marchés Publics.* SPM, République du Cameroun.

Services du Premier Ministre (SPM) du Cameroun (2011b) *Circulaire N° 002/CAB/PM du 31 Janvier 2011 Relative à l'Amélioration de la Performance du Système des Marchés Publics*. SPM, République du Cameroun.

Services du Premier Ministre (SPM) du Cameroun (2011c) *Arrêté N° 023/CAB/PM du 02 Février 2011 Fixant les Modalités d'Application de la Demande de Cotation.* SPM, République du Cameroun.

Shane, J. S., Molenaar, K. R., Anderson,S., Schexnayder, C. (2009) *Construction Project Cost Escalation Factors.* Journal of Management in Engineering. ASCE. 25(4) 221-229.

Siegel, S.; Castellan, N. J. (1988) *Nonparametric Statistics for the Behavioral Sciences.* 2nd Edition, Mc Graw-Hill,Inc. New York.

Siemiatycki, M. (2009) *Academics and Auditors: Comparing Perspectives on Transportation Project Cost Overruns*. Journal of Planning Education and Research,29,142-156.

Sweet, J. S.; Schneier, M. M. (2009) *Legal Aspects of Architecture, Engineering, and the Construction Process*, Cengage Learning, Stanford.

Teke, E. (2011) *President Paul Biya Authorizes Sales of Treasury Bonds Worth 200 Billion FCFA.*http://www.crtv.cm/cont/nouvelles/nouvelles_sola_fr.php?idField=9450&table=nouvelles&sub=national, Accessed June 11, 2011

Tumi, S.; Omran, A.; Pakir, A. (2009) *Causes of Delay in Construction Industry in Libya*. The International Conference on Administration and Business, University of Bucharest.

Van De Walle, N.; Johnston, T. (1996) *Improving Aid to Africa.* John Hopkins University Press, Baltimore, MD

Weisberg, H. F.; Bowe, B. D. (1977) *An Introduction to Survey Research and Data Analysis*. W. H. Freeman and Company, San Francisco.

Wickwire, J., Driscoll, T., Hurlbut, S., Hillman, S. (2003) *Construction Scheduling: Preparation, Liability, and Claims* Aspen Publishers, New York, NY

World Bank, (2009) *Status of Projects in Execution (SOPE) FY 2009*. Operations Policy and Country Services

World Bank, (2004) *Report No 28057-CM Implementation Completion Report on a Loan/credit/Grant in the Amount of SDR 41.7 Million to the Republic of Cameroon for the Transport sector Technical Assistance Project*.

World Bank, (1997) *Progress Report*. Sub-Saharan Africa Transport Policy Program, Working Paper No 28.

World Bank, (1995) *Report No P-6559-CM Technical annex to the Memorandum and Recommendation on a Proposed Credit in the Amount Equivalent to SDR 6.9 Million to the Republic of Cameroon for a Transport sector Technical Assistance Project*.