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EXPERIENCE OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTING SYSTEM IN DEVELOPING COUNTRIES AND FUTURE PROSPECTS IN ETHIOPIAN FEDERAL ROAD CONSTRUCTION

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Experience of Output and Performance Based road contracting system in developing countries and future prospects in Ethiopian federal road construction

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Declaration

I, the undersigned, certify that this research work titled "Experience of Output and Performance Based Road Contracting System in developing countries and future prospects in Ethiopian Federal Road Construction" is my own work performed under the supervision of my research advisor Dr. Abraham Assefa as part of Master of Engineering in Construction and Technology Management and has not been presented elsewhere for assessment and for a degree in any other university. All sources of materials used for this thesis have also been duly acknowledged in the text.

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ABSTRACT

The government of Ethiopia has given significant attention to the road sector considering its immense impact on the socio-economic development of the country as road transport reaches the majority of the people. In this respect, the Ethiopian Roads Authority (ERA) is mainly responsible for the construction and maintenance of federal road networks of the country.

The road maintenance and construction practice of ERA is predominantly based on the conventional method of quantity and unit rate based contracts by which several works are planned and carried out. The government has faced problems in maintaining the serviceability of road infrastructure systems by using these traditional methods of contracting. However, in recent years other alternative contracting methods are attempted including output and performance based road contracting (OPRC) in the Ethiopian road sector. These types of procurement methods have a substantial success records in many developed and developing countries. Nonetheless, taking the long term nature of the contract into account, OPRC projects require careful planning and capacity from the contracting authority and the contractor to implement it successfully.

In the traditional approaches of project delivery systems, after the Contractor hands over the project any failures arising out of design or execution are the headaches of the Employer/Government and heavy costs are spent on the rehabilitation and maintenance of roads that doesn't serve the expected life. In order to tackle the above mentioned shortcomings of the traditional approaches of project delivery systems, other alternative project delivery systems that account the serviceability and usability of the road becomes critical. One of the project delivery systems that is being used by different countries and now initiated for implementation in our country (for Nekemte - Bure Road Project with its three lots) as a pilot project is OPRC (Output and Performance based Road Contract) which is believed to address the design, improvement works/construction and management and maintenance services in one package.

This research tries to study the specific characteristics/features, advantages and disadvantages of this type of project delivery system from different stakeholder's perspective, study the experience of other countries, and evaluate the contract and performance to date and encountered challenges of the newly initiated projects in our country by benchmarking other countries experiences and forward recommendation for further implementation for Ethiopian Federal Road Projects.

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LIST OF ABBREVIATIONS/GLOSSARY

- **ERA** : Ethiopian Roads Authority
- **OPRC**: output and performance based road contract
- **WB SBD**: World Bank Standard Bidding Document
- **ADB**: African Development Bank
- **AMC**: Asset Management Contracts
- **PSMC**: Performance Specified Maintenance Contracts
- **PBRMC**: Performance–based Road Maintenance Contracts
- **MAC**: Managing Agent Contracts
- **PPP**: Public Private Partnership
- **DBB**: Design Bid Build
- **DB**: Design Build
- **BO**T: Build Operate System
- **MWUD**: Ministry of Works and Urban Development
- **DBMOT**: Design, Build, Maintain, Operate and Transfer
- **DoT**: Department of Transportation
- **MAC**: Managing Agent Contracts
- **FRE**: Finnish Road Enterprise
- ***CREMA****: Contrato de REcuperacion MAntenimiento*
- **PERS**: Public Enterprise "Roads of Serbia"
- **PM** *:* Project Manager
- **RoW** *:* Right of Way
- **RDM***:* Road Durability Performance measures
- **FWD***:* Falling Weight Deflectometer
- **IRI***:* International Roughness Index
- **CE**: Concurrent Engineering
- **JIT**: Just in Time
- **LDR** : Latent Defect Risk
- **SoC**: State Owned Contractors
- **SoE**: State Owned Enterprises

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1. BACKGROUND

The government of Ethiopia has undergone rapid expansion in road infrastructure since 1997 as the result of the Road Sector Development Program and massive amount of capital has been invested by the government and with the support of international donors. After such a massive investment, this vital asset is observed to fail and not serve for the designed service life time due to a number of reasons.

The maintenance and construction practice of road in ERA is predominantly based on conventional method of quantity and unit rate based contracts where several activities are planned and executed. In this traditional method of contracting, the client (ERA) demands the contractor what work is to be done and the extent of the work. The contractor is paid on the basis of quantity accomplished according to the contract rates. ERA is responsible to supervise the construction and maintenance works executed by the contractors, by its Engineers and assigned consultants. In an effort to look other methods of delivery, ERA contracted out major road improvement and maintenance works to international contractors with the support of the World Bank in 2016 through output and performance based road contract (OPRC) and it is under implementation. Since OPRC is a long-term contract, before the introduction of it for road infrastructure development in a country, it requires massive planning and a cultural change among the road authority (Sultana et al., 2012).

As mentioned above, one of the project delivery systems that is being used by different countries and now initiated for implementation in our country (i.e. for Nekemte - Bure Road Project with three lots) as a pilot project is OPRC (Output and Performance based Road Contract) type of Contract which addresses the design, improvement works/construction and management and maintenance services.

Regassa (2015) studied Performance Based Road Maintenance Contracting System for Ethiopian Federal Roads by assessing the current contractual practice while identifying the status of contracted federal roads using case studies of contractual practices in the ten road maintenance projects from July 2013 to June 2014. However, the study is only limited to maintenance contracts not the design, construction and maintenance as a one package contract.

In addition, recently Debella et al. (2019), has written a journal on " a case study on the problems and prospects of output and performance Based Road Contracting (OPRC) in Ethiopia" on the international journal of

Construction Engineering and Management". However, the journal is only limited to an overview of the project delivery system on the initiated projects.

Performance-based contracting for the management and maintenance of road networks is a new concept designed to increase the efficiency and effectiveness of road maintenance operations. It should ensure that the physical condition of the roads under contract is adequate for the need of road users, over the entire period of the contract which is normally several years (Schliessler/Gericke, 2014).

Performance Contracts are defining a product and it is up to the contractor how to achieve this. Therefore, work selection, design and delivery are all his responsibility. Hence, the choice and application of technology and the pursuit of innovative materials, processes and management are all up to the contractor. This allocates higher risk to the Contractor compared to traditional contract arrangements, but at the same time opens up opportunities to increase his margins where improved efficiencies and effectiveness of design, process, technology or management are able to reduce the cost of achieving the specified performance standards (WB, 2006).

Current best-practice techniques in outsourcing rely on output and performance-based contracts. Under this type of arrangement, the contracting owner defines an end outcome goal (e.g., high quality roads) and the contractor decides how best to achieve the desired outcome. The contract creates clearly defined performance measures, clearly defined outcomes and timetables, and allows for new and innovative methods. Because output and performance based contracts define success in terms of outcomes alone, they spark Contractor innovation and improve quality. This arrangement creates opportunities for value engineering and improved efficiencies (Stankevich/Qureshi, 2005).

What significantly differentiates an OPRC is that the contractor is assigned a number of responsibilities and risks that is used to be borne by the owner agency under traditional method-based contracts. On the one hand, the contractor is not tied down by the contracting agency in making his decisions regarding what to do?, when to do?, and how to do? He is free to innovate with techniques and technologies to reduce his own costs, as long as the level of service specified are achieved (WB, 2006).

Hence, since this type of project delivery system has many features that differentiates it from other traditional types of project delivery systems, this research tries to study the specific features/characteristics and advantages and disadvantages of this type of project Contract, study the experience of other countries, evaluate the contract and to date execution and encountered challenges of the newly initiated project in our country by benchmarking

other countries experiences and forward recommendation for further implementation for Ethiopian Federal Road Projects.

1.1. STATEMENT OF THE PROBLEM

After huge investments are spent on road infrastructures in Ethiopia, most road projects are observed to fail before serving the expected life and heavy unexpected costs are spent on the rehabilitation and maintenance of roads.

After the Contractor hands over the road project, any failures arising out of design or execution are the headaches of the Employer/Government/public body. In order to tackle the above mentioned shortcomings of the traditional approaches of project delivery systems, other systems that account the serviceability and usability of the road becomes critical. One of the project delivery systems is Output and Performance based Road Contract which addresses the design, improvement works/construction and management and maintenance services in one package.

This research tries to study the specific features/characteristics and advantages and disadvantages of using this type of project Contract, study the experience of other countries, and evaluate the contract and to date execution and encountered challenges of the newly initiated project in our country by benchmarking other countries experiences and forward recommendation for further implementation for Ethiopian Federal Road Projects.

1.2. OBJECTIVE

1.2.1. GENERAL OBJECTIVE

- The general objective of the research is to study the specific features/characteristics and advantages and disadvantages of Output and Performance based Road Contracts for Implementation for Ethiopian Federal Road Projects.

1.2.2. SPECIFIC OBJECTIVE

The aim of the research paper is to study the specific features/characteristics and advantages and disadvantages of Output and Performance Based Road Contract (OPRC) for Implementation in Ethiopia Federal Road projects from exhaustive literature review, surveys, study of other countries experiences and evaluating the contract and

by analyzing the to date execution and encountered challenges of the currently initiated Output and Performance Based Road Projects in Ethiopia.

The specific objectives of this research are stated as follows: -

- To compare and contrast Output and performance based road contracting approach with other methods of commonly used project delivery systems from different stakeholder's view.
- To study the specific features/characteristics and advantages and disadvantages of output and Performance Based Road Contracts for implementation for Ethiopia Federal Road projects.
- By benchmarking the international practices and lessons learned and by evaluating the contract and the to date execution of the currently initiated Contracts in Ethiopia and studying distinguishing characteristics and advantages and disadvantages of Output and Performance based Road Contract, propose the delivery system for further implementation in Ethiopia.

1.3. EXPECTED BENEFITS

As stated above, after huge investments are spent on road infrastructures in Ethiopia, most road projects are observed to fail before serving the expected life and heavy unexpected costs are spent on the rehabilitation and maintenance of roads and any failures arising out of design or execution are the headaches of the Employer/Government/public body in the traditional approaches of project delivery systems.

Hence, studying one of the alternative project delivery system which is Output and Performance based Road Contract which addresses the design, improvement works/construction and management and maintenance services in one package will help to assure the long term service of the roads without interruption, reduce cost and shift the risk of maintenance from the public body. Furthermore, it creates a stable business opportunity for Contractors and Consultants, opens a room for innovation and new technologies, improve quality, limit unpredictable costs occurring and reduce administrative expenses.

1.4. RESEARCH QUESTIONS

- What are specific features/characteristics of output and performance based road contracts as compared to other commonly used types of project delivery systems?

- What are the advantages and disadvantages of Output and Performance based Road Contracts from different stakeholder's view?
- What are the advantages and disadvantages and features of the newly initiated Output and Performance based Road Contracts in Ethiopia basing the experience of other countries?
- For what type specific project characteristics are Output and Performance Based Road Contract is an alternative solution?

1.5. SCOPE OF THE STUDY

This thesis work studies the benefits and challenges of OPRC for Ethiopian Federal Road Projects through;

- Exhaustive literature review and studying the experience of other countries
- Collecting and analyzing data about the specific features/characteristics and advantages and disadvantages of Output and Performance based Road contracts
- Evaluating the contract and to date execution of the newly initiated Output and Performance based Road Contract projects in Ethiopia (Nekemte - Bure Road Project with three lots) by benchmarking other countries experience.

1.6. LIMITATION OF THE STUDY

This thesis work is limited to the following issue

- The newly initiated Output and Performance based Road Contract projects in Ethiopia (the three lots of Nekempt - Bure Road Project) are just signed on March 2016 which will make it difficult to evaluate the performance of the Contract type at this early stage. Hence, only contractual evaluations and encountered challenges of the projects will be conducted.

- The research has some limitations since it has been based on only involvement of professionals involved in one pilot OPRC project consisting three contracts. The results would have been more rigorousness if more case studies could have been conducted. The low number of interview participants may affect the scope of the research output.

- Only one project cannot be construed as a model to represent other projects. Further, the two lots are constructed by one Contractor which faces the same problems.
- The two case study projects (i.e. Lot I and Lot III) are currently suspended and under termination process with progresses 12% and 10% respectively which makes it difficult to evaluate the accomplishment and challenges of the delivery system.

2. LITERATURE REVIEW

2.1. INTRODUCTION

Output and performance based road contracting (OPRC) is an agreement between a government and a private contractor whereby the private contractor maintains the road to achieve specified standards for a certain period of time in return for a fixed payment for meeting specified performance indicators. These indicators include riding quality, strength of the road, safety features, and roadside conditions management (Mulmi, 2016).

Output- and Performance-based contracting for Roads is designed to increase the efficiency and effectiveness of road asset management and maintenance. It should ensure that the physical condition of the roads under contract is adequate for the needs of road users, over the entire period of the contract which is normally several years. This type of contract significantly expands the role of the private sector, from the simple execution of works to the management and conservation of road assets (WB, 2006).

The contract covers an array of activities needed to achieve and maintain a certain Service Level for road users, including many activities related to the Management and Maintenance (including periodic evaluation) of the road network under contract.

It includes carrying out Rehabilitation Works to bring the Road up to pre-defined standards, Improvement Works specified by the Employer aiming at adding new characteristics to the Road in response to new traffic, safety or other conditions and Emergency Works needed to reinstate the Road after damage has occurred as a result of natural phenomena with imponderable consequences (such as strong storms, flooding and earthquakes) under the conditions defined in the contract (WB, 2006).

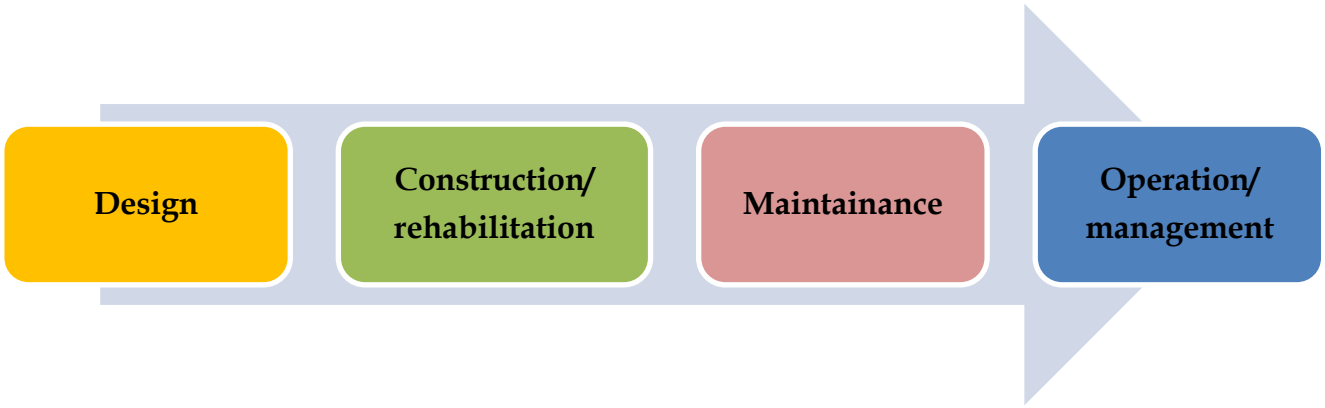


Figure 1. Process of Output and Performance Based Project Delivery System

The term output and performance based road contracting (OPRC) is mainly used by the World Bank (ADB, 2018). However, different terminologies are utilized in many countries including: Asset Management Contracts in USA, Performance Specified Maintenance Contracts in Australia and New Zealand (PSMC), Performance–based Road Maintenance Contracts (PBRMC), Contract for Rehabilitation and Maintenance in Argentina and other Latin American countries, Managing Agent Contracts (MAC) in the UK, and Area Maintenance Contracts in Finland (Sultana et al., 2012). For the purpose of this study, we use the World Bank terminology of output and performance based road contracting (OPRC)

Developed countries switched from conventional contracting out to performance based contract mainly due to the potential for cost savings while for developing countries, the main driving force to introduce performance based contract is to secure sufficient long-term financing for road maintenance and guarantee better road conditions (ADB, 2018). Other reasons for adopting of performance based contract include reduce the strain of management, initiate a Public Private Partnership (PPP), have private sector interest, allow to bundle multiple contracts into a single contract, ease to fulfil the compliance requirements, and regulate inspections (Shrestha & Powers, 2018). Furthermore, according to Zietlow (2007), there are some other reasons for implementing OPRC projects including:

- to reduce maintenance costs through the application of more effective and efficient technologies and work procedures;
- to provide transparency for road users, road administrations and contractors with regard to road maintenance;
- to improve control and enforcement of quality standards; and
- to improve overall road conditions.

2.2. TYPES OF PROJECT DELIVERY SYSTEMS

Procurement and Contract Delivery system is the way Project Owners together with Project Regulators and Financers determine the assignment of responsibilities to Project Stakeholders along the Construction Process.

Procurement and Contract Delivery system is often determined during the Basic Planning phase of Construction Project (Jekale, 2009).

Generally, there are six types of Procurement and Contract Delivery systems. These are:

- Force Account,
- Design Bid Build (DBB),
- Design Build (DB) or Turnkey,
- Output and Performance Based Road Contracting
- Finance / Build Operate System (BOT),
- Construction/Facility Management Consultancy, &
- Alliances and Outsourcing.

A. FORCE ACCOUNT

When the Project Owners engage themselves to undertake the project, it is called a force account delivery system. Often such a system is promoted if the Project Owners believe that there is a comparative advantage in Cost, Time and Quality issues. Besides, when there is a lack of capacity from the private sector to undertake very large and technologically new projects, public companies do undertake such projects using Force account delivery systems.

These days this type of delivery system is often used when projects are small and places are remote such that reaching them is difficult and in general they are not attractive enough to call the attention of Bidders.

B. DESIGN BID BUILD (DBB)

This is the most practiced type of delivery system in the Construction Industry of Ethiopia since the 1987. After project owners did prepare the Basic Planning that identifies construction project programs, they call upon the participation of Design and / or Supervision Consultants either by tender or by negotiated contracts. This consultant will carry out the design together with the necessary tender documents which will be the bases for tendering to select contractors. These process is called Design - Bid - Build and hence the name for such delivery system.

In this type of delivery system, projects are divided into different packages interfacing to each other. Though the design and supervision consultant will be the prime professional on behalf of the owner and largely the administrator of the construction contract; the employer takes the responsibility of coordinating the various project packages and their respecting interfaces.

Besides, designers have not been required to guarantee results but rather methods. That is, they are held accountable on the basis of their superior knowledge and sufficient competency and ability to design with a

reasonable degree of technical skills. As a result, contracts and courts focused on professional duty of care, not results or project goals. Contractors are also responsible to construct works with due care and diligence and complete them in accordance with the contract, but they are not held responsible for design deficiencies.

Since the 1980s, this traditional approach becomes less popular due to the following factors:

- Severe Adversarial relations between the design and contract administration consultant and the contractor
- Fragmented contract for the project owner
- Project owner responsibility for risks associated with the design and contract administration
- Non - Impartiality of the Design and Contract Administration services
- The inability of design and contract administration consultants to cope up with new construction technologies and constructability issues of their designs
- The indirect contractual obligation assigned for the Design and Contract Administration consultants
- The incompatibility of consultancy fee to the desired activities they are required to provide, etc.

The following standard forms of DBB Conditions of Contract are known for use for such delivery system:

- ✓ FIDIC White Book for Consultancy Services (Design and Supervision) and Red Book for Construction Works

C. DESIGN BUILD (DB) / TURNKEY

Design Build or Turnkey Delivery system is a response to problems associated to the last two types of delivery systems. These were promoting privatization and its businesslike approach to enhance the Force Account System and reducing fragmentation, adversarial relations and Project Owners' risk which are recurrent manifestations in the DBB delivery system.

Design Build or Turnkey by principle reduces numbers of procurement processes engaged in the fragmented process and employ only one procurement process and a single contractor to provide the entire Construction Implementation Process (Design and Construction Implementations).

In the 1970s, large firms began to offer both design and construction services in order to provide project owners with a single source for project delivery. At the beginning, this delivery system was limited to complex projects such as industrial, big plants and big infrastructural constructions.

DB delivery system is common worldwide specifically for Private projects. This led lead contracting firms to form a team or consortium of designers and specialty contractors who work together to meet the entire demand. Such services are initiated after the Project Owner built the project concept during the basic planning phase and brought to the DB Contracting Firms. The project concept should clearly define the performance criteria such as output, input, waste and any other performances the employer may desire. This makes an additional responsibility to the contractor which is ¨fitness to purpose¨ according to the Orange Book of Fidic. Fitness to purpose is beyond the professional duty of care and places liability on the contractor for any failure of the design to perform the standards required.

Typical advantages of this system include:

- reducing fragmentation and adversarial relations between designers and constructors;
- minimizing Project owners' risk transferable due to Designers' faults;
- accountability and entire responsibility for both design and construction which entitle the employer to receive completed project is onto a single contractor;
- employers' responsibility to co-ordinate interfaces between different project elements is avoided;
- single point responsibility minimizes the opportunity to claims by the contractor due to design related issues;
- coordination between design and construction processes will also be enhanced (both in communication for constructability as well as in fast tracking); and
- The client budget or financial requirement is defined early enough in the development process.

For this type of delivery systems, either joint ventures or firms with large design and construction capabilities are able to participate.

The disadvantage of this delivery system is **loss of control, cost of tender and cost of risks**.

- ✓ Since limited supervisory role by the employer representative is practiced; which is relatively flexible and makes the employer distanced from the whole process, the employer has little chance to understand what is developed and entertain variations in requirements implying **loss of control**.

- ✓ Contractors in order to provide reasonable offer, their **tender cost** is higher than in the case for DBB delivery system. This is because they need to carryout acceptable design for project cost offers. Though it

was not practiced often, employers who shared costs related to tendering are informed to get seriously considered offers.

- ✓ The increase in risk transferred onto the contractor will be counterbalanced by the increase in contract prices which can be taken to include these **costs of risks**.

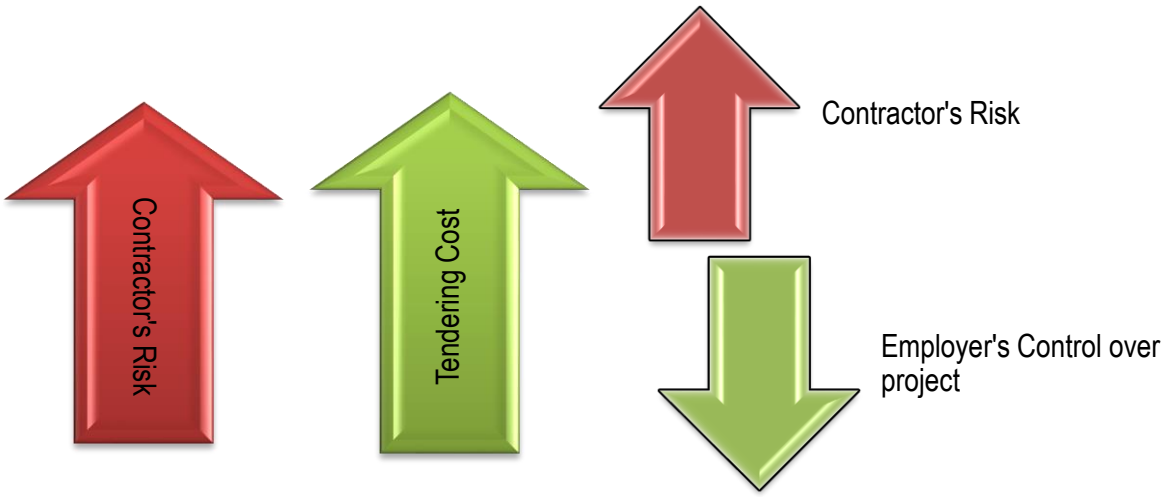


Figure 2. Relation between Risk, Project Cost and Employers Involvement on OPRC projects

Projects carried out using DB delivery system are often called Turnkey Projects because a single contractor is responsible to hand over the completed facility and let the Project owner to turn the key and gets in. Often Turnkey projects use Lump-Sum contract type. The following standard forms of DB Conditions of contract are known for use for such delivery systems:

- FIDIC Orange Book
- ENAA Model Form International Contract
- ICE Design & Construct Conditions of Contract
- EIC Contract
- AIA Contract Form A191

D. FINANCE / BUILD OPERATE TRANSFER (BOT)

Build - Operate - Transfer is a form of procurement and contract delivery system that promotes Public Private Partnership (PPP) in which a private company is contracted to finance, design, construct, and operate for a certain period (usually 10 years) and transfer. BOT contractors look to project financiers for the realization of projects through equity contributions or credits. Such provisions are different from budgeted finances such that

they involve no or limited re – course which means the project owner is not responsible for any liability other than force majeure and agreed upon claim adjustments. This obliges that projects should first be viable for revenue generation in order to payback its debts.

The Typical BOT contract is the process whereby a government grants a concession to a project development company to develop and operate what would normally be a public sector project, for a given period of time known as the concession period. BOT project involves a potentially complex contractual structure. The Operation period between completion and transfer gives the contractor an opportunity to verify the quality of the output of the services and works, and train the employer personnel on how to manage the facility afterwards. In some BOT contracts, defect liability period will be included in order to ensure the quality of the facility during transfer. This is because, operators in an attempt to save costs, may decrease operating and maintenance expenditures towards the end of the concession period.

This delivery system is advantageous because of three major factors:

- it minimizes owners' scarcity of financial resources;
- It devoid of considerable risks from the project owners and lesson regulatory activities; and
- The facility is well operated and transferred with free of charge or minimum compensations to project owners.

Such delivery system requires appropriate packaging of projects and their definition clearly. It is advisable to start with small projects and tries to develop experience and expertise to make such delivery system successful. Most BOT projects failed because of their built up and engagement in very large projects which is an extremely risky business for contractors. Consortium of contractors is used to carry out such projects. The increasing popularity of the BOT project is largely due to a shortage of public funding and the opinion that the facility will be more efficiently managed by a private entity.

The following standard forms of BOT Conditions of Contract are known for use for such delivery systems:

- FIDIC Yellow Book

E. CONSTRUCTION / FACILITY MANAGEMENT CONSULTANCY

Construction Management Consultancy Delivery System is a response to problems associated with DB and BOT where the Project Owner was not well represented for its benefit and the problem of fragmentation between

Planning and Implementation. As a result, construction management consultancy firm is used to coordinate all activities from concept inception through acceptance of the facility. Facility management consultancy adds operation of facility during operation to Construction Management Consultancy.

Construction Management service in such delivery system include the management activities related to a construction program carried out during the Basic Planning, Design & Construction Implementation and its completion process that contributes for the successful completion of projects. The main difference of this delivery system is that, while all the others involve only during the implementation phase after major decisions was made during the Basic planning phase of the construction process, it is involved in the whole construction processes.

Construction Management Consultancy services are particularly attractive to organizations that involve in construction physical infrastructures such as MoE, MoH, Real Estate Organizations, MoWRs, MoT&C, etc. Construction Management Consultants then represents Project Owners to carry out the following services:

- Feasibility studies of Construction related services
- Plan and Monitor the Triple Constraints of Project Performances
- Lead and Organize regulatory systems of the Construction Industry
- Valuation, Quantity Surveying and Procurement and Contract Management Services

F. PARTNERING, ALLIANCES AND OUTSOURCING AND CE & JIT (RUNNING AND SPECIALIZED DELIVERY SYSTEM)

The need for constructing quicker, cheaper and to a higher quality of physical infrastructure by clients and at the same time with very minimized or no dispute questioned fragmentation of packaging, costs related to wastes and overheads, single staged procurement systems, involving in less competitive and comparative advantage for services and works and existing stakeholders relationships. As a result,

- running delivery system using Partnering and Alliances,
- specialized delivery system using Outsourcing,
- fast tracking, parallel and coordinated implementations using Concurrent Engineering and Just in Time principles

Which focuses most on management of relationships and value adding to ensure quicker, cheaper and quality services and products with less disputes are recent developments. These systems require overcoming cultural

and behavioral barriers among interest groups and control motivated performance based management. These types of delivery systems are often the bases behind DB, BOT, FM\CM consultancy delivery systems but there at most and recent developments.

2.3. COMPARISON OF CONVENTIONAL CONTRACTS VERSUS OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

In traditional road construction and maintenance contracts, the Contractor is responsible for the execution of works which are normally defined by the Road Administration or the Employer, and the Contractor is paid on the basis of unit prices for different work items, i.e. a contract based on "inputs" to the works. The results of conventional road contracts are in many cases less-than-optimal. The problem is that the Contractor has the wrong incentive, which is to carry out the maximum amount of works, in order to maximize his turnover and profits. Even if the work is carried out according to plan and considerable money is spent, the overall service quality for the road user depends on the quality of the design given to the Contractor who is not accountable for it. In many cases the roads do not last as long as they should because of deficiencies in the original design, aggravated by inadequate maintenance (WB, 2006).

The OPRC as a model for road asset management is similar to Design, Build, Maintain, Operate and Transfer (DBMOT) model of contracts which addresses the issue of inadequate incentives. During the bidding process, contractors compete among each other by essentially proposing fixed lump-sum prices for bringing the road to a certain service level and then maintaining it at that level for a relatively long period.

Contractors are not paid directly for "inputs" or physical works (which they will undoubtedly have to carry out), but for achieving specified Service Levels, i.e., the Improvement or Rehabilitation of the road to pre-defined standards, and the management and maintenance service necessary to ensure certain Service Levels on the roads under contract, all represented in outputs or outcomes, expressed in Service-Levels criteria (Trauner Consulting Services, 2007).

A lump-sum periodic remuneration paid to the Contractor will cover all physical and non-physical services provided by the Contractor, except for unforeseen emergency works which are remunerated separately. In order to be entitled to these periodic payments, the Contractor must ensure that the roads under contract comply with the Service Levels which have been specified in the bidding document. It is possible that during some months he will have to carry out a rather large amount of physical works in order to comply with the required Service Levels

and very little work during other months. However, his periodic payment remains the same as long as the required Service Levels are complied with (Schliessler/Gericke, 2014).

An illustrative example of the process for traditional project delivery systems and Output and Performance based Road contracting system is shown below;

- **Traditional Project delivery system**

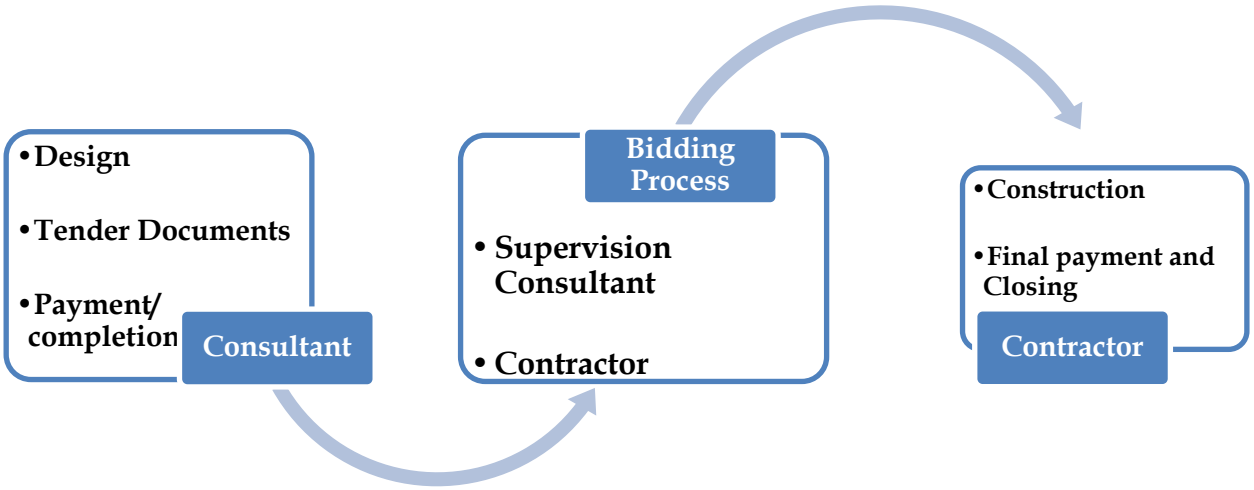


Figure 3. Process of Conventional Project delivery systems

- **Output and Performance based Road contracting system**

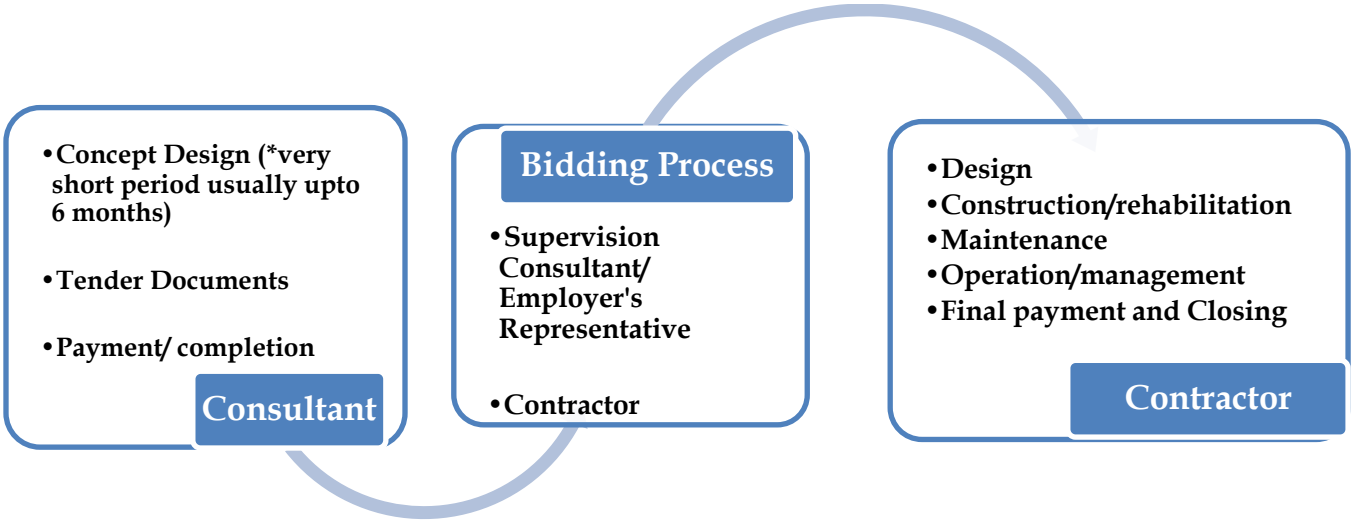


Figure 4.process of OPRC

A simple comparison of Output and Performance based road contract with traditional contracts is shown in the table below:

Table 1. Comparison of Conventional project delivery system vs OPRC

Traditional/Conventional Contracts	OPRC
Conventional contracts are evaluated basically from Road Engineers view (Road characteristics)	Output and Performance based road contracts are evaluated through Road User view (Service Levels)
The process is physical Completion of works, final Payment and fully closing out the project except Design and Build type of road contracts which have 3 to 4 years of extended warranty period.	Output and Performance based road contracting is Provision of required Service Level over long periods
Payment based on Input quantities and Unit Prices and for Design and Build Road Contracting lump sum basis based on weightings	Output and Performance based road contracting payment is based on Outputs (agreed service levels)
Design is not the Contractor's responsibility in Design, Bid, Build Delivery system	Contractor is responsible for detailed design and improvement
There is a higher chance of unpredictable costs occurring except Design and Build which is based on lump sum basis	Fewer chance of unpredictable costs occurring
higher administrative expenses and road agency overhead	Reduction in administrative expenses and road agency overhead due to better packaging of Contracts

2.4. FUNDAMENTAL FEATURES OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

A fundamental feature of the OPRC is that the Contractor is responsible for designing and carrying out the works, services and actions he believes are necessary in order to achieve and maintain the Service Levels stated in the contract. The Service Levels are defined from a road user's perspective and from a "strength of the pavement" point of view and may include factors such as riding comfort, safety features, residual strength of pavement, etc. If the Service Level is not achieved in any given month, the payment for that month may be reduced or even suspended (Trauner Consulting Services, 2007).

OPRC is not designed for the contractor to simply build a road and then move on to other things. It is meant to establish a longer-term Public-Private Partnership (PPP) between the contractor and the Government, in which both parties have long-term commitments. The contractor's focus will not simply be on road construction, but on the Integral Management of the Road Asset over a period which should reflect the expected lifetime of the asset.

In this sense, the "contractor" must be a firm or a business venture which has the technical, managerial and financial capacity to fulfill the contract in all its aspects (Bull/ Brekelmans, 2014).

Output-based contracts can help governments build their capacity to implement PPPs. Output-based maintenance contracts can serve as an introduction to PPPs and the resulting change in the public sector's role from a purchaser of goods or inputs to a purchaser of services. This shift requires different capacities and implementing output-based contracts is one way for governments to build experience in PPPs.

Output-based maintenance contracts usually do not involve large upfront capital investments and are often simpler to implement than other types of PPPs. These types of contracts can therefore be a starting point for governments interested in PPPs and can help governments build a track record of monitoring PPP contracts.

Several factors need to be considered when designing output-based contracts in order to achieve value-for-money and efficiencies over traditional contracts. These factors include:

Affordability	• is the government able to meet its long-term financial liabilities?
Incentive structure	• Does the contract have standards that encourage private operators to be efficient, innovative, transparent, responsible and reliant?
Risk Allocation	• Are risks allocated to the public and private parties who are most able to bear them, in order to optimize the efficiency of the contract?
Contract Scope	• Does the scope of the contract allow for economies of scale to be achieved? Is the scope of the contract manageable for the relevant public agency? Does the scope allow for synergies to be achieved or innovative approaches to be used?
Length/Duration	• Is the contract period long enough to transfer life-cycle risks to private operators? • Is it sufficiently long for private investors to earn a return on any investment?

Figure 5. Factors to be considered when designing OPRC contract

Under the OPRC, the Contractor has a strong financial incentive to be both efficient and effective whenever he undertakes work. In order to maximize profits, he must reduce his activities to the smallest possible volume of well-designed interventions, which nevertheless ensure that pre-defined indicators of Service Level are achieved and maintained over time. This type of contract makes it necessary for the Contractor to have a good management capacity.

The role of the Road Administration and of the Employer is to enforce the contract by verifying compliance with the agreed Service Levels and with all applicable legislation and regulations. The Contractor will be responsible for the detailed design of the improvement/rehabilitation and other consequent phases included in the life-span of the project. The Design Standards and specifications shall be recommended by the monitoring consultant and meet at least the minimum specified design standards (Nekemte - Bure Works Requirement, 2014).

Maintaining a road network includes both routine and periodic tasks. Routine Maintenance consists of many different tasks frequently necessary to maintain the function of the road (such as pothole repairs, cleaning of drainage, sealing of cracks, cutting of vegetation, etc.). Periodic Maintenance consists of predictable and more costly measures of a less frequent nature designed to avoid road degradation (such as grading, drainage work, Resealing, asphalt concrete overlays, etc.). Intelligent management, the timeliness of interventions and the adequacy of technical solutions are critical (WB, 2006).

Minimum road conditions and Service Levels are defined through output and performance measures, and these are used under the OPRC to define and measure the desired performance of the Contractor. In the OPRC, the defined performance measures are thus the accepted minimum thresholds for the quality levels of the roads for which the Contractor is responsible.

The performance criteria should ideally cover all aspects of the contract and take account of the fact that different sub-areas within the contract area might require different Service Levels. Criteria can be defined at three levels (Nekemte - Bure Works Requirement, 2014);

- **Road User Service and Comfort measures**, which can be expressed in terms such as: road Roughness, lane width, rutting, skid resistance, vegetation control, visibility of road signs and markings, availability of each lane-km for use by traffic, response times to rectify defects that compromise the safety of road users, attendance at road accidents, drainage off the pavement (standing water is dangerous for road users)...

- **Road Durability measures**, which can be expressed in terms such as: longitudinal profile, pavement strength, the extent of repairs permissible before a more extensive periodic maintenance treatment is required, functionality of drainage facilities...

- **Management Performance Measures**, which define the information the Employer requires both to govern the asset during the term of the contract, requirements should include: delivery of regular progress reports to the Roads Authority, inventory updates and other data sharing requirements, maintenance history (so subsequent tenders can price the work), compliance with social and environmental standards...

Under the terms of the contract, the Contractor will also be responsible for the continuous monitoring and control of road conditions and Service Levels for all roads or road sections included in the contract. This will not only be necessary to fulfill the contract requirements, but it is an activity which will provide him with the information needed to be able (i) to know the degree of his own compliance with Service Level requirements, and (ii) to define and plan, in a timely fashion, all physical interventions required to ensure that service quality indicators never fall below the indicated thresholds (WB, 2006).

Under the OPRC model, the Contractor will not receive instructions from the Employer concerning the type and volume of road maintenance works to be carried out. Instead, all initiative rests with the Contractor who must do whatever is necessary and efficient to achieve the quality levels required. This concept is expected to lead not only to significant efficiency gains but also to technological innovation.

The beneficiaries of the new delivery system are expected to be the road users, the Road Administration, and the contractors or other private sector enterprises. In a wider sense, future generations will be able to benefit from a better preservation of past investments in roads. Road users will be able to know the Service Level they can expect in return for the payments they make for the use of the infrastructure (tolls, tariffs, user fees, taxes, etc.). The Road Administrations should benefit by obtaining better overall road conditions at the same levels of expenditure. For Contractors and other private sector enterprises, the new type of contracts should open up new business opportunities, in which longer contract periods provide a more stable business environment, and for the establishment of true Public-Private Partnership relations (Schliessler/Gericke, 2014).

Output- and Performance-based Road Contracts as the model for road asset management transfers a significant burden of risk onto the contractor. It is important that this burden is both equitable and within the capacity of the industry. The contract defines the risk profile carried by the contractor arising from storm events, legislation

changes, changes in traffic volumes, and roadside development. Some emergency works should always be foreseen. Those are meant to remedy unexpected damage which occurs as a result of extraordinary natural phenomena, and which affect the normal use of the road network, or the safety and security of the users.

For emergency works, the contract limits the responsibility of the Contractor, establishing that the Employer will approve execution of services and separate remuneration based on specific amounts proposed by the Contractor for each case, on the basis of volume of works estimated at each time and on unit prices included in the bid and in the contract.

Contractors bidding for the Output and Performance based Road Contracts are expected to present their financial offer for (Nekemte - Bure Works Requirement, 2014);

- The **Management and Maintenance Services** in the form of the amount of the monthly lump-sum payment demanded by the bidder according to the conditions of contract (this will be a monthly amount applicable throughout the duration of the contract);
- The **Rehabilitation Works**, in the form of a lump-sum amount, while indicating the quantities of measurable outputs to be executed in order that the road achieves the performance standards specified in the bidding documents. Payments will be made in accordance with the progress in the execution of those measured outputs;
- The **Improvement Works** in the form of a lump-sum amount for the design, road improvements, structural and associated ancillary works; payments for improvements will be made in proportion to the length of the road constructed in stages, (i) to the top of sub-base and (ii) with all works completed, as a pro-rata of the total lump-sum amount for the improvement works; and
- Unit prices for **Emergency Works** in the form of a traditional bill of quantities. Payments will be made for each emergency on a case-by-case basis, in the amount of a lump-sum value estimated by the Contractor and approved by the Employer, on the basis of the estimated quantities and on the quoted unit process.

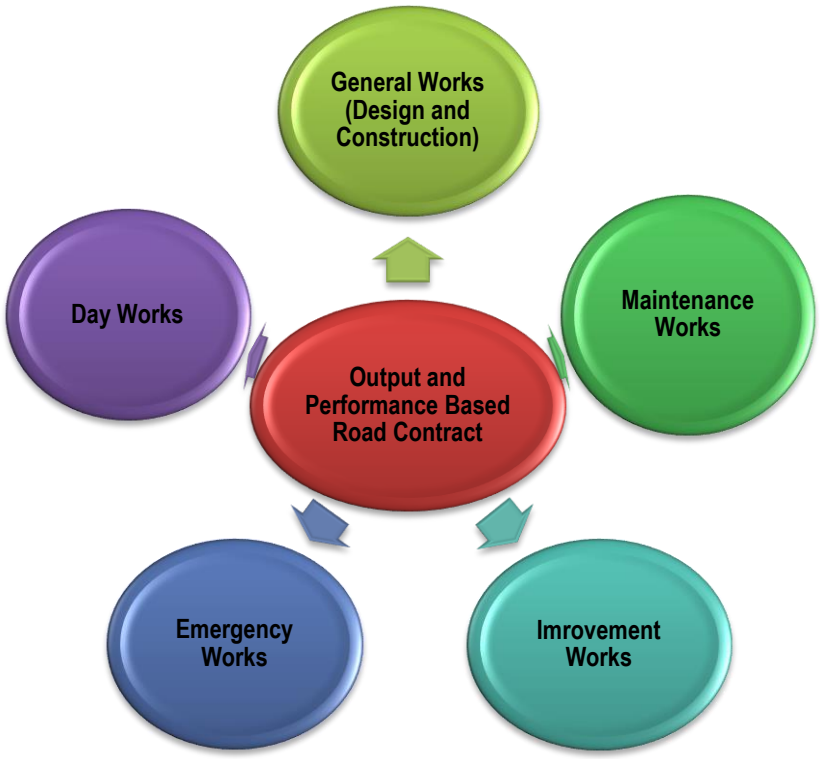


Figure 6. Output and Performance Based Contract Components

The agreed monthly/periodic payment for maintenance works and services will be made to the Contractor if he has complied, during the month for which the payment is to be made, with the agreed Service Levels on the road network under contract. Together with his Periodic Payment Report, the Contractor will report the result of his own evaluation of compliance with the required Service Levels, based on his own monitoring system which is mandatory. His statement will then be verified by the Employer or his representative (supervision/monitoring consultant) through inspections. If the Service Levels are not met, payments are reduced, based on a schedule given in the contract, payments may even be suspended, and the contract cancelled, if the contractor fails during an extended period to achieve certain minimum thresholds values of Service Levels (WB, 2006).

2.5. KEY OBJECTIVES FOR IMPLEMENTING OUTPUT & PERFORMANCE BASED ROAD CONTRACTS

The main reasons for contracting out road maintenance implementing Performance Contracts are to:

- Reduce maintenance costs through the application of more effective and efficient technologies and work procedures which avoid the headaches of the Employer.

- Provide transparency for road users, road administrations and contractors with regard to the conditions roads have to be maintained consistently;
- Improve control and enforcement of quality standards;
- Improve overall road conditions;
- Helps to insure variation orders are minimized and that the contractor is generally paid in equal monthly installments throughout the contract period. The risk for cost overruns is transferred to the contractor and the road agency faces fewer unpredictable costs;
- The OPRC can lead to cost savings through: Incentives to the private sector for innovation and higher productivity; Reduction in administrative expenses and road agency overheads, due to better packaging of contracts, requiring fewer agency personnel to administer and supervise contracts.
- An OPRC can help ensure stable financing for the maintenance program over a longer-term when compared with traditional method-based contracts. OPRC typically covers a period of several years. It therefore obliges the government treasury to make a multi-year funding commitment for road maintenance
- To minimize total systems cost, including the long-term cost of preserving road, bridge and traffic assets and the cost to the road user, and
- To satisfy comfort and safety of road users.

2.6. CHALLENGES FOR IMPLEMENTING OUTPUT & PERFORMANCE BASED ROAD CONTRACTS

There are many challenges in introducing performance based road contract in developing countries. The challenges are including:

- Cultural change (change of the tradition project delivery systems)
- Insufficient Contractor's capacity
- Fear of risks
- Inability to achieve sufficient competition
- Support from the government,
- Dependency on external funding,

- Political influence and corruption,
- Lack of experience and knowledge on OPRC,
- Lack of planning,
- Challenges in estimating the cost,
- Fear of losing job,
- Performance and attitude of contractors,
- Monitoring the cost savings,
- Loss of competition, and
- Loss of control of the network

2.7. ADVANTAGES AND DISADVANTAGES OF OUTPUT & PERFORMANCE BASED ROAD CONTRACTS FROM DIFFERENT STAKEHOLDERS PERSPECTIVE

Table 2: Advantages and disadvantages of OPRC from different stakeholder's perspective

ADVANTAGES	DISADVANTAGES
CONTRACTOR	
• Creates innovation in order to bring efficiency, effectiveness and profit since the choice of application of technology is the Contractors as long as he meets the service levels defined in the Contract • provide a more stable business environment and for establishment of true Public Private Partnership relations in order to acquire sufficient capacity • minimize waste since the Contractor is paid at a set level for performance, not based on the value of the inputs used	• Higher risk is shifted to the Contractor • Since the delivery system requires high capacity, Insufficient Contractors capacity is a limitation. In addition, it will be very difficult for local contractors to participate • the delivery system highly differs from the commonly used conventional project delivery systems, which will make it difficult to get familiar and know the clear roles and responsibilities • maintaining cash flow will be a higher problem • Design risk is the Contractors
SUPERVISION CONSULTANT	
• The supervision is simpler than that required for the traditional project delivery systems since the Contractor will also be responsible for the continuous monitoring and control of road conditions and service levels for all road	• close verification of the Contractors method of testing the compliance of the service levels is required • difficult for local consultants to compete

ADVANTAGES	DISADVANTAGES
and road sections included in the Contract. Only verifying is required. longer service duration/stable job opportunity	
EMPLOYER/PROCURING ENTITY/PUBLIC BODY	
Improved quality shifting the risk of design and design related problems to the Contractor No maintenance problem since the road will be maintained by the Contractor for longer duration Provide stable financing for the maintenance program Lower chance of unpredictable costs occurring. Limited/no variation orders expected. Easy for budgeting Reduction in administrative expenses and road agency overhead due to better packaging of contracts	Higher project cost due to higher risk transfer to the Contractor and highly extended project duration making sure that all information/data to be supplied to the Contractor specially those specified in the Employers requirement of the works contract are accurate since they might lead to claims and disputes Affordability: is the government able to meet its long term financial liabilities?
ROAD USER	
the required service levels are met for the extended service duration No traffic interruption and closing of the road since the Contractor will be penalized if the road access is interrupted Improve the road condition for longer duration of the Contract rather than ad hoc repairs.	

2.8. EXPERIENCE OF OTHER COUNTRIES IN OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

2.8.1. KEY LESSONS LEARNED IN IMPLEMENTING OPRC FROM EXPERIENCE OF OTHER COUNTRIES

Although well-designed output-based contracts have several benefits over traditional contracts, it can be challenging for governments to implement these contracts for the first time. This issue briefly addresses key lessons learned in designing and implementing output and performance-based road maintenance contracts. While these lessons apply broadly to most contexts, the local context should be considered before applying the points discussed below.

1. **Successful output-based contracts require sufficient dedicated fiscal resources and realistic performance expectations**

   On what output-based maintenance contracts can achieve and therefore under-estimate the level of fiscal resources required under these contracts. Output based contracts are instruments that can generate various benefits, but they do not solve the underlying need for governments and/or road-users (e.g. through tolls) to continue to provide sufficient funding for road maintenance. This is particularly salient when the existing road infrastructure is in a poor state. In these situations, this will require substantial regular contract payments in order to rehabilitate and keep the road at a much higher quality standard.

   These payments, in some cases, might be significantly higher and more frequent than current maintenance expenditure on the same network. On that basis, the contracting agency needs to make a realistic estimation of the required public funds, and the Ministry of Finance can assess whether this estimate fits the fiscal budget and the government's priorities. Likewise, private sector bidders will be anxious to see evidence that the contracting authority can afford and is committed to these same payment obligations so that the risk of payment default by the government is minimized. Educating public officials on the use of output-based contracts and what benefits can be achieved by using them can improve the implementation and monitoring of these contracts and sustain private sector appetite.

2. **Private operators may need training and capacity building to bid for and implement output-based contracts**

   In many countries private operators are not used to the fundamental element of output-based contracts i.e., pre-financing outputs before being reimbursed by government payments. This need to provide working-capital financing can make private parties reluctant to participate in bidding or to make investments that minimize maintenance costs in the longer term. Additionally, private contractors that are awarded contracts may be unable to meet the performance standards if they are not familiar with the requirements of output-based contracts. Both of these challenges can limit the success of output-based contracts.

   Market sounding and capacity building with local private sector firms can help address these challenges. In countries where private operators have limited capacity and hold misperceptions about output-based contracts, the government could carry out market soundings, which will enable it to refine contracts in a way that a sufficient number of private operators can participate in bidding.

   In countries where domestic players lack financial resources or expertise to bid as head Contractor, international firms could be encouraged to partner with domestic firms to build local capacity. Training and capacity building sessions that improve private Contractors' understanding of the structure of output-based contracts can improve contractor performance and increase the number of firms able to bid for these contracts.

3. **Clear baseline data is needed to establish and monitor performance indicators and standards**

   Limited baseline data makes it hard to define the right performance indicators and set performance standards for output-based maintenance contracts. This issue is further compounded by latent defect risk, which is a major risk for road maintenance. LDR (Latent defect risk) is the risk that public and private parties do not fully understand the road's condition before the contract is signed and therefore cannot accurately price the works required to achieve the desired standards. If the road is in worse condition than anticipated, the private contractor may not be able to finance all of the repairs needed or on the agreed-upon schedule. This can cause the contractor to miss the performance targets established in the contract and jeopardize the implementation of the contract.

Additionally, the payment for successful performance may not be sufficient to cover the cost of the works if the road is in worse condition than anticipated. This removes the financial incentive to hit performance targets and cause the contract to fail.

Having a clear set of baseline data before designing the contracts will make the needs clearer and allow the contracting authority to tailor the design of the contract to the situation. If the road is in much worse condition than expected, for example, the government could rehabilitate the road before procuring an output-based maintenance contract. Collecting baseline data may require a comprehensive action plan to improve the management of road data, taking into account the stakeholder environment and budgetary constraints.

4. Simple performance indicators and user monitoring can improve contract performance

Output-based contracts require government resources to monitor the performance of contractors against the performance indicators established in the contract. This often represents a shift in the contracting authority's role, from paying on a per-input basis to monitoring against a set of indicators.

Additionally, it can be efficient to create output-based contracts with a large geographical or asset scope in order to benefit from economies of scale. However, for many countries it is practically and financially challenging to regularly monitor large areas on multiple performance indicators used in output-based contracts. Simple and unambiguous performance indicators reduce the resources needed to monitor output-based contracts. In addition, complicated indicators can lead to differing interpretations among practitioners. Contracting agencies often measure these indicators in an unstructured way and measurement methods and assessed indicators may differ from one area to another. Likewise, contractors may have a different interpretation than the authority, which can lead to disputes over payment and performance. These issues can be prevented in part by having a set of simple performance indicators and clarifying how the indicators will be measured up-front. (Matt Bull, October 2014)

In addition to the indicators, all parties should understand the roles and responsibilities of monitoring the contract. The contractor can conduct self-monitoring and periodically report on indicators to the public contracting agency. At the same time, the contracting agency (or an appointed agency or independent engineer) can verify these reports through periodic inspections. This verification can include random tests

and does not need to encompass the whole road network. Finally, the contracting agency and the private operator should take advantage of road users in their monitoring efforts.

2.8.2. OTHER COUNTRIES EXPERIENCE

Under the OPRC, the Contractor has a strong financial incentive to be efficient and effective whenever he undertakes work. In order to maximize profits, he must reduce his activities to the smallest possible volume of intelligently designed interventions, which nevertheless ensure that pre-defined indicators of Service Level are achieved and maintained over time. This type of contract makes it necessary for the Contractor to have a good management capacity. In other words, the Contractor is entitled to independently define: (i) what to do, (ii) where to do it, (iii) how to do it, and (iv) when to do it. The role of the Road Administration and of the Employer is to enforce the contract by verifying compliance with the agreed Service Levels and with all applicable legislation and regulations.

Maintaining a road network includes both routine and periodic tasks. Minimum road conditions and Service Levels are defined through output and performance measures, and these are used under the OPRC to define and measure the desired performance of the Contractor.

Performance measures define the minimum acceptable Service Level for the particular road. In setting the measures various criteria (both technical and practical) need to be carefully considered, such as (i) traffic volume and composition, (ii) urban vs. rural roads (iii) flat, hilly or mountainous terrain, (iv) subgrade quality and type, (v) quality of available construction materials, (vi) capacity of available contractors, (vii) any environmental constraints, such as protected areas, parks, forest reserves, etc. However, probably the most important criterion is the question of what Service Level can be afforded and economically justified for the road in question. Under the terms of the contract, the Contractor will also be responsible for the continuous monitoring and control of road conditions and Service Levels for all roads or road sections included in the contract.

WORLD WIDE RESULTS

Road agencies that have adopted an OPRC approach have achieved:

- **Cost savings from 10 % up to 40 %**. Examples are given in Tab. 3. In addition, recent evaluations indicate that the savings in costs accrued from the CREMA are in order of 12 to 18 % compared to the traditional method-based contracts.

Table 3:Cost savings of different countries under PBC over the conventional contracts

Country	Cost savings, %
Norway	about 20 ÷ 40
Sweden	about 30
Finland	about 30 ÷ 35 about 50 % less cost/km
Holland	about 30 ÷ 40
Estonia	20 ÷ 40
England	10 % minimum
Australia	10 ÷ 40
New Zealand	about 20 ÷ 30
USA	10 ÷ 15
Ontario, Canada	about 10
Alberta, Canada	about 20

This cost savings are achieved through;

- Incentives to the private sector for innovation and higher productivity
- Reduction in administrative expenses and road agency overheads, due to better packaging of contracts, requiring fewer agency personnel to administer and supervise contracts
- Significantly greater flexibility in the private sector (than in the public sector) to reward performance and react quickly against nonperformers

- **Expenditure certainty**. As the contractor is paid a fixed price, based on a regular schedule the road agency enjoys full control of expenditures without unexpected variation orders.

- **Reduction of the in-house workforce**. For example, in Estonia, where 63 % of the national network is under PBC, the workforce of the national and subnational road agencies has declined, specifically from 2046 (administration staff - 561, workers - 1485) in 1999 to 692 employees (administration staff - 343, workers - 349) in 2003.

- **Improved conditions of contracted road assets and reduction of roads in poor condition**. Many road agencies have acknowledged that on completion of an OPRC, road assets are generally returned either in an improved condition when the OPRC was awarded. Argentina has reduced the share of roads in poor condition from 25 % to less than 5 % by the end of 1999 due to the PBC approach.

- **Greater road user satisfaction**. Road users appear to become more satisfied with the services delivered and the condition of the roads maintained under OPRCs.

- **Multi-year financing of a maintenance program**.

  The growth and expansion of an OPRC approach to other roads in the network is the best indicator of its success. The Department of Transportation (DoT) in Washington, D.C., USA, recognizes OPRC as an effective way to keep assets at or above their current condition. It has therefore decided to apply this approach for management and maintenance of tunnels, street lighting, and other streets in Washington, D.C. Peru has expanded its program of performance-based contracting of microenterprises from the rural to the national network. Argentina expanded a performance-based contracting from the national to provincial roads. The Florida DoT increased from the current 19 performance-based contracts to 28 by 2008[2].

Output and Performance Based Road Contracting system had been implemented in many countries in two ways, the first is being done by giving the full package (i.e. the design, Construction and Maintenance) to one Contractor and the other is the design and improvement for maintenance roads.

1) Canada

In Canada, the development of performance-based contracts started in the late 1980s and early 1990s. Performance standards still leaned toward required work procedures rather than outputs or outcomes. British Columbia now uses performance-based contracts to maintain 100% of its provincial highways. Ontario, another province of Canada uses 95% lump sum performance based contracts ranging from 7-9 years.

The contracts include all routine maintenance such as pothole repair, vegetation management, bridge maintenance and cleaning, electrical work, and line painting. Other types of work addressed include winter maintenance, patrolling to conduct visual inspections, and emergency assistance to deal with accidents and spills. Maintenance performance standards include both outcome and time-based performance criteria. Failure to meet the standards can result in penalties. Over time, the duration of the contract period has been increasing gradually and the number of maintenance activities has grown (N.Stankevich, Sept. 2005).

2) Australia

Many countries over the last decade have used Performance Based contracting to manage roads. The implementation of the contracting system provides additional benefits to the government such as cost saving and improved conditions of contracted road assets.

In Australia the contracting system is already being implemented on all categories of roads national, state, urban and rural. Australian Output and Performance based Road Contract arrangement is designed to turn over control and responsibility for road way system maintenance, rehabilitation, and capital improvement projects to private Contractors. Contractor's responsibilities include determination of treatment types, the design, programming and the undertaking of the works to bring the roads to a predetermined performance (N.Stankevich, Sept. 2005).

3) New Zealand

In New Zealand, the national road agency is known as Transit New Zealand (Transit NZ). In 1998, it let its first long-term performance-based maintenance contract known as a Performance-Specified Maintenance Contract (PSMC). Today, lump-sum PSMCs with 10-year terms are used on 15% of the nation's entire road network, mainly on national roads. Transit NZ also has hybrid contracts that incorporate features of both method and performance specifications.

A large number of the performance standards are expressed in terms of intervention times. The term of the hybrid contracts is only 5 years. Industry experts have asserted that these PSMCs have resulted in improved maintenance service and road quality (N.Stankevich, Sept. 2005).

4) United Kingdom

The UK Highways Agency is responsible for 8,850 km of the most strategically important part of the nation's highway network. This portion of the highway system amounts to only 4% of the total roadway miles in the United Kingdom, but it carries 30% of the total traffic and 60% of the truck traffic.

Performance-based maintenance contracts are known as Managing Agent Contracts (MAC) in the United Kingdom. These contracts incorporate performance specifications to increase efficiency and effectiveness, allocate responsibility and risk between the client and the contractor, foster innovation, and focus the attention of the contractor on outcomes. Some important characteristics of MACs are as follows: (N.Stankevich, Sept. 2005)

- Increased outcome orientation
- Lump-sum and unit prices as a basis for payment
- Strengthened partnering
- Emphasis on continuous improvement
- Focus on life-cycle costs
- Better risk management

5) Finland

In 2001, Finland undertook a major reorganization. The part responsible for design, engineering, and maintenance and operations was transformed into a wholly state-owned production organization known as the Finnish Road Enterprise (FRE) to compete with the private sector regarding capital, maintenance, and operations projects.

Finland remained the client organization responsible for procuring contractors and entering into contracts. Initially, public tendering began in 23 of 99 maintenance areas on the network. Because of the potential impact of the FRE on the competitive position of existing private firms, the FRE was introduced gradually into the mix of contractors. Full and open contracting involving the FRE throughout the country did not start until 2005. The original 23 maintenance area contracts were lump-sum, mainly output (accomplishment). A few were outcome-oriented, and these were 3-year contracts (N.Stankevich, Sept. 2005).

6) Argentina

Since 1995 Argentina has pursued a number of different contracting approaches involving performance-based maintenance, including kilometer/month contracts for routine maintenance, *Contrato de REcuperacion y MAntenimiento* (CREMA) Phase I, Phase II, and concessions (NCHRP, 2009).

In 1995, Argentina launched a series of performance based maintenance contracts covering about 3,600 km of these national roads. Contracts were lump-sum and payments were made each month according to an amount per kilometer (based on equivalent liters of gasoline to account for inflation but expressed here as dollars/kilometer/month). The contracts were for two years and were renewable. Performance standards addressed specific measures concerning ride quality, safety features, and aesthetics including vegetation (N.Stankevich, Sept. 2005).

7) Chad

Chad's first performance-based road management and maintenance contract occurred in 2001 with the assistance of the World Bank. The 4-year contract addressed 440 km of unpaved roads. A French firm was the contractor and used mainly local labor. A Cameroon engineering firm provided contractor over sight. Elements of the contract included the following:

- Management and maintenance as well as self-monitoring of the contractor

- Rehabilitation over the first 21 months of the contract
- Rebuilding or replacement of drainage structures and signs
- Emergency help for those in accidents
- Rain erosion and axle load control; and
- Other emergency works as needed.

The contractor received a fixed monthly fee based on a lump-sum for the contract period. However, the contractor was paid on the basis of unit price for emergency work (N.Stankevich, Sept. 2005).

8) *Serbia*

In the period from 2004 to 2008 in Serbia was carried out Pilot Output-Performance Based Maintenance Contract (OPBMC) for routine road maintenance works on about 1200 km of road network in Mačva and Kolubara.

The World Bank Project included implementations of two Pilot Contracts for Output Performance-based Maintenance Contract (OPBMC) for routine road maintenance on about 1200 km of road network in Mačva and Kolubara District for 3 years + additional 2 years (2004 ÷ 2008). The agency responsible for the implementation of the Transport Rehabilitation Project (in the further text TRP) financed by the Credit was the Republic of Serbia Road Directorate, i.e. Public Enterprise "Roads of Serbia" (PERS).

Main characteristics of the Pilot Project are:

- Procurement of routine road maintenance works by international bidding procedures involving interested companies from the private sector;
- Separating of routine maintenance contracting from all other type of works (construction, reconstruction, rehabilitation and periodic maintenance);
- Introducing into practice service quality level, lump sum payments and demerit points for non-compliance with the requested standards, as well as other typical PB Contract characteristics, for the certain types of routine maintenance items;
- Appliance of new winter maintenance service organization and winter maintenance performing

After initial problems in adapting to new concept of road maintenance in the first year of the implementation, the Pilot project is completed successfully. Engagement of Consultants on Pilot project, especially through continuing education contractors, as well as the establishment of standards.

In the second and third year of the realization of Contract, the realization was significantly improved. Comparing to the rest of Serbia territories, the Pilot Project territories achieved routine maintenance cost savings in range from 31 % to 55 % (average 46 % for 5 years). Procedures and records, has significantly contributed to its successful completion. Consumption of material for pavement maintenance is significantly reduced and the savings achieved total costs over the first year of implementation of the contract, particularly with respect to the parameters for the rest of the road network in the Republic of Serbia. The most significant savings are made in the winter maintenance.

2.8.3. BACKGROUND OF OPRC IN ETHIOPIA

It is reported that due to under-maintenance of road infrastructure in Ethiopia, the government is exposed to additional capital spending of USD263 million per year (Foster & Morella, 2010). This mainly happened because of early failure of roads because of lack of maintenance and the deficiency in enforcement of the conventional outsourcing method of maintenance works based on quantity of works and unit rates.

Under the traditional road maintenance contracts, the contractor is responsible for the execution of works which are normally defined by the contracting authority or the Employer, and the contractor is paid on the basis of unit prices for different work items. On the other hand, Output and Performance-based Road Contracting (OPRC) is designed to increase the efficiency and effectiveness of road asset management and maintenance to ensure that the physical condition of the roads under contract is adequate for the need of road users, over the entire period of the contract (Radović et al., 2014).

The Ethiopian Roads Authority (ERA) attempted to outsource the improvement and maintenance works through output and performance based road contract (OPRC) to state owned enterprises (SOE) in 2016. Accordingly, ERA launched a restricted tender for the maintenance of the following road projects.

Table 4: OPRC projects launched for restricted tender

No	Name of Project	Length (km)	Type of works
1	Adama-Awash (Km 60-Km 120)	60	Overlay and Performance Based Contracting
2	Chancho-Fitche	75	
3	Addis- Gibe Contract 1-Addis-Kore	80	
4	Addis- Gibe Contract 2-Kore-Gibe River	92	
5	Fitche-Gohatsion	75	
6	Adi Gudom-Mekele-Wukro	92	Heavy Maintenance and

No	Name of Project	Length (km)	Type of works
7	Ambo-Gedo	65	Performance Based Contracting
8	Gibe-Jimma	165	

As the concept of OPRC was new to ERA and the road sector, the contract was drafted so as to share the risk by the SoC (state owned contractors) and ERA. To this end, the periodic maintenance of the asphalt overlay works to bring the road into a pre-defined level of service was planned to be paid on a unit rate basis on a completed section of the road meeting the required level of service as defined in the specification. The management and maintenance service was designed to be paid on a fixed periodic remuneration rate after the periodic maintenance works was completed and accepted by ERA.

With the above understanding, ERA had shortlisted and invited the following four state owned contractors to submit their bids for the specific projects the contractors were interested.

Table 5: List of Invited SoE Applicants for Bidding of OPRC Projects

No	Name of firm	Nationality
1	F.D.R.E Ministry of Defence, Defence Construction Enterprise	Ethiopia
2	Ethiopian Construction Works Corporation Transport Infrastructure Constructions	
3	Amhara Road Works Enterprise	
4	Oromia Roads Construction Enterprise (ORCE)	

However, only three state owned enterprises were awarded OPRC road projects through the above bidding process which are currently under implementation as shown in Table 6. The main reason for only three of the projects were awarded successfully was due to high cost offer by the bidders for the remaining projects.

Table 6:Projects Awarded to SoE through OPRC

No	Project	SoE Contractor
1	Adama-Awash (Km 60-Km 120)	Ethiopian Construction Works Corporation Transport Infrastructure Constructions
2	Adi Gudom-Mekele-Wukro	F.D.R.E Ministry of Defence, Defence Construction Enterprise
3	Fitche-Gohatsion	Amhara Road Works Enterprise

In the meantime, with the support of the World Bank, ERA recently contracted out a major full package OPRC project, Nekempte - Bure Road Project, to international contractors through competitive bidding in 2016. The

study mainly focused on the study of preliminary contractual, to date execution evaluation and encountered challenges of the newly initiated project contracts in Ethiopia (i.e. Nekemte - Bure Road project).

3. RESEARCH DESIGN AND METHODOLOGY

3.1. INTRODUCTION

Studying the specific features/characteristics, advantages and disadvantages and the encountered challenges of Output and Performance based Road Contracts for implementation of Ethiopian Federal Road projects will be made possible by referring literature and gathering data through questionnaire to be distributed to main stakeholders and study of preliminary contractual, to date execution evaluation and encountered challenges of the newly initiated project contracts in Ethiopia (i.e. Nekemte - Bure Road project).

The research will start with literature review of Output and Performance based Road Contract to identify the advantages of the delivery system in lieu of commonly practiced project contracting systems and gaps of the delivery system from other countries experiences will be collected.

After that the Contractual and progress (i.e. current status) review of the case study project contracts in Ethiopia (i.e. Nekemte - Bure Road project) will be made to investigate the advantages and potential gaps of the delivery system with respect to contractual provisions.

Subsequently, questionnaire will be prepared based on the literature and the contractual review. The target population to distribute the sample of the questionnaire and for the interview will be selected based on expert sampling from the target populations of Experienced Engineers (Senior Engineers and higher) specifically selected from the Client (Ethiopian Roads Authority), the Contractors (i.e. IL and FS Transportation Networks Limited - Elsamex S.A. and JMC Projects LTD), the Consultants (RENARDET sub consultant UNICON, LEE sub consultant UNICON and KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultantancy ETHIOINFRA Eng PLC) of the case study projects and the Consultant who prepared Concept design and drafted the Contract Document (ETHIOINFRA Engineering PLC) who is also supervising as a sub consultant on one of the case study projects.

This will help to get reliable information from experienced professionals who involved on the implementation of the delivery system and has an insight on the features and gaps of the delivery system. Hence, the collected data is believed to be credible.

The basic information of the case study project (i.e. Nekemte - Bure Output and Performance based road contract with three lots) is shown in Section 3.3.1.

Following the above mentioned qualitative approach, the analysis of the questionnaire will be conducted by highlighting common obstacles and prospects for the future implementation of the delivery system.

3.2. RESEARCH DESIGN

Qualitative Research of explanatory type will be adopted in order to identify advantages and disadvantages and challenges of OPRC project delivery system.

The overall approach to be followed are; having established the basis of the research, necessary data will be collected, analyzed, and conclusions and recommendations will be made based on the findings. The methods of data collections employed for the research are case study, desk study, and questionnaire. The case study project as a model is analyzed along with the desk study in relation to theoretical propositions, and the responses obtained from the questionnaire were also analyzed.

3.3. DATA COLLECTION

3.3.1. CASE STUDY

The Ethiopian Roads Authority (ERA) with the financial support of the World Bank has contracted out to contractors to implement the design, improvement and management and maintenance service works of Nekemete - Bure road upgrading project under an output and performance based road contract (OPRC). The project is divided in to three contracts undertaken by three independent contractors and consultants with the following details shown in table .

Table 7:Nekempt Bure OPRC Project Information

Description	Project Name		
	Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
Design Standard/class	DS4	DS4	DS4
Length (Km)	86	87.65	84.56
Financer	World bank	World bank	World bank
Contractor	IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)	JMC Projects (India) LTD	IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)

Description		Project Name		
		Lot I (Nekempt - A.Gutin-Andhode)	**Lot II (Andhode Agamsa)**	**Lot III (Agamsa-Bure)**
Consultant (Employer's Representative)		RENARDET sub consultant UNICON	LEE sub consultant UNICON	KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultancy ETHIOINFRA Eng. PLC
Contract signing date		18-Mar-16	18-Mar-16	18-Mar-16
Type of Contract/project delivery system		Output and Performance Based Road Construction (DBM)	Output and Performance Based Road Construction (DBM)	Output and Performance Based Road Construction (DBM)
Original Contract Amount including VAT	Local (ETB)	1,048,885,237.35	537,642,867.11	1,262,498,327.02
	Foreign (USD)	37,312,292.91	59,708,347.48	38,012,408.41
	Exchange Rate (USD to ETB)	20.36	20.56	20.36
	Total Amount	**1,808,395,615.68**	**1,765,186,782.95**	**2,036,259,906.41**
Current Progress		**10% (Suspended)**	**27% (on progess)**	**12% (Suspended)**

Hence, the case study project taken for this research as a model is Nekemete - Bure road upgrading project since there is no any other project with such kind of delivery system.

3.3.2. DESK STUDY

Desk study was chosen as one of the instruments to assess and obtain actual data about the Output and Performance Based Project delivery System from relevant studies, reports, Contract documents and other countries experience.

3.3.3. QUESTIONNAIRE

The questionnaire of the project comprises of 6 sections with focus areas described below,

- **Section A- General Background Information –** prepared to Identify the correspondents Working Company/Stakeholder, working experience of the company and the correspondent, exposure to OPRC contract, etc.

- **SECTION-B –** Studying effect of proper selection of the best project delivery system on the projects successfully accomplishment
  Objective- To study the effects of selection of project delivery system on identified major project performance indicators.

- **SECTION C -** Identifying Specific Features of Output and Performance Based Road Contracting System
  Objective- rating factors distinguishing Output and Performance Based Road Contracting System as a project delivery system from the Conventional Project delivery systems.

- **SECTION D -** Challenges of implementing Output and Performance Based contracting system in developing countries
  Objective- To rate identified challenges of implementing Output and Performance Based contracting system in developing countries

- **SECTION E -** Procurement stage effects on the implementation of Output and Performance Based contracting system
  Objective- To identify the implications of procurement phase processes on the overall implementation of Output and Performance Based contracting system.

- **SECTION F -** Output and Performance Based Contracting System Contractual Indicators
  Objective- To rate the impact of some of the Specific contractual conditions of Output and Performance Based road contracts

3.3.4. SAMPLE SIZE AND RESEARCH POPULATION

The research population will be drawn to professionals working for the major contracting parties who specifically are engaged on Output and Performance Based Road Contracting System, i. e Employer (Ethiopian Roads Authority, Western Regional Directorate), Supervision Consultants (RENARDET sub consultant UNICON, LEE sub consultant UNICON and KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultancy ETHIOINFRA Eng. PLC) and Contractors (IL and FS Transportation Networks Limited - Elsamex S.A. and JMC Projects LTD)

The questionnaire was distributed to 26 professionals 10 to the Employer, 10 to the Consultant and 6 to the Contractor (since there are only 2 Contractors). Subsequently, 19 questionnaires out of the 26 (**73% response rate**) are collected back.

Profile of Professionals engaged in the Questionnaire are Senior Project Engineers, Team Leaders and Director from Ethiopian Roads Authority, Project Managers, Contract Engineer and Assistant Project Manager from

Contractor and Resident Engineers, General Manager and Contract Engineer from Supervision Consultants as shown below:

Table 8: Questionnaire Respondents Profile

Contracting Party	No of Correspondents based on the Nature of Company		Position of Correspondents
	Local Company	Foreign Company	
Employer	8		4 Senior Project Engineers, 3 Team Leaders and 1 Director
Contractor	-	5	3 Project Managers, 1 Contract Engineer and 1 Assistant Project Manager
Consultant	2	4	3 Resident Engineers, 1 General Manager and 2 Contract Engineers
Total	10	9	
	19		

3.4. DATA ANALYSIS

3.4.1. Case Study

3.4.1.1. Preliminary Contractual valuation of the Case Study

3.4.1.1.1. Case Study Project Description

The Case study focuses on preliminary contractual review of the Contract for design, improvement and management and maintenance service works of Nekemete - Bure road upgrading project.

Description	Project Name		
	Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
Design Standard/class	DS4	DS4	DS4
Length (Km)	86	87.65	84.56
Financer	World bank	World bank	World bank
Contractor	IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)	JMC Projects (India) LTD	IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)
Consultant (Employer's Representative)	RENARDET sub consultant UNICON	LEE sub consultant UNICON	KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultancy ETHIOINFRA Eng. PLC
Contract signing date	18-Mar-16	18-Mar-16	18-Mar-16
Type of Contract/project delivery system	Output and Performance Based Road Construction (DBM)	Output and Performance Based Road Construction	Output and Performance Based Road Construction (DBM)

Description		Project Name		
		Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
			(DBM)	
Original Contract Amount including VAT	Local (ETB)	1,048,885,237.35	537,642,867.11	1,262,498,327.02
	Foreign (USD)	37,312,292.91	59,708,347.48	38,012,408.41
	Exchange Rate (USD to ETB)	20.36	20.56	20.36
	Total Amount	**1,808,395,615.68**	**1,765,186,782.95**	**2,036,259,906.41**
Current Progress (%)		**12% (Suspended)**	**27% (under progress)**	**10% (Suspended)**

The contract duration of the projects is eight (8) years. For the purpose of setting the time for completion of the annual construction periods for the improvement works **(3 years)** and maintenance services **(5 years)**, the entire contract duration (period) is divided in to eight (8) separable portions.

Table 9: Contractual duration of Nekempt Bure OPRC contract

Separable Portion	Duration
1	One (1) calendar year from the Start Date of the Contract (Year 1)
2	One (1) calendar year from the End Date of Year 1
3	One (1) calendar year from the End Date of Year 2
4	One (1) calendar year from the End Date of Year 3
5	One (1) calendar year from the End Date of Year 4
6	One (1) calendar year from the End Date of Year 5
7	One (1) calendar year from the End Date of Year 6
8	One (1) calendar year from the End Date of Year 7

The mile Stone criteria's and payment schedule for the projects Improvement works for the three lots is shown below;

Table 10: Improvement Works Schedule of Nekempte Bure OPRC project

Contract Year	Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
	Total Length of improvement works (km)		
1	17	17	17
2	34	35	34
3	35.1	35.65	35.1
4	0	0	0
5	0	0	0

Contract Year	Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
	Total Length of improvement works (km)		
6	0	0	0
7	0	0	0
8	0	0	0
Project Length	**86.1**	**87.65**	**86.1**

3.4.1.1.2. Payment Related Provisions of the Contract

The payment modality of the projects is classified into three parts and the Contractors offers (Contract amount) to conduct the projects is presented below;

- ✓ A-1- Design and Construction of Improvement works- 70%
- ✓ A-2 – Management and Maintenance services – 30%
- ✓ B – Emergency works – Bill of Quantity based

Table 11: Contract Amount /Payment schedule of Nekempte Bure OPRC project

Item	Project Name					
	Lot I (Nekempt - A.Gutin-Andhode)		Lot II (Andhode Agamsa)		Lot III (Agamsa-Bure)	
	ETB	USD	ETB	USD	ETB	USD
A-1	610,572,605.92	21,720,072.99	311537926.5	34598087.15	737103381.4	22193355.96
A-2	261,673,973.97	9,308,602.71	133516254.2	14827751.63	315901449.2	9511438.27
B	39,827,539.55	1,416,796.39	22461355.96	2494463.39	44819801.69	1349473.95
Sum	912,074,119.44	32,445,472.09	467,515,536.62	51,920,302.17	1,097,824,632.19	33,054,268.18
VAT	136,811,117.92	4,866,820.81	70,127,330.49	7,788,045.33	164,673,694.83	4,958,140.23
USD/ETB Conversion rate		20.36		20.559		20.3555
Total Amount (ETB)	**1,808,395,615.55**		**1,765,186,783.27**		**2,036,259,906.35**	

As per the Contract, Measurement and payment provisions for the improvement works shall be made upon completion of each section of the improvement works, and may be made upon completion of each section of the improvement works and may be paid in following verification by the Project Manager that a minimum specified length of 5km has been constructed according to the specifications and intervention programs. Out of the 70% of the payment allotted for improvement works,

- 40% of the 70% will be for continuous completed improvement works upto the top of subbase level carried out to the requirements

- 60% of the 70% will be made when works to the required level of service are completed including all safety, social and environmental works related to the improvement works

However, the Contractor shall not be paid for more than 15 continuous lengths of partially completed works to the sub base level. The Contractor needs to complete construction of at least a 15km continuous length before requesting partial payment for the next 5km section to sub base level.

Payment schedule for Management and maintenance services will be a series of monthly uniform payments made throughout the duration of the contract with a portion of this payment dependent upon the Contractor achieving specified performance criteria given in the specification for each road. The Mode of payment will be equal monthly payments less reductions for non-compliance with specified service levels.

And, payment for Emergency works will be made for each emergency on a case by case basis provided in the contract, based on the actual work quantities approved by the Employer and using the Bill of Quantity rates.

3.4.1.1.3. Projected Cash Flow Diagrams

At bidding stage, as part of qualification criteria, bidders shall submit their projected cash flow schedule. The projected cash flow schedule shall show the bidders estimated expenditure in preparing the design and implementing the improvement works and management and maintenance services, and on the revenue side, the net payments to which the Contractor will become entitled with due allowance for the advance payment and repayment, material repayment, material prepayment, and retention money, but excluding Price Adjustment for rise and fall and provisional sums for Emergency works. The expenditures and revenues shall be used to derive the bidder's projected net cash flow during the Contract Period.

The projected Cash flow diagrams of the three lots is shown below (please also refer Annex)

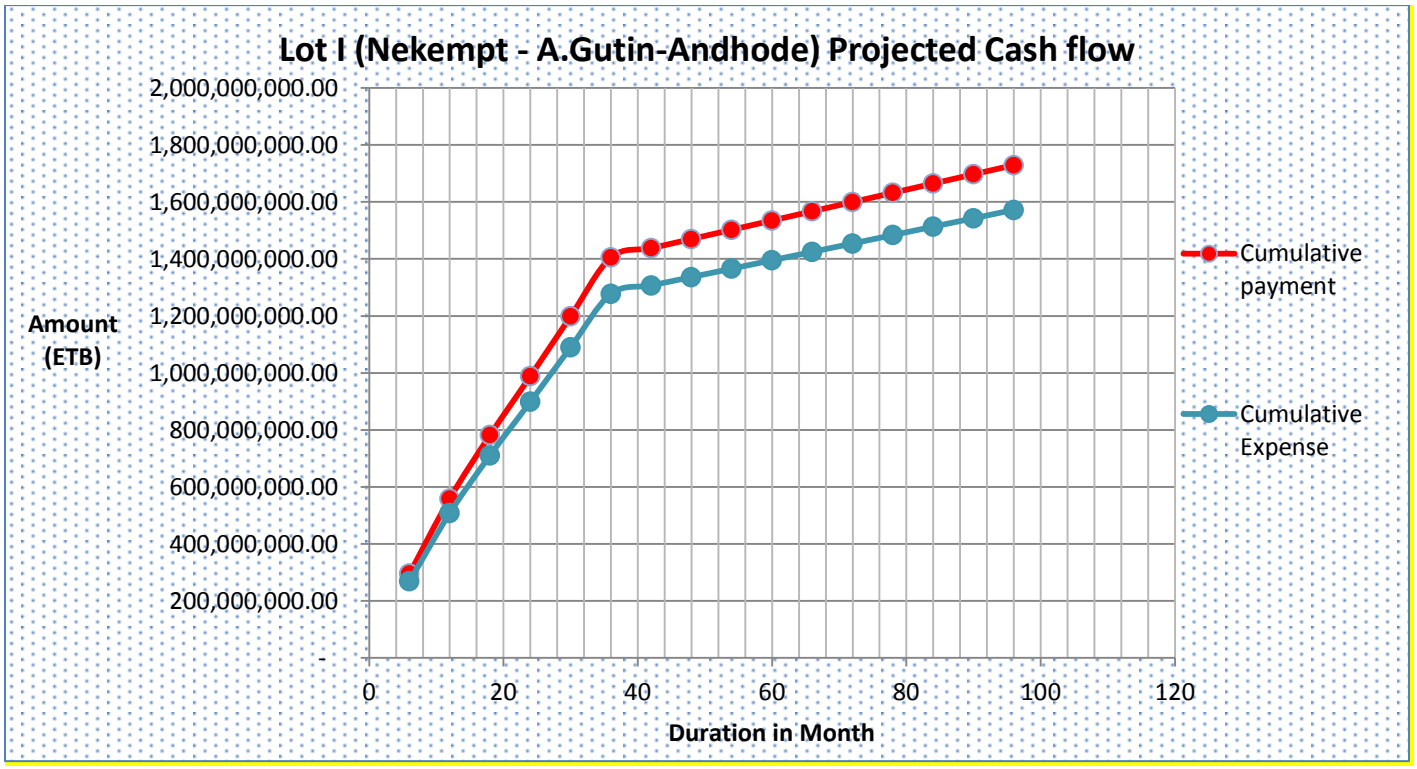


Figure 7. Projected cash flow diagram of Lot I (Nekempt - A.Gutin-Andhode)

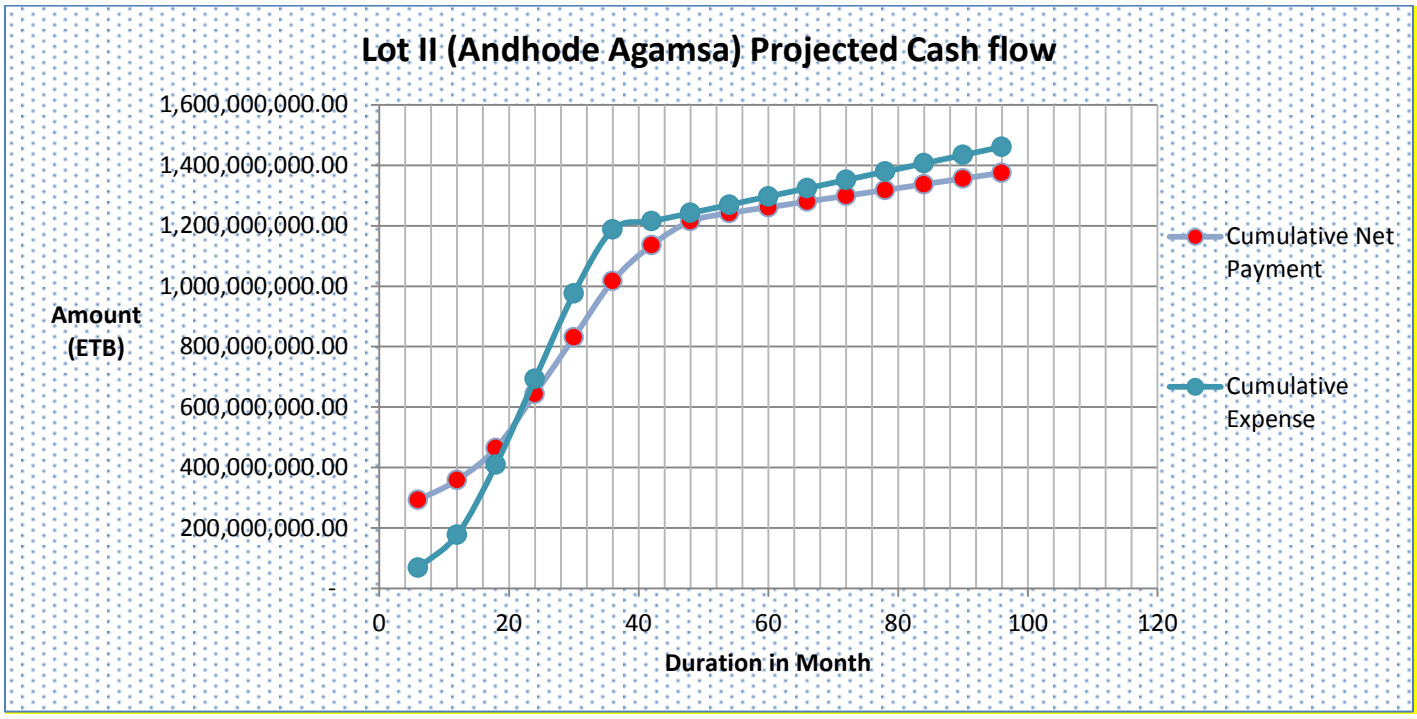


Figure 8. Projected cash flow diagram of Lot II (Andhode Agamsa)

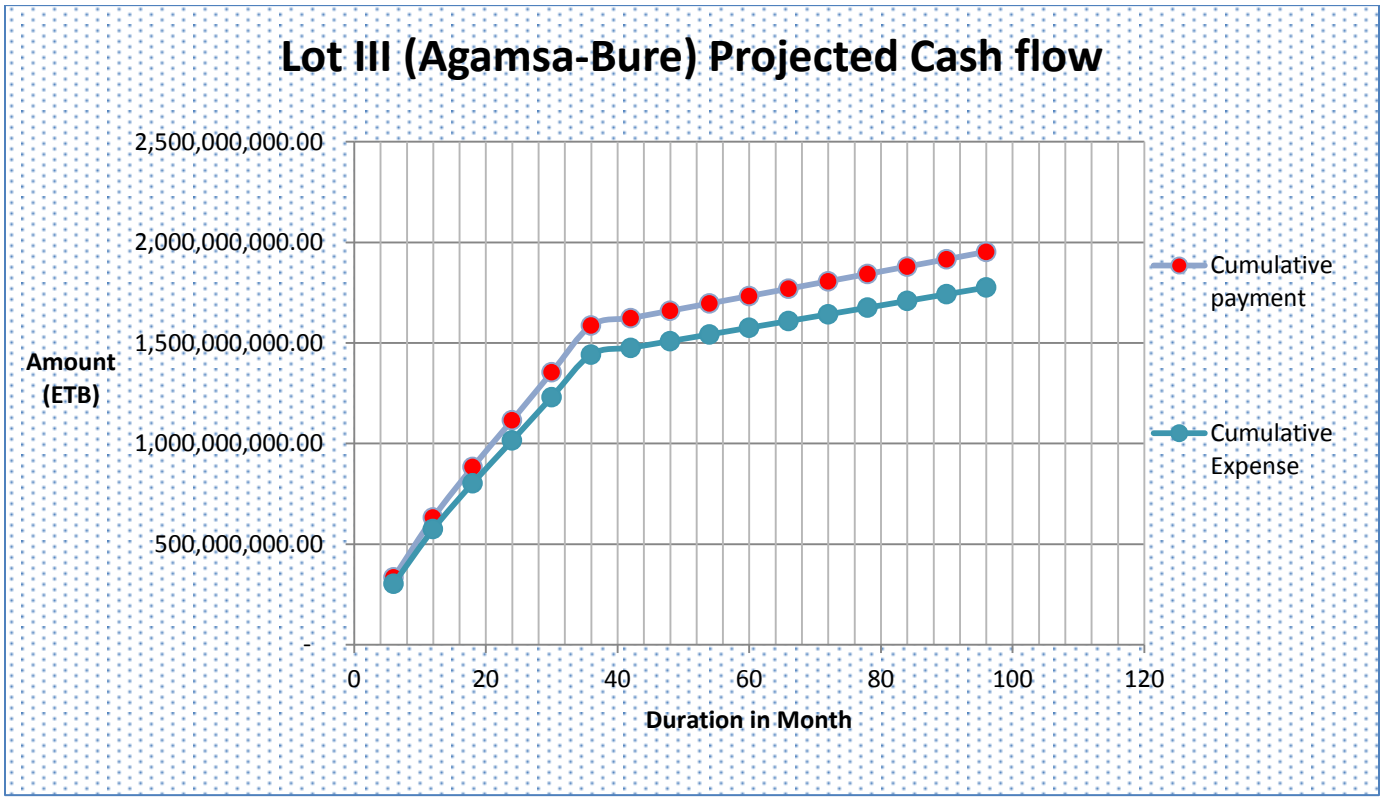


Figure 9. Projected cash flow diagram of Lot III (Agamsa-Bure)

As can be observed from the projected cash flow diagrams, the cash flow diagram for Lot I and III shows that throughout the Contract duration, the Contractor maintains a positive cash flow which is not in tandem with the scope of the project and the payment modality since there will be times where the Contractor is obliged to execute a large volume of construction and maintenance works with insufficient amount of money/payment. Further, the advance payment effect on the Cash flow schedule is not shown on the diagram.

In addition, even if the cash flow diagram for Lot II seems realistic showing the effect of Advance Payment on the cash flow and negative cash flow at some times of the project where the Contractor executes a large volume of construction and maintenance works with insufficient amount of money/payment; the projects overall cash flow interpretation shows that the project is not profitable since the cumulative payment is lesser than the cumulative expense.

3.4.1.1.4. Contractual Penalties and Performance Measurements of the Contract

The Contracts associated Contractual penalties for Defaults and the grounds for failure to execute the contract are;

- For improvement works- after the completion of 90 calendar days period of delay in meeting milestones established in the current program of performance, the Employer shall have the right to terminate the contract.
- For Management and Maintenance Works – failing of more than any 7 road sections /5km each/, simultaneously, to meet the criteria for payment in more than three consecutive monthly payment reports shall give the Employer the right to terminate the Contract.

Performance is monitored on a regular basis by the Contractor in terms of compliance with required service levels, reported in the Contractors monthly report, and forwarded to the Project Manager for assessment. The project manager will conduct a regular formal inspection of the road condition and compliance with service levels for the purpose of approving the monthly payment as well as informal inspections at any time to monitor the Contractors performance.

The management and maintenance services levels required by the contract are divided into four parts,

I. **Road Usability** – the Contractor is obliged to ensure the usability of the road at all times during the contract including before the start of construction of the improvement works, during the construction period and after completion of improvement works. This entails that the road must be open to traffic and free of interruptions at all time. Road closures are only permitted for a maximum of 6 hrs for some specific cases. The inspection of the road usability may be carried out by the Project Manager at any time. In case of noncompliance, a deduction of 20% will be applied to full monthly payment for the entire road section. The deduction will be repeated for every 24 hour period in which the obstruction is not removed and road usability is restored.

II. **Road User Service Levels** – The Contractor is required to maintain the Contract road in compliance with the service levels defined in the specifications. The road principal elements /i.e. Carriageway, shoulder, drainage, Bridges, slopes, Right of Way, Traffic Safety for each road element, one or more Performance Indicators are identified and for each performance indicator one or more service levels are specified which

must be computed with. Failure to maintain any specified service levels within the time permitted is defined as a non-compliance for which a deduction will be made from payments to the Contractor for management and maintenance services until the defect is corrected. In the case of noncompliance a percentage deduction is made from the payment for the kilometer section where the defect occurs,

III. **Road user Service Levels after completion of Improvements:** The Contractor is required to maintain the road after completion of construction to a standard which ensures that road users obtain the full benefits of the improvements in terms of increased safety, increased comfort, reduced travel times and reduced vehicle operating costs

IV. **Road Durability [performance measures] :** Road durability performance measures /RDM/ are the measures undertaken by the Contractor to protect the pavement and surfacing assets and check the Consumption of these assets over the duration of the contract.

The road durability performance measures to be applied in this contract are

- Road Roughness – International Roughness Index
- Road Deflection – Falling weight Deflectometer /FWD/

3.4.1.2. Findings of the Case Study

From the case study incorporating evaluation of the of the Contracts documents and current performance of the projects, the following contractual gaps were observed which are also identified as reasons of termination for the two Lots (i.e. Lot I and III);

- The Contractors Projected Cash flow diagram is not presented considering the scope of the work and features of the Output and Performance delivery system
- The Cash flow capacity of the Contractors is not in line with the demand of the project,
- For OPRC contract the Contractor has to carryout Engineering and Design before the submission of the bid to be competitive and responsive. However, the time allotted for the preparation and submission of bid is not sufficient.
- The lack of expertise on the OPRC delivery system and lack of capacity of winning contractors
- Delay in Right of Way Removal processes by the Employer,
- No coordination and Cooperation between the Zonal, Regional and Federal Administrations in tackling project hindrances

- The mode of payment (The fact that the Contractor have to carry out rather large amount of physical works in order to comply with the required service levels at some times and very little work during others) is creating cash flow problems on the Contractors due to lack of planning,
- The burden of risk transferred to the Contractor is found very high based on the capacity of the Contractor,

3.4.2. Desk Study

Desk study was chosen as one of the instruments to assess and obtain actual data about the Output and Performance Based Project delivery System from relevant studies, reports, Contract documents and other countries experience.

Accordingly, from the desk study the experience of other countries was reviewed and key success factors and lessons learned were identified. Further, features of the delivery system from the major stakeholder's different perspective were identified. Most of all, Key Performance Indicators, to be used in the questionnaire were identified in this study.

3.4.3. QUESTIONNAIRE

The demography of the participants in the Questionnaire is shown below;

a) Section A

Table 12:Questionnaire Respondents Demography

Contracting Party	No of Correspondents based on the Nature of Company		Position of Correspondents
	Local Company	Foreign Company	
Employer	8		4 Senior Project Engineers, 3 Team Leaders and 1 Director
Contractor	-	5	3 Project Managers, 1 Contract Engineer and 1 Assistant Project Manager
Consultant	2	4	3 Resident Engineers, 1 General Manager and 2 Contract Engineers
	10	9	
Total	19		

Profile of the Company		
Time	**Total Years of Establishment**	**Experience in Road Construction**
>10 years	17	17
5-10 years	2	2
<5 years	0	0
Total	19	19

Respondents Profile		
Years of experience on Road Construction Projects	OPRC Experience	
	Yes	No
>10 years	15	2
5-10 years	2	0
<5 years	0	0
Total	17	2
	19	

Out of the 26 questionnaires distributed to target participants 19 questionnaires were received back which leaves **73%** response rate.

The Analysis of the questionnaires and response is summarized below,

b) Section B- effect of proper selection of the best project delivery system on the projects successfully accomplishment

Table 13: Section B rating summary

Effects	Rating Scale				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Finalizing the project within the anticipated cost		1	2	4	12
Finalizing the project as per the scheduled time frame		2	4	6	7
Finalizing the project complying the desired quality		1	1	9	8
Road Asset Management (infrastructure administration)			4	8	7
Service life of the road (avoiding/minimizing premature failures)			3	8	8
Influence on the serviceability and usability of the road (i.e. riding quality, strength of the road, safety features etc.)			6	7	6
Reduction of Employers (public bodies) responsibility/ role towards asset management			5	8	6
Reduction of Consultants construction and defects liability supervision role		1	5	6	7
Addressing design, improvement works/construction and maintenance obligations on the Contracting parties		1	8	5	5
Opening room for initiation of Public Private Partnership (PPP)		1	7	4	7
Avoiding/minimizing design deficiencies		1	7	6	5

It is well known that **COST**, **TIME** and **QUALITY** parameters of the project should be controlled in such a way that they are optimized and achieved. And, amongst others, one of the methods taking the lions share in controlling/affecting these parameters is the selection of a suitable project delivery system.

From questionnaires distributed to participants to picture the impact of the selection of a project delivery system on the time, cost and quality parameters of the project, it can be concluded that the selection of the best delivery system, have a paramount importance on the Cost, Time and Quality features of the project. The selection of the suitable project delivery system for a project improves the overall cost, quality and time targetsof a project.

As can be seen in the figure below, most of the respondents reaffirmed that the selection of the best project delivery system will increase the impact of the projects accomplishment towards the Cost, Time and Quality triangles of the project.

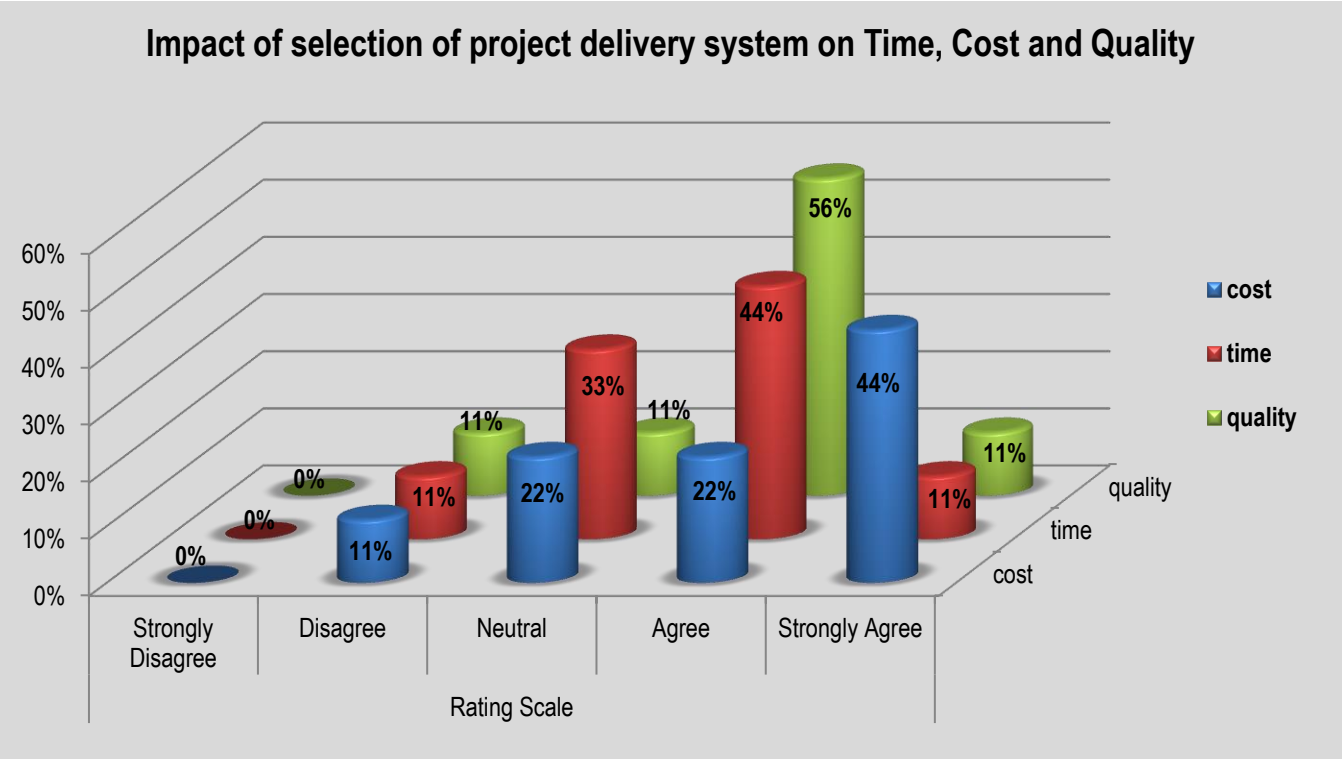
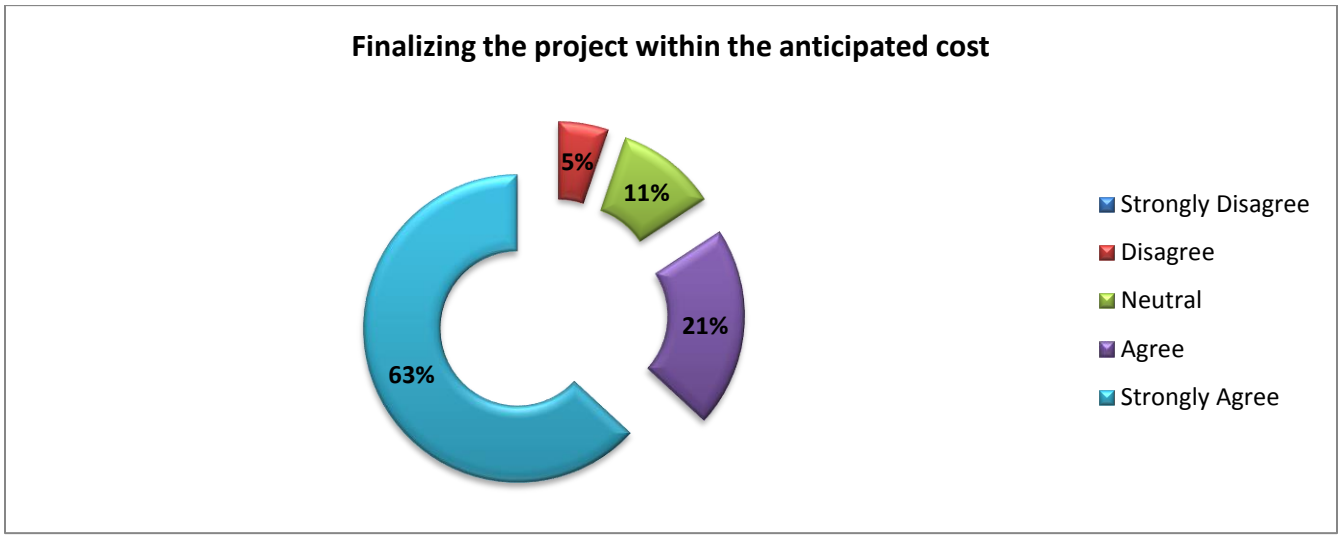
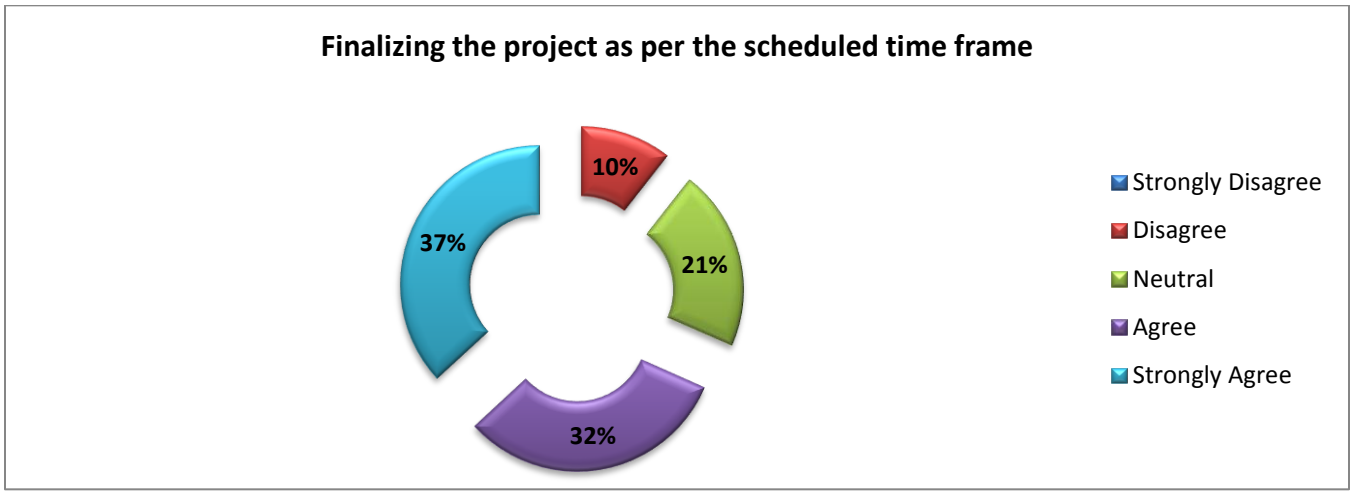


Figure 10. Impact of project delivery system versus Time, cost and Quality

It is well known that triple constraints (i.e. Time, Cost and Quality) shall be managed in Projects delivery. Each Constraint as expressed in the Project Triangle are connected and interrelated to one another and affecting or changing one parameter will obviously affect the other two.

And, it can be easily concluded that, one of the major parameters in defining these constraints is the selection of the project delivery system. The effect of the project delivery system in defining each parameters as per the response of the participants is figured below,





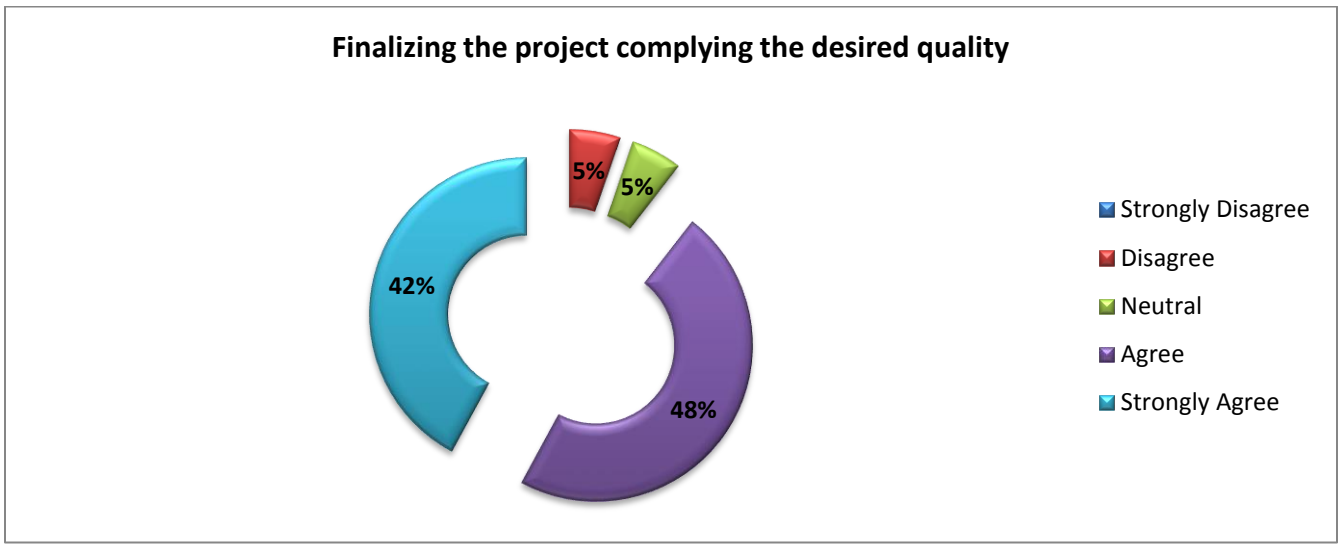


Figure 11: Effect of Delivery system on Cost, Time and Quality Parameters

It was also found out from the collected data that the service life of the road, serviceability/usability, defining the roles and responsibilities of project parties, risk sharing scenarios are all defined solely based on the selection of a suitable project delivery system which shall be evaluated at the contract formulation stage. Further, respondents verified that the selection of the best project delivery system has a high impact for opening rooms for Public Private Partnership and maximizing or minimizing design deficiencies that affect the projects service life.

In addition the following additional points were raised and reflected by the participants;

- ✓ Dealing with complex Projects requires the selection of the best project delivery system,
- ✓ The lack of expertise on the OPRC delivery system and lack of capacity of local contractors was identified as a major gap
- ✓ The best project delivery system will optimize traffic management, reduce/avoid accidents and reduce Environmental Impacts,
- ✓ Delay in Right of Way Removal processes from the Employer's side shall be mitigated through delivering the possession of site before commencing the work,
- ✓ Foreign Contractor participants raised that the rules and regulations of the country are challenging and unattractive for new Contractor's,
- ✓ Lack of coordination and Cooperation between the Zonal, Regional and Federal Administrations of the Country in tackling project hindrances was observed,

c) SECTION-C – Identifying Specific Features of Output and Performance Based Road Contracting System

Table 14: Section C rating Summary

Effects	Rating Scale				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Leads to greater road user satisfaction		1	2	9	7
Results in a Better life cycle cost		1	2	11	5
Increased application of technology and pursuit of innovative materials, processes and management	1		3	11	4
Increased incentive for performance improvement		1	2	11	5
Reducing fragmentation and adversarial relations between designers and Contractors by merging design and construction responsibilities to the Contractor		3	1	11	4
Increased burden of risk on the Contractor	1	2	1	9	6
Create opportunity for Value Engineering and improved efficiency	1		3	9	6

Effects	Rating Scale				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
improve the service life of the road through extended contractual period for maintenance	1		3	11	4
Increased transparency for road users, road administration and Contractor			9	7	3
Improves quality assurance and controlling mechanism through valuation of end product			2	13	4
Limits occurrence of unpredictable costs (Variation Orders and Cost Claims) for the Employer through transfer of risks		3	6	6	4
Increases design accountability on the Contractor	1	3	2	8	5
Increased obligation to construct fit for purpose project		1	4	10	4
Minimizes owners scarcity of financial resources through packaged contract		3	5	9	2
Avoids/minimizes Employers responsibility of coordinating interfaces between different projects		3	7	6	3
Enhances coordination between design and construction processes	1	2	1	11	4

Amongst the identified advantages of OPRC system from the Desk Study as compared to other commonly used/conventional project delivery systems, 71% strongly agreed and agreed that OPRC have the identified advantages over the conventional project delivery system,19% stayed neutral on the concept and the rest disagreed as shown below,

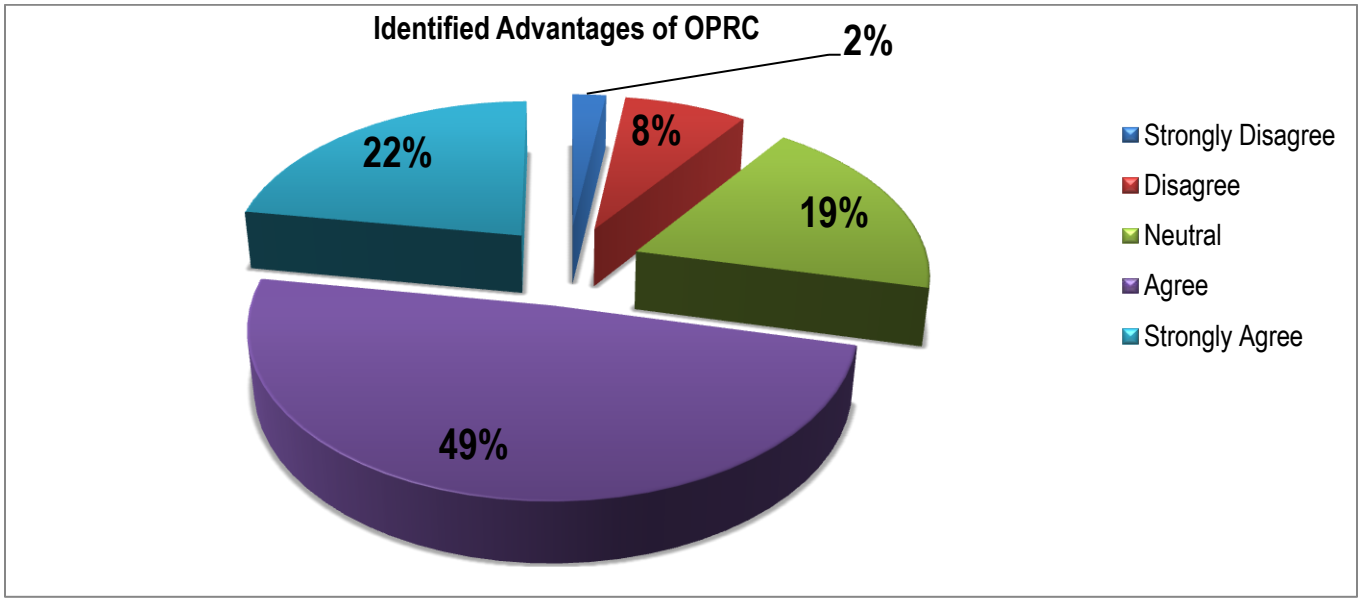


Figure 12. Rating of advantages of Output and Performance Based Contract

d) SECTION D - Challenges of implementing Output and Performance Based contracting system in developing countries

Table 15: Section D rating summary

Effects	Effect Rating				
	Very Low	Low	Moderate	High	very High
Lack of support of the government	1	2	6	6	4
Lack of Finance (Budget Constraint) and dependency on external funding	1	2	3	9	4
Fear of cultural change		5	6	6	2
Political influence		3	6	9	1
Lack of experience and knowledge	1	1	4	9	4
Poor planning		1	3	7	8
Challenges in estimating project cost		1	6	7	5
Poor performance and attitude of Contractors		3	3	8	5
Loss of competitive bidding due to shortage of qualifying Contractors			5	8	6
Difficulty of monitoring the quality and service level of the road	1	5	2	9	2
Difficulty in participating local contractors and capacity building	1	3	1	9	5
Difficulty in participating local consultants and capacity building		4	6	5	4

From Literature and Experience of other countries, the effects of the identified challenges were rated, and as per the respondents response the identified challenges are ranked below (from bottom to Top) based on their effect priority depending on the rated impact,

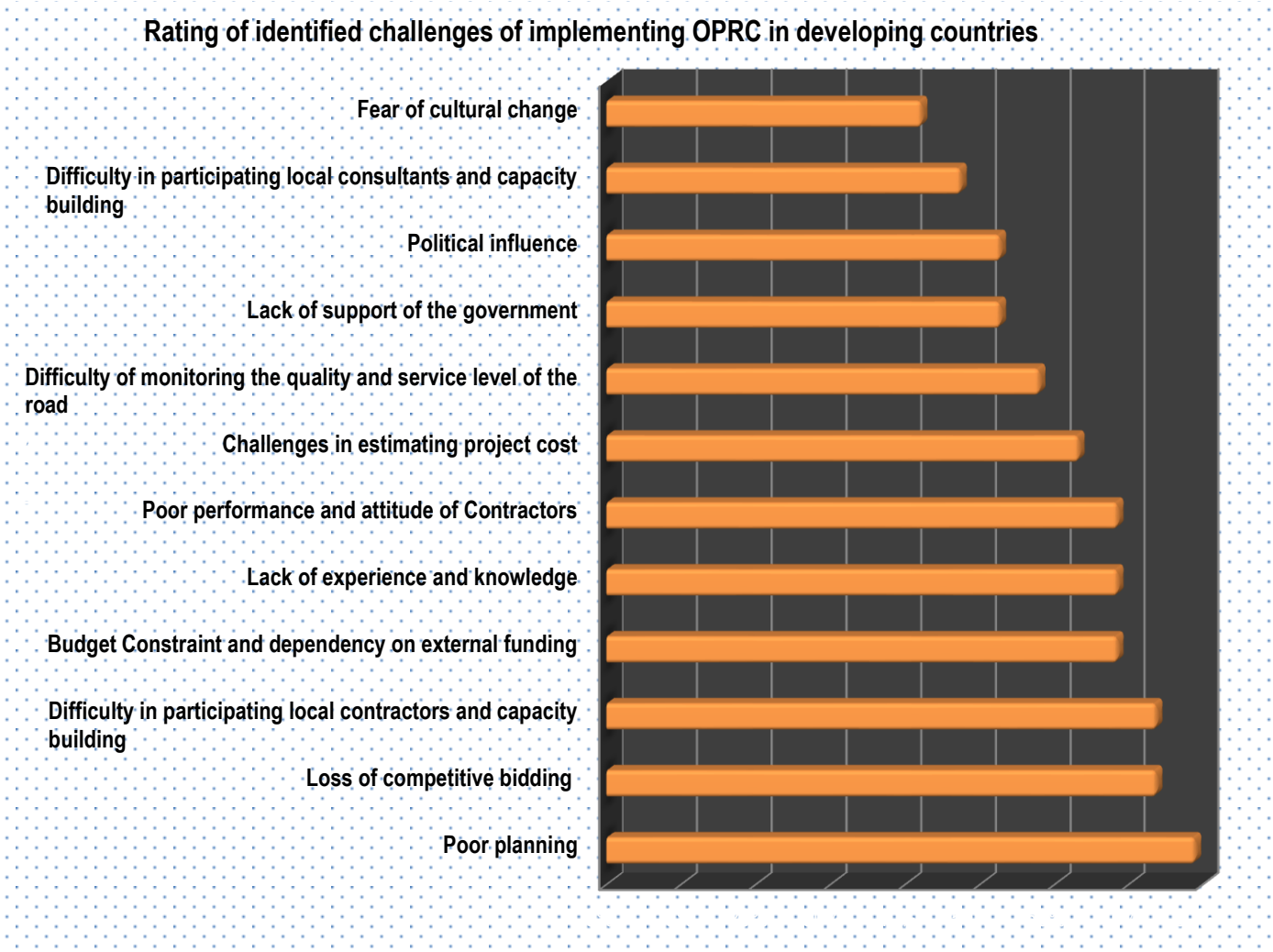


Figure 13. Rating of Identified challenges of implementing OPRC in developing countries

e) SECTION E - Procurement stage effects on the implementation of Output and Performance Based contracting system

Table 16: Section E rating summary

Effects	Rating Scale				
	No implication	very small implication	Small implication	High Implication	very High Implication
Unreasonable tendering cost/offer of Contractor's as compared to the Engineering Cost Estimate		2	4	7	6
Importance of providing comprehensive training and capacity building		1	4	11	3
Study of the market surrounding to refine the	1		3	11	4

Effects	Rating Scale				
	No implication	very small implication	Small implication	High Implication	very High Implication
bid qualification requirements so that sufficient number of private contractors can participate in the tender					
Evaluation and selection criteria with respect to design and construction capacity to compare bidders		1	3	10	5
Evaluation of Contractors and Consultants capacity with respect to experience, capacity, cash flow and healthy turnover			2	8	9
The need for Mandatory requirements with respect to site visit before bid		2	7	5	5

From Literature review, some the effects related to procurement of the works and service contracts were rated, and as per the respondents response the procurement challenges are ranked below,

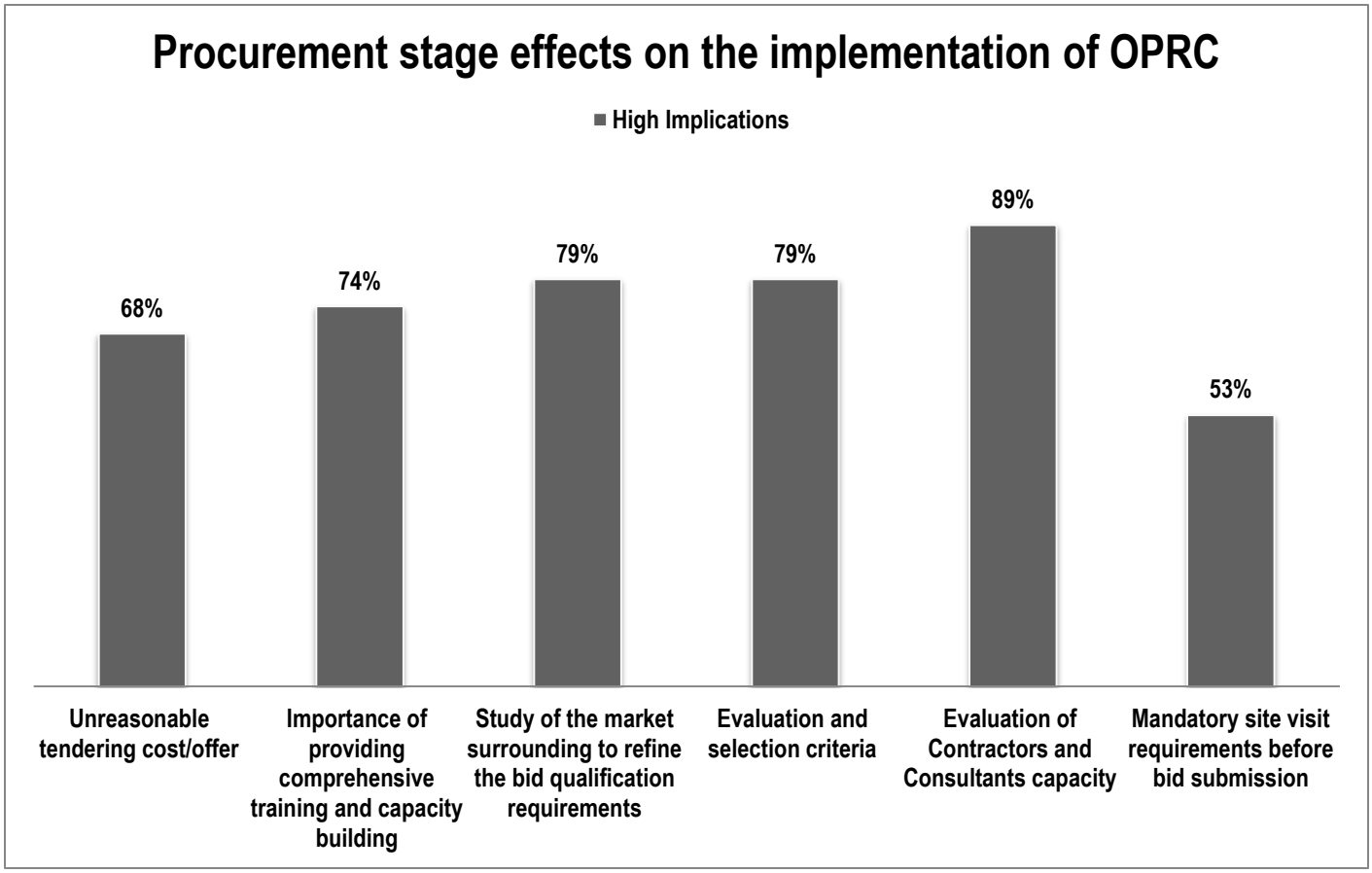


Figure 14.Rating of Procurement stage effects on OPRC implementation

Some respondents implied that the procurement process should focus on selection of capable Contractors who has a stable cash flow and specifically have an understanding of PPP concept and believed that the procurement methods and qualification requirements should be revisited to comprehend the successfulness of the Project Delivery System.

f) SECTION F - Output and Performance Based Contracting System Contractual Indicators

Table 17: Section F rating summary

Effects	Rating Scale				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The mode of payment (payment related with achieving specified service levels and not paid directly for inputs or physical works) is a better way of administering the finance and the Contract		1	7	7	4
The fact that the Contractor have to carry out rather large amount of physical works in order to comply with the required service levels and very little work during other months has a significant cash flow impact on the Contractor		1	7	9	2
The burden of risk transferred to the Contractor through the Contract is equitable and within the capacity of the industry		2	9	6	2
The contractual baseline data's to monitor the performance indicators (road user service and comfort measurement indicators of the contract, road durability measure indicators, management performance measure indicators) and standards are clear and unambiguous			8	7	4
Clear maintenance related provisions and associated contractual obligations with consequences for noncompliance are incorporated in the contract		1	8	10	
Milestone/ Time table criteria of the contract and associated contractual obligations are clear and achievable		1	7	12	0
The periodic evaluation requirement of the contract is easy for implementation and/or monitoring		2	8	6	3

From the contract evaluation of the Nekempte – Bure OPRC projects major contractual gaps were identified and rated as shown in Figure 15 below.

From the respondents, other than the participants who stayed silent/Neutral on the identified gaps, most of the respondents implicated that the identified gaps are the major contractual provisions and criteria's that affected the overall accomplishment of the delivery system of the case study projects.

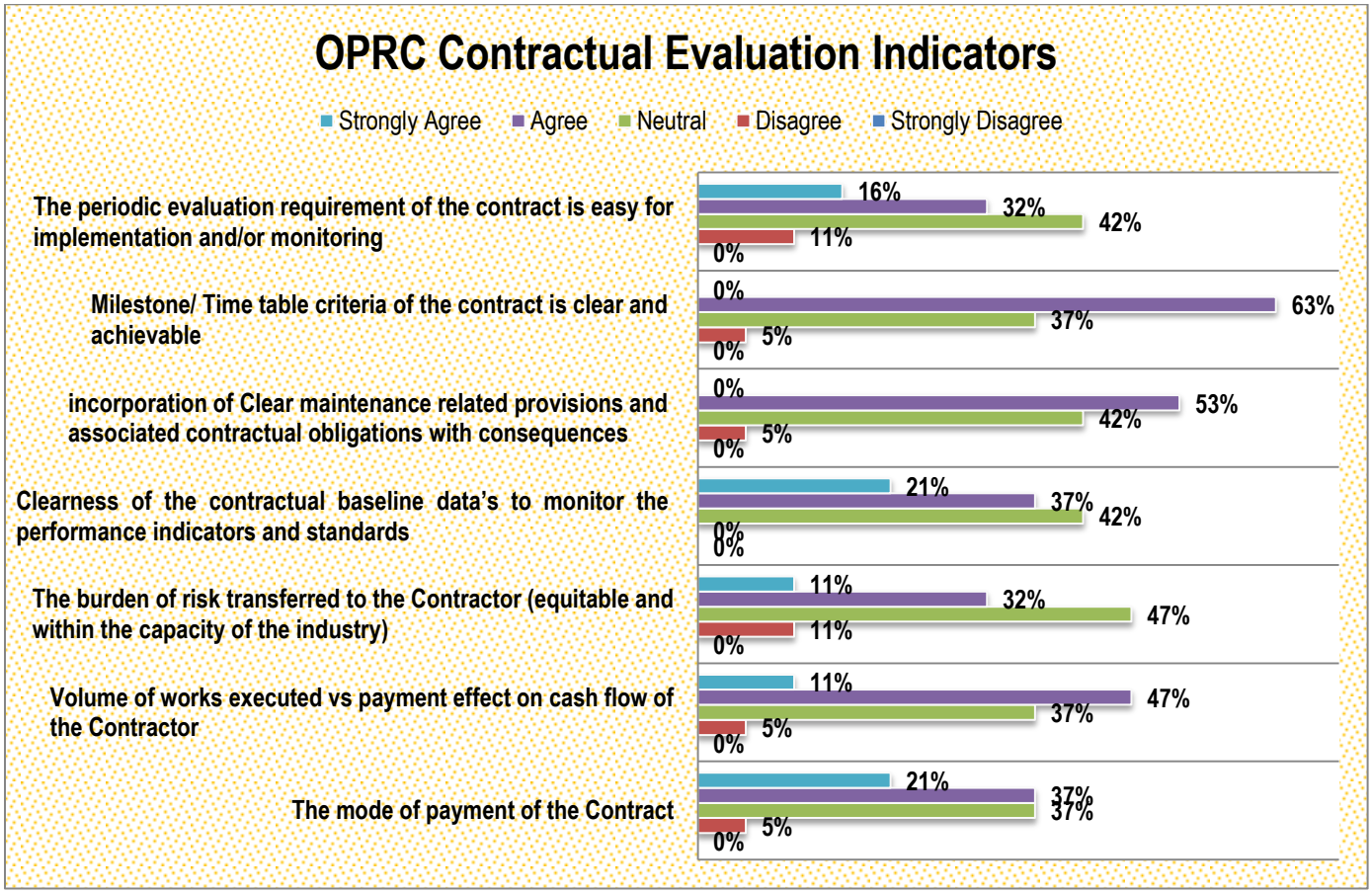


Figure 15. OPRC Contractual evaluation indicators rating

In addition, the following additional contractual gaps were also identified:,

- ✓ Lack of clear contractual measures for the Contractors failure to attain maintenance and improvement work requirements of the contract,
- ✓ The Contract lacks rooms for means of correcting any contractor defaults (e.g. cash flow problems due to delay or target time frame deviations) when predefined contractual obligations are deviated from the assumption,
- ✓ As a PPP model, the Employer must understand his obligation before entering into such kind of Project Delivery Systems and commitments,

- ✓ The Financial Model of the Contractor shall be part of the prequalification and post qualification criteria,
- ✓ It is observed that most Contractors and the Employer do not have any Financial Models and since OPRC is a PPP model and cash flow is the cardinal issue of the delivery system, the Financial Model shall be presented with the tender with adequate evidences and shall be part of the qualification requirement.
- ✓ Contractor's fail to have a realistic program that takes into account the physical works in tandem with the cash flow requirement,
- ✓ The Contractors lack of understanding of the project needs and resource requirements, wrong perception towards enforcement of the contract provision and rely on support from the Employer during implementation despite clear obligations of the Contract,
- ✓ The Projects that qualify for OPRC contract must be identified in advance. Long list of potential projects for OPRC Contract should be debated in advance,
- ✓ The OPRC contract provision assumes a limited volume of improvement works. In case of Nekempte – Bure, the Major work is Improvement works. The 70% to 30% financial model is fictious to attract Contractors. However, the scenario should be the payment for Improvement works should be minimal. Otherwise, it will create a financial risk to the Employer through paying extended amount while less work is done,
- ✓ The reduction of the supervision engagement to monitor the day to day quality of works and limiting the role of supervision to evaluate end products creates risk of quality,
- ✓ The Financial Institutions capacity to avail loan must be carried in Advance,
- ✓ Project formulation and development must be carried in advance,

Identified default of contractual parties arising out of lack of understanding of the contract and the roles and responsibilities of contracting parties,

- ✓ Right of Way Obstruction clearance issues that are not attended timely by the Public body have been recorded as a major challenge

- ✓ The Contractors method of waiting the maintenance works payment to cover obligations/expenses for improvement works due to lack of cash flow stability of the Contractors is also observed,
- ✓ Contractors are observed to produce programs not in line with the defined mile stones of the contract due to failure to understand basic contract features,
- ✓ Livelihood restoration should be treated along with the project to avoid RoW obstruction clearance delays,

Other raised points by the correspondents

- ✓ The delivery possesses the best features in all aspects and will elevate the general performance over the road sector to the next level as it significantly minimizes the role of the Consultant and Employer,
- ✓ Successful Output based Contracts require sufficient dedicated fiscal resources and realistic performance expectations,
- ✓ Clear baseline data is required to establish and Monitor Performance indicators and Standards

4. CONCLUSION AND RECOMMENDATION

4.1. CONCLUSION

This research evaluated the problems and prospects of the pilot OPRC projects under implementation in tandem with literatures, other studies and experience of other countries. From the analysis of the case study, desk study and questionnaires, the following conclusions can be drawn and summarized to offer insights to increase the chance of successful adoption of OPRC projects in Ethiopia.

- The selection of the suitable project delivery system have a paramount impact on projects successful accomplishment from every Engineering parameters,
- In principle, even if introduction of Output and Performance Road Contracting was an appropriate decision to the road sector to curb the common phenomenon of cost overrun, time overrun and quality and mainly avoiding maintenance headaches (asset management) headaches of the Employer, selection of the right project suitable for the delivery system shall be taken into consideration in advance at planning stage,
- Even if theoretically Output and Performance Road Contracting project delivery system has significant advantages over the conventional project delivery systems, the current performance of the pilot case study projects (Nekempte – Bure) is unsatisfactory due to a number of attributable reasons,
- Lack of expertise of the Employer, the Consultant and the Contractor on the Output and Performance Road Contracting delivery system supported by lack of technical and financial capacity of Contractors is majorly identified as a gap,
- The Contractors Projected Cash flow diagram submitted along the tender is not presented considering the scope of the work and features of Output and Performance delivery system as verified during the implementation phase. And, the Cash flow capacity of the Contractors is not in line with the demand of the project. Further, Contractor's fail to have a realistic program that takes into account the physical works in tandem with the cash flow requirement,
- Employer's defaults with respect to timely removal of Right of Way Obstructions shall be avoided or minimized,

4.2. RECOMMENDATION

From the data analysis, case study and literatures, the following recommendations can be drawn for the proper implementation and successful accomplishments of Output and Performance Based project delivery system

- The Ethiopian Roads Authority should evaluate the pilot Output and Performance Road Contracting project contract documents thoroughly to rectify the unattainable conditions, provisions and ambiguous obligations of the contract noted for future procurement of similar projects.
- The Contractors Financial Model shall be part of the prequalification and post qualification criteria and shall be present with the tender with adequate evidences to assure the capacity of the Contractors and the successful accomplishment of the projects,
- Projects that are suitable for Output and Performance Road Contracting project delivery system must be identified in advance and long list of potential projects for OPRC Contract should be selected prior by professionals and experts to assure the successful accomplishment of the projects,
- The supervision Consultants engagement to monitor the day to day quality of works and limiting the role of supervision to only evaluating end products and service levels will create loss of control of the quality of works and might lead to risk of quality and hence the Supervision consultants role should be revisited so as to engage the Consultant in controlling the process of works also,
- The Contracting parties must identify all the associated problems that contributed for the unsatisfactory accomplishment of the case study pilot projects so as to resolve the identified defaults on this independent project (but not limited to) for the successful accomplishment of the projects. Further, the defaults must be avoided for any future projects to be implemented with the delivery system.
- Further comprehensive researches without limitations shall be conducted on Output and Performance Based Project delivery system to identify its importance's, challenges and suitability for different scope of projects prior to proposing the delivery system further,

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Annexes

Questionnaire

Dear Respondents,

As part of my Master of Engineering study in Construction Technology and Management at Addis Ababa University, I am undertaking a research on the title **"Experience of Output and Performance Based Road Contracting System in developing countries and future prospects in Ethiopian Federal Road Construction".**

The main objectives of the study are:

- To study the specific features/characteristics and advantages and disadvantages of Output and Performance based Road Contracts for Implementation for Ethiopian Federal Road Projects.
- To compare and contrast Output and performance based road contracting approach with other methods of commonly used project delivery systems from different stakeholder's view.
- By benchmarking the international practices and lessons learned and by evaluating the contract and the to-date execution of the currently initiated Contracts in Ethiopia, propose the delivery system for some specific road projects in Ethiopia.

I have developed this questionnaire to collect views of professionals working for Employer, Contractors and Consultants who specifically involved on the implementation of Output and Performance based Road Contracting system which is believed will help to get reliable/credible information from exposed professionals for completeness of my research.

It is my belief that the research, in addition to its academic significance, will have a practical significance/prospect for the development of the delivery system and will initiate further related research on the topic.

Your response, in this regard, is highly valuable and contributory to the outcome of the research. All feedback will be kept strictly confidential, and utilized for this academic research only. If you have any question concerning the research study, please contact me through the address below.

Thank you in advance for your kind contribution.

Best Regards,
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Addis Ababa, Ethiopia

SECTION- A

General Background Information

The questions below are related to your organisation and yourself. Please indicate your response by ticking (X or √) the appropriate box (es) or by filling the blank spaces provided, as appropriate.

1.1 *Name of organization (Optional)*: _____

1.2 To which one of the parties is your organization categorized:
Employer ☐ Contractor ☐ Consultant ☐

1.3 Nature of your company:
Local ☐ Foreign ☐

1.4 Total years of establishment:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.5 Organization experience in road construction projects:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.6 Your specific experience on road projects:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.7 Do you have experience in Output and Performance Based Road Construction projects?
Yes ☐ No ☐

1.8 Your Name, Title and Contact address:

- ☞ Name (optional): _____
- ☞ Job Title: _____
- ☞ Tel (optional): _____
- ☞ E-mail address: _____

SECTION-B - Effect of proper selection of the best project delivery system on the projects successfully accomplishment

Objective of the Questions: To study the effects of selection of project delivery system on identified major project performance indicators.

Please fill in the blanks.

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Question: State the level on how the selection/adoption of project delivery system (such as Design-Bid Build, Design Build, etc.) affects the overall project features

Effects	Rating Scale				
	1	2	3	4	5
Finalizing the project within the anticipated cost					
Finalizing the project as per the scheduled time frame					
Finalizing the project complying the desired quality					
Road Asset Management (infrastructure administration)					
Service life of the road (avoiding/minimizing premature failures)					
Influence on the serviceability and usability of the road (i.e. riding quality, strength of the road, safety features etc.)					
Reduction of Employers (public bodies) responsibility/ role towards asset management					
Reduction of Consultants construction and defects liability supervision role					
Addressing design, improvement works/construction and maintenance obligations on the Contracting parties					
Opening room for initiation of Public Private Partnership (PPP)					
Avoiding/minimizing design deficiencies					

State any other effects of impacts observed

……
……
……
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SECTION C

Identifying Specific Features of Output and Performance Based Road Contracting System

Objective of the Questions: Factors distinguishing Output and Performance Based Road Contracting System as a project delivery system from the Conventional Project delivery systems.

Please, tick and fill in the blanks if you select others.

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Question: Rate whether Output and Performance Based Road Contracting System has the following advantages/features over the conventional project delivery systems (Design Bid Build or Design Build) or not if properly implemented

Effects	Rating Scale				
	1	2	3	4	5
Leads to greater road user satisfaction					
Results in a Better life cycle cost					
Increased application of technology and pursuit of innovative materials, processes and management					
Increased incentive for performance improvement					
Reducing fragmentation and adversarial relations between designers and Contractors by merging design and construction responsibilities to the Contractor					
Increased burden of risk on the Contractor					
Create opportunity for Value Engineering and improved efficiency					
improve the service life of the road through extended contractual period for maintenance					
Increased transparency for road users, road administration and Contractor					
Improves quality assurance and controlling mechanism through valuation of end product					
Limits occurrence of unpredictable costs (Variation Orders and Cost Claims) for the Employer through transfer of risks					
Increases design accountability on the Contractor					
Increased obligation to construct fit for purpose project					
Minimizes owners scarcity of financial resources through packaged contract					
Avoids/minimizes Employers responsibility of coordinating interfaces between different projects					
Enhances coordination between design and construction processes					

SECTION D

Challenges of implementing Output and Performance Based contracting system in developing countries

Objective of the questions: To rate identified challenges of implementing Output and Performance Based contracting system in developing countries

Each scale represents the following rating: (5) = very High, (4) = High, (3) = Moderate, (2) = Low, (1) = Very Low

Questions: Rate the following identified challenges in introducing Output and Performance Based Road projects in developing countries

Effects	Rating Scale				
	1	2	3	4	5
Lack of support of the government					
Lack of Finance (Budget Constraint) and dependency on external funding					
Fear of cultural change					
Political influence					
Lack of experience and knowledge					
Poor planning					
Challenges in estimating project cost					
Poor performance and attitude of Contractors					
Loss of competitive bidding due to shortage of qualifying Contractors					
Difficulty of monitoring the quality and service level of the road					
Difficulty in participating local contractors and capacity building					
Difficulty in participating local consultants and capacity building					

SECTION E

Procurement stage effects on the implementation of Output and Performance Based contracting system

Objective of the questions: To identify the implications of procurement phase processes on the overall implementation of Output and Performance Based contracting system.

Each scale represents the following rating: (5) = very High Implication, (4) = High Implication, (3) = Small implication, (2) = very small implication, (1) = No implication

Questions: State the level on the implications of the procurement system on the proper implementation of Output and Performance Based Road projects

Effects	Rating Scale				
	1	2	3	4	5
Unreasonable tendering cost/offer of Contractor's as compared to the Engineering Cost Estimate					
Importance of providing comprehensive training and capacity building					
Study of the market surrounding to refine the bid qualification requirements so that sufficient number of private contractors can participate in the tender					
Evaluation and selection criteria with respect to design and construction capacity to compare bidders					
Evaluation of Contractors and Consultants capacity with respect to experience, capacity, cash flow and healthy turnover					
The need for Mandatory requirements with respect to site visit before bid					

SECTION F

Output and Performance Based Contracting System Contractual Indicators

Objective of the Question: To rate the impact of some of the Specific contractual conditions of Output and Performance Based road contracts

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Questions: Rate the impact of the following contractual features on the successful accomplishment of Output and Performance Based road contracts?

Remark: The identified effects are basically prepared after review of the Nekempt-Bure Contract document

Effects	Rating Scale				
	1	2	3	4	5
The mode of payment (payment related with achieving specified service levels and not paid directly for inputs or physical works) is a better way of administering the finance and the Contract					
The fact that the Contractor have to carry out rather large amount of physical works in order to comply with the required service levels and very little work during other months has a significant cash flow impact on the Contractor					
The burden of risk transferred to the Contractor through the Contract is equitable and within the capacity of the industry					
The contractual baseline data's to monitor the performance indicators (road user service and comfort measurement indicators of the contract, road durability measure indicators, management performance measure indicators) and standards are clear and unambiguous					
Clear maintenance related provisions and associated contractual obligations with consequences for noncompliance are incorporated in the contract					
Milestone/ Time table criteria of the contract and associated contractual obligations are clear and achievable					
The periodic evaluation requirement of the contract is easy for implementation and/or monitoring					

Please add any observed contractual gaps other than the above listed

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Please express any observed defaults of contractual parties arising out of lack of understanding of the Contract and the roles and responsibilities of contracting parties

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Any Other comments you may forward with regard to the subject matter

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Thank You

Projected Cash flow of Contractors

Lot I

start	Period (month)	Cost of Improvement works /ETB/	Cost of Maintenance services /ETB/	Total Expense	Cumulative Expense	Net payment to be received /ETB/	Cumulative payment	Net cashflow
1	6	239,266,626.26	29,479,336.80	268,745,963.06	268,745,963.06	295,620,559.37	295,620,559.37	26,874,596.31
6	12	210,292,903.10	29,479,336.80	239,772,239.90	508,518,202.96	263,749,463.89	559,370,023.26	23,977,223.99
12	18	172,854,527.49	29,479,336.80	202,333,864.29	710,852,067.25	222,567,250.72	781,937,273.98	20,233,386.43
18	24	158,405,918.66	29,479,336.80	187,885,255.46	898,737,322.71	206,673,781.01	988,611,054.99	18,788,525.55
24	30	161,724,411.13	29,479,336.80	191,203,747.93	1,089,941,070.64	210,324,122.73	1,198,935,177.72	19,120,374.80
30	36	158,017,520.58	29,479,336.80	187,496,857.38	1,277,437,928.02	206,246,543.12	1,405,181,720.84	18,749,685.74
36	42		29,479,336.80	29,479,336.80	1,306,917,264.82	32,427,270.48	1,437,608,991.32	2,947,933.68
42	48		29,479,336.80	29,479,336.80	1,336,396,601.62	32,427,270.48	1,470,036,261.80	2,947,933.68
48	54		29,479,336.80	29,479,336.80	1,365,875,938.42	32,427,270.48	1,502,463,532.28	2,947,933.68
54	60		29,479,336.80	29,479,336.80	1,395,355,275.22	32,427,270.48	1,534,890,802.76	2,947,933.68
60	66		29,479,336.80	29,479,336.80	1,424,834,612.02	32,427,270.48	1,567,318,073.24	2,947,933.68
66	72		29,479,336.80	29,479,336.80	1,454,313,948.82	32,427,270.48	1,599,745,343.72	2,947,933.68
72	78		29,479,336.80	29,479,336.80	1,483,793,285.62	32,427,270.48	1,632,172,614.20	2,947,933.68
78	84		29,479,336.80	29,479,336.80	1,513,272,622.42	32,427,270.48	1,664,599,884.68	2,947,933.68

start	Period (month)	Cost of Improvement works /ETB/	Cost of Maintenance services /ETB/	Total Expense	Cumulative Expense	Net payment to be received /ETB/	Cumulative payment	Net cashflow
84	90		29,479,336.80	29,479,336.80	1,542,751,959.22	32,427,270.48	1,697,027,155.16	2,947,933.68
90	96		29,479,336.80	29,479,336.80	1,572,231,296.02	32,427,270.48	1,729,454,425.64	2,947,933.68
		1,100,561,907.22	471,669,388.80			1,729,454,425.64		

Lot II

start	end	Cost of Improvement works /ETB/		Cost of Maintenance services /ETB/		Total Expense	Cumulative Expense	Net payment to be received /ETB/		Total Net Payment	Cumulative Net Payment
		ETB	USD	ETB	USD			ETB	USD		
Start								89010836.13	9885167.75	292,239,999.90	292,239,999.90
1	6	12,461,517.66	1,383,923.49	8,344,765.89	926,734.48	68,311,100.76	68,311,100.76	20,183,207.09	2,241,461.79	66,265,420.03	358,505,419.93
6	12	24,923,034.12	2,767,846.97	8344765.89	926734.48	109,224,700.04	177,535,800.80	32,021,648.30	3,556,189.10	105,133,340.01	463,638,759.94
12	18	62,307,585.29	6,919,617.43	8344765.89	926734.48	231,965,500.10	409,501,300.89	54,821,138.18	6,086,204.21	179,947,410.53	643,586,170.47
18	24	77,884,481.62	8,649,521.79	8344765.89	926734.48	283,107,500.16	692,608,801.06	56,903,355.96	6,319,446.53	186,824,857.17	830,411,027.64
24	30	77,884,481.62	8,649,521.79	8344765.89	926734.48	283,107,500.16	975,716,301.22	56,903,355.96	6,319,446.53	186,824,857.17	1,017,235,884.81
30	36	56,076,826.76	6,227,655.69	8344765.89	926734.48	211,508,700.16	1,187,225,001.38	36,186,083.85	4,018,673.73	118,805,997.07	1,136,041,881.88
36	42			8344765.89	926734.48	27,397,500.06	1,214,622,501.44	23,921,662.21	2,656,638.83	78,539,499.92	1,214,581,381.79
42	48			8344765.89	926734.48	27,397,500.06	1,242,020,001.51	8,334,765.89	926,734.48	27,387,500.06	1,241,968,881.86

start	end	Cost of Improvement works /ETB/		Cost of Maintenance services /ETB/		Total Expense	Cumulative Expense	Net payment to be received /ETB/		Total Net Payment	Cumulative Net Payment
		ETB	USD	ETB	USD			ETB	USD		
48	54			8344765.89	926734.48	27,397,500.06	1,269,417,501.57		926,734.48	19,052,734.17	1,261,021,616.03
54	60			8344765.89	926734.48	27,397,500.06	1,296,815,001.64		926,734.48	19,052,734.17	1,280,074,350.21
60	66			8344765.89	926734.48	27,397,500.06	1,324,212,501.70		926,734.48	19,052,734.17	1,299,127,084.38
66	72			8344765.89	926734.48	27,397,500.06	1,351,610,001.76		926,734.48	19,052,734.17	1,318,179,818.56
72	78			8344765.89	926734.48	27,397,500.06	1,379,007,501.83		926,734.48	19,052,734.17	1,337,232,552.73
78	84			8344765.89	926734.48	27,397,500.06	1,406,405,001.89		926,734.48	19,052,734.17	1,356,285,286.90
84	90			8344765.89	926734.48	27,397,500.06	1,433,802,501.96		926,734.48	19,052,734.17	1,375,338,021.08
90	96			8344765.89	926734.48	27,397,500.06	1,461,200,002.02		926,734.48	19,052,734.17	1,394,390,755.25
		311,537,927.07	34,598,087.16	133,516,254.24	14,827,751.68			378,286,053.57	49,423,838.79		

Lot III

start	end	Cost of Improvement works /ETB/	Cost of Maintenance services /ETB/	Total Expense	Cumulative Expense	Net payment to be received /ETB/	Cumulative payment
1	6	270,215,040.18	33292399.79	303,507,439.97	303,507,439.97	333,858,183.97	333,858,183.97
6	12	237,493,653.62	33292399.79	270,786,053.41	574,293,493.38	297,864,658.75	631,722,842.72
12	18	195,212,737.45	33292399.79	228,505,137.24	802,798,630.62	251,355,650.96	883,078,493.68
18	24	178,895,244.79	33292399.79	212,187,644.58	1,014,986,275.20	233,406,409.04	1,116,484,902.72
24	30	182,642,974.23	33292399.79	215,935,374.02	1,230,921,649.22	237,528,911.42	1,354,013,814.14

start	end	Cost of Improvement works /ETB/	Cost of Maintenance services /ETB/	Total Expense	Cumulative Expense	Net payment to be received /ETB/	Cumulative payment
30	36	178,456,608.60	33292399.79	211,749,008.39	1,442,670,657.61	232,923,909.23	1,586,937,723.37
36	42		33292399.79	33,292,399.79	1,475,963,057.40	36,621,639.77	1,623,559,363.14
42	48		33292399.79	33,292,399.79	1,509,255,457.19	36,621,639.77	1,660,181,002.91
48	54		33292399.79	33,292,399.79	1,542,547,856.98	36,621,639.77	1,696,802,642.68
54	60		33292399.79	33,292,399.79	1,575,840,256.77	36,621,639.77	1,733,424,282.45
60	66		33292399.79	33,292,399.79	1,609,132,656.56	36,621,639.77	1,770,045,922.22
66	72		33292399.79	33,292,399.79	1,642,425,056.35	36,621,639.77	1,806,667,561.99
72	78		33292399.79	33,292,399.79	1,675,717,456.14	36,621,639.77	1,843,289,201.76
78	84		33292399.79	33,292,399.79	1,709,009,855.93	36,621,639.77	1,879,910,841.53
84	90		33292399.79	33,292,399.79	1,742,302,255.72	36,621,639.77	1,916,532,481.30
90	96		33292399.79	33,292,399.79	1,775,594,655.51	36,621,639.77	1,953,154,121.07
		1,242,916,258.87	532,678,396.64			1,953,154,121.07	

ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Questionnaire

On

Experience of Output and Performance Based Road Contracting System in developing countries and future prospects in Ethiopian Federal Road Construction

BY: Addishiwot Tadesse

ADVISOR: Dr. Abraham Assefa (*Assistant Professor)*

FOR THE PARTIAL FULFILLMENT OF MASTER OF ENGEENEERING DEGREE IN CIVIL ENGINEERING
(MAJOR: CONSTRUCTION TECHNOLOGY AND MANAGEMENT)

May, 2019

Experience of Output and Performance Based Road Contracting System in developing countries and future prospects in Ethiopian Federal Road Construction

Dear Respondents,

As part of my Master of Engineering study in Construction Technology and Management at Addis Ababa University, I am undertaking a research on the title **"Experience of Output and Performance Based Road Contracting System in developing countries and future prospects in Ethiopian Federal Road Construction".**

The main objectives of the study are:

- ☞ To study the specific features/characteristics and advantages and disadvantages of Output and Performance based Road Contracts for Implementation for Ethiopian Federal Road Projects.

- ☞ To compare and contrast Output and performance based road contracting approach with other methods of commonly used project delivery systems from different stakeholder's view.

- ☞ By benchmarking the international practices and lessons learned and by evaluating the contract and the to-date execution of the currently initiated Contracts in Ethiopia, propose the delivery system for some specific road projects in Ethiopia.

I have developed this questionnaire to collect views of professionals working for Employer, Contractors and Consultants who specifically involved on the implementation of Output and Performance based Road Contracting system which is believed will help to get reliable/credible information from exposed professionals for completeness of my research.

It is my belief that the research, in addition to its academic significance, will have a practical significance/prospect for the development of the delivery system and will initiate further related research on the topic.

Your response, in this regard, is highly valuable and contributory to the outcome of the research. All feedback will be kept strictly confidential, and utilized for this academic research only. If you have any question concerning the research study, please contact me through the address below.

Thank you in advance for your kind contribution.

Best Regards,
Addishiwot Tadesse
Post Graduate Student, Construction Technology and Management
A.A University, Institute of Technology, School of Civil and Environmental Engineering
Tel:+251 913581205
E-mail: tadesse.addishiwot1@gmail.com
Addis Ababa, Ethiopia

SECTION- A

General Background Information

The questions below are related to your organisation and yourself. Please indicate your response by ticking (X or √) the appropriate box (es) or by filling the blank spaces provided, as appropriate.

1.1 *Name of organization (Optional)*: _____

1.2 To which one of the parties is your organization categorized:
Employer ☐ Contractor ☐ Consultant ☐

1.3 Nature of your company:
Local ☐ Foreign ☐

1.4 Total years of establishment:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.5 Organization experience in road construction projects:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.6 Your specific experience on road projects:
More than 10 years ☐ 5-10 years ☐ Less than 5 years ☐

1.7 Do you have experience in Output and Performance Based Road Construction projects?
Yes ☐ No ☐

1.8 Your Name, Title and Contact address:

- ☞ Name (optional): _____
- ☞ Job Title: _____
- ☞ Tel (optional): _____
- ☞ E-mail address: _____

SECTION-B - Effect of proper selection of the best project delivery system on the projects successfully accomplishment

Objective of the Questions: To study the effects of selection of project delivery system on identified major project performance indicators.

Please fill in the blanks.

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Question: State the level on how the selection/adoption of project delivery system (such as Design-Bid Build, Design Build, etc.) affects the overall project features

Effects	Rating Scale				
	1	2	3	4	5
Finalizing the project within the anticipated cost					
Finalizing the project as per the scheduled time frame					
Finalizing the project complying the desired quality					
Road Asset Management (infrastructure administration)					
Service life of the road (avoiding/minimizing premature failures)					
Influence on the serviceability and usability of the road (i.e. riding quality, strength of the road, safety features etc.)					
Reduction of Employers (public bodies) responsibility/ role towards asset management					
Reduction of Consultants construction and defects liability supervision role					
Addressing design, improvement works/construction and maintenance obligations on the Contracting parties					
Opening room for initiation of Public Private Partnership (PPP)					
Avoiding/minimizing design deficiencies					

State any other effects of impacts observed

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SECTION C

Identifying Specific Features of Output and Performance Based Road Contracting System

Objective of the Questions: Factors distinguishing Output and Performance Based Road Contracting System as a project delivery system from the Conventional Project delivery systems.

Please, tick and fill in the blanks if you select others.

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Question: Rate whether Output and Performance Based Road Contracting System has the following advantages/features over the conventional project delivery systems (Design Bid Build or Design Build) or not if properly implemented

Effects	Rating Scale				
	1	2	3	4	5
Leads to greater road user satisfaction					
Results in a Better life cycle cost					
Increased application of technology and pursuit of innovative materials, processes and management					
Increased incentive for performance improvement					
Reducing fragmentation and adversarial relations between designers and Contractors by merging design and construction responsibilities to the Contractor					
Increased burden of risk on the Contractor					
Create opportunity for Value Engineering and improved efficiency					
improve the service life of the road through extended contractual period for maintenance					
Increased transparency for road users, road administration and Contractor					
Improves quality assurance and controlling mechanism through valuation of end product					
Limits occurrence of unpredictable costs (Variation Orders and Cost Claims) for the Employer through transfer of risks					
Increases design accountability on the Contractor					
Increased obligation to construct fit for purpose project					
Minimizes owners scarcity of financial resources through packaged contract					
Avoids/minimizes Employers responsibility of coordinating interfaces between different projects					
Enhances coordination between design and construction processes					

SECTION D

Challenges of implementing Output and Performance Based contracting system in developing countries

Objective of the questions: To rate identified challenges of implementing Output and Performance Based contracting system in developing countries

Each scale represents the following rating: (5) = very High, (4) = High, (3) = Moderate, (2) = Low, (1) = Very Low

Questions: Rate the following identified challenges in introducing Output and Performance Based Road projects in developing countries

Effects	Rating Scale				
	1	2	3	4	5
Lack of support of the government					
Lack of Finance (Budget Constraint) and dependency on external funding					
Fear of cultural change					
Political influence					
Lack of experience and knowledge					
Poor planning					
Challenges in estimating project cost					
Poor performance and attitude of Contractors					
Loss of competitive bidding due to shortage of qualifying Contractors					
Difficulty of monitoring the quality and service level of the road					
Difficulty in participating local contractors and capacity building					
Difficulty in participating local consultants and capacity building					

SECTION E

Procurement stage effects on the implementation of Output and Performance Based contracting system

Objective of the questions: To identify the implications of procurement phase processes on the overall implementation of Output and Performance Based contracting system.

Each scale represents the following rating: (5) = very High Implication, (4) = High Implication, (3) = Small implication, (2) = very small implication, (1) = No implication

Questions: State the level on the implications of the procurement system on the proper implementation of Output and Performance Based Road projects

Effects	Rating Scale				
	1	2	3	4	5
Unreasonable tendering cost/offer of Contractor's as compared to the Engineering Cost Estimate					
Importance of providing comprehensive training and capacity building					
Study of the market surrounding to refine the bid qualification requirements so that sufficient number of private contractors can participate in the tender					
Evaluation and selection criteria with respect to design and construction capacity to compare bidders					
Evaluation of Contractors and Consultants capacity with respect to experience, capacity, cash flow and healthy turnover					
The need for Mandatory requirements with respect to site visit before bid					

SECTION F

Output and Performance Based Contracting System Contractual Indicators

Objective of the Question: To rate the impact of some of the Specific contractual conditions of Output and Performance Based road contracts

Each scale represents the following rating: (5) = Strongly Agree, (4) = Agree, (3) = Neutral, (2) = Disagree, (1) = Strongly Disagree

Questions: Rate the impact of the following contractual features on the successful accomplishment of Output and Performance Based road contracts?

Remark: The identified effects are basically prepared after review of the Nekempt-Bure Contract document

Effects	Rating Scale				
	1	2	3	4	5
The mode of payment (payment related with achieving specified service levels and not paid directly for inputs or physical works) is a better way of administering the finance and the Contract					
The fact that the Contractor have to carry out rather large amount of physical works in order to comply with the required service levels and very little work during other months has a significant cash flow impact on the Contractor					
The burden of risk transferred to the Contractor through the Contract is equitable and within the capacity of the industry					

Effects	Rating Scale				
	1	2	3	4	5
The contractual baseline data's to monitor the performance indicators (road user service and comfort measurement indicators of the contract, road durability measure indicators, management performance measure indicators) and standards are clear and ambiguous					
Clear maintenance related provisions and associated contractual obligations with consequences for noncompliance are incorporated in the contract					
Milestone/ Time table criteria of the contract and associated contractual obligations are clear and achievable					
The periodic evaluation requirement of the contract is easy for implementation and/or monitoring					

Please add any observed contractual gaps other than the above listed

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Please express any observed defaults of contractual parties arising out of lack of understanding of the Contract and the roles and responsibilities of contracting parties

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Any Other comments you may forward with regard to the subject matter

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----- The End -----

Please kindly check that no points are left unanswered and Thank You for Your Time!!!

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

ADDIS ABABA INSTITUTE OF TECHNOLOGY (AAIT)

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Master of Engineering in Civil Engineering (Construction Technology and Management)

EXPERIENCE OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTING SYSTEM IN DEVELOPING COUNTRIES AND FUTURE PROSPECTS IN ETHIOPIAN FEDERAL ROAD CONSTRUCTION

By-Addishiwot Tadesse

Advisor- Dr. Abraham Assefa Tsehayae

June 2019

CONTENTS OF PRESENTATION

1.BACKGROUND

1. STATEMENT OF THE PROBLEM
2. OBJECTIVE
3. EXPECTED BENEFITS
4. RESEARCH QUESTIONS
5. SCOPE OF THE STUDY
6. LIMITATION OF THE STUDY

2.LITERATURE REVIEW

3. RESEARCH DESIGN AND METHODOLOGY

DATA COLLECTION

case study

Questionnaire

SAMPLE SIZE AND RESEARCH POPULATION

4. DATA ANALYISIS

CASE STUDY

QUESTIONNAIRE

5. CONCLUSION

6. RECCOMENDATION

1. BACKGROUND

- **Output and performance based road contracting (OPRC)** is an agreement between a government and a private contractor whereby the private contractor maintains the road to achieve specified standards for a certain period of time in return for a fixed payment for meeting specified performance indicators

- Performance-based contracting for the management and maintenance of road networks is a new concept designed to increase the efficiency and effectiveness of road maintenance operations

- project delivery system has many features that differentiates it from other traditional types of project delivery systems, this research tries to study the **specific features/characteristics and advantages and disadvantages of this type of project Contract**, **study the experience of other countries**, **evaluate the contract and to date execution and encountered challenges of the newly initiated project in our country (Nekempt – Bure)** by benchmarking other countries experiences and forward recommendation for further implementation for Ethiopian Federal Road Projects.

1.BACKGROUND

1.1. STATEMENT OF THE PROBLEM

- After huge investments are spent on road infrastructures in Ethiopia, most road projects are observed to fail before serving the expected life and heavy unexpected costs are spent on the rehabilitation and maintenance of roads.

- After the Contractor hands over the road project, any failures arising out of design or execution are the headaches of the Employer/Government/public body

- In order to tackle the above mentioned shortcomings of the traditional approaches of project delivery systems, other systems that account the serviceability and usability of the road becomes critical. One of the project delivery systems is Output and Performance based Road Contract which addresses the **design, improvement works/construction and management and maintenance services in one package**.

1.BACKGROUND
1.2 OBJECTIVE

GENERAL OBJECTIVE

- To study the specific features/characteristics and advantages and disadvantages of Output and Performance based Road Contracts for Implementation for Ethiopian Federal Road Projects.

SPECIFIC OBJECTIVE

- To compare and contrast Output and performance based road contracting approach with other methods of commonly used project delivery systems from different stakeholder's view.
- To study the specific features/characteristics and advantages and disadvantages of output and Performance Based Road Contracts for implementation for Ethiopia Federal Road projects.
- By benchmarking the international practices and lessons learned and by evaluating the contract and the to date execution of the currently initiated Contracts in Ethiopia and studying distinguishing characteristics and advantages and disadvantages of Output and Performance based Road Contract, propose the delivery system for further implementation in Ethiopia.

1.BACKGROUND

1.3. EXPECTED BENEFITS

- studying Output and Performance based Road Contract will help to assure the **long term service of the roads without interruption**, **reduce cost** and **shift the risk of maintenance from the public body**. Furthermore, it **creates a stable business opportunity for Contractors and Consultants**, **opens a room for innovation and new technologies**, **improve quality**, **limit unpredictable costs** occurring and **reduce administrative expenses.**

1.BACKGROUND
1.4. SCOPE OF THE STUDY

This thesis work studies the benefits and challenges of OPRC for Ethiopian Federal Road Projects through;

- Exhaustive literature review and studying the experience of other countries
- Collecting and analyzing data about the specific features/characteristics and advantages and disadvantages of Output and Performance based Road contracts
- Evaluating the contract and to date execution of the newly initiated Output and Performance based Road Contract projects in Ethiopia (Nekemte - Bure Road Project with three lots) by benchmarking other countries experience.

1.BACKGROUND

1.5. LIMITATION OF THE STUDY

- The newly initiated Output and Performance based Road Contract projects in Ethiopia (the three lots of Nekempt - Bure Road Project) are just signed on March 2016 which will make it difficult to evaluate the performance of the Contract type at this early stage. Hence, only contractual evaluations and encountered challenges of the projects will be conducted.

- The research is based on only involvement of professionals involved in one pilot OPRC project consisting three contracts. The results would have been more rigorousness if more case studies could have been conducted. The low number of interview participants may affect the scope of the research output.

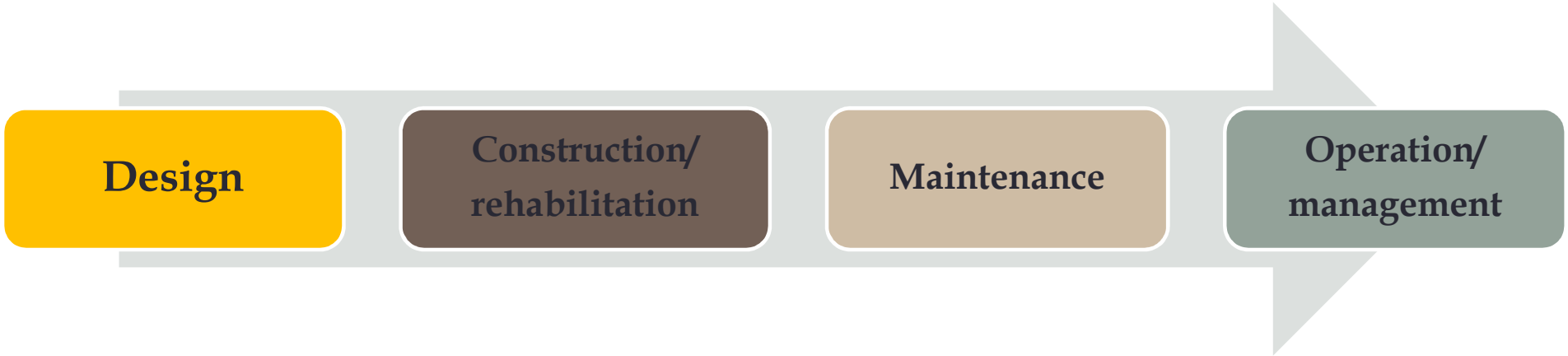
- Only one project cannot be construed as a model to represent other projects. Further, the two lots are constructed by one Contractor which faces the same problems.

- The two case study projects (i.e. Lot I and Lot III) are currently suspended and under termination process with progresses 12% and 10% respectively which makes it difficult to evaluate the accomplishment and challenges of the delivery system.

2. LITERATURE REVIEW

2.1 INTRODUCTION

- Output and performance based road contracting (OPRC) is an agreement between a government and a private contractor whereby the private contractor maintains the road to achieve specified standards for a certain period of time in return for a fixed payment for meeting specified performance indicators
- It should ensure that the physical condition of the roads under contract is adequate for the needs of road users, over the entire period of the contract which is normally several years
- The contract covers an array of activities needed to achieve and maintain a certain Service Level for road users, including many activities related to the Management and Maintenance (including periodic evaluation) of the road network under contract



2.LITERATURE REVIEW

2.1. INTRODUCTION cont…..

Reasons for implementing OPRC projects including:

- to reduce maintenance costs through the application of more effective and efficient technologies and work procedures;
- to provide transparency for road users, road administrations and contractors with regard to road maintenance;
- to improve control and enforcement of quality standards; and
- to improve overall road conditions.

2. LITERATURE REVIEW
2.2. TYPES OF PROJECT DELIVERY SYSTEMS

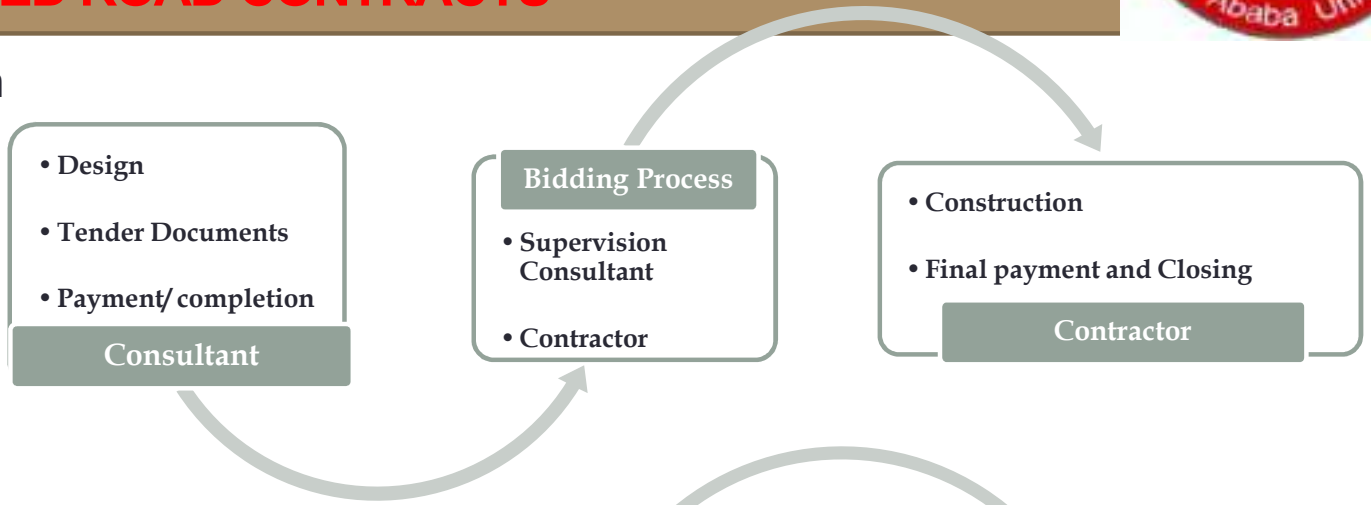
Types of Procurement and Contract Delivery systems;

- Force Account,
- Design Bid Build (DBB),
- Design Build (DB) or Turnkey,
- Output and Performance Based Road Contracting
- Finance / Build Operate System (BOT),
- Construction/Facility Management Consultancy, &
- Alliances and Outsourcing.

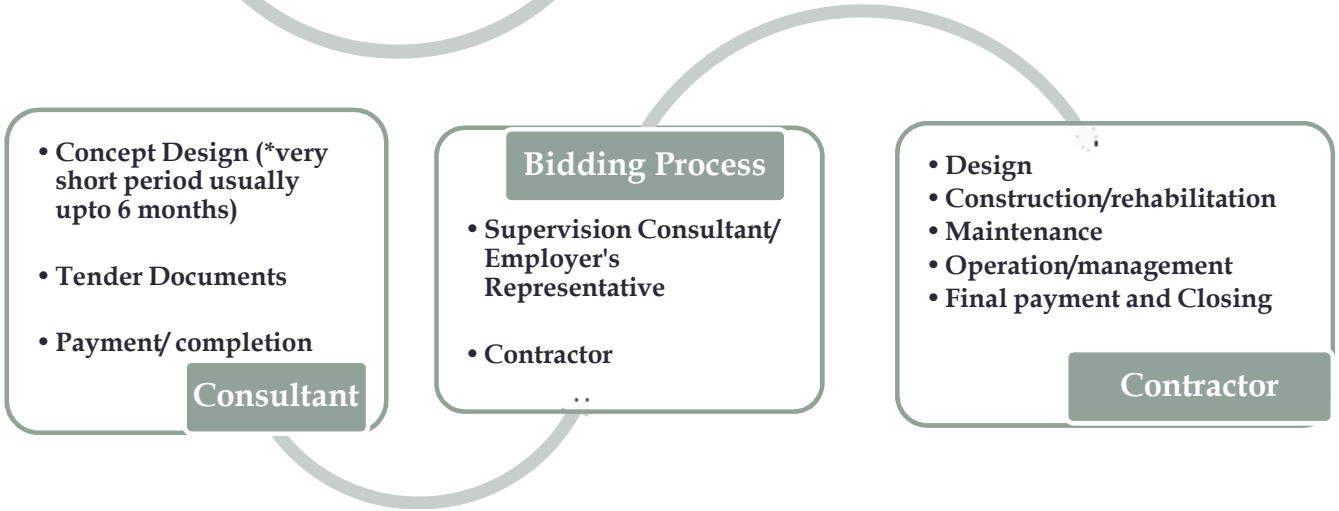
2.LITERATURE REVIEW

2.3. COMPARISON OF CONVENTIONAL CONTRACTS VERSUS OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

- **Traditional Project delivery system**



- **Output and Performance based Road contracting system**



2.LITERATURE REVIEW

2.4. FUNDAMENTAL FEATURES OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

- Several factors need to be considered when designing output-based contracts in order to achieve value-for-money and efficiencies over traditional contracts. These factors include:

Affordability

- is the government able to meet its long-term financial liabilities?

Incentive structure

- Does the contract have standards that encourage private operators to be efficient, innovative, transparent, responsible and reliant?

Risk Allocation

- Are risks allocated to the public and private parties who are most able to bear them, in order to optimize the efficiency of the contract?

Contract Scope

- Does the scope of the contract allow for economies of scale to be achieved? Is the scope of the contract manageable for the relevant public agency? Does the scope allow for synergies to be achieved or innovative approaches to be used?

Length

- Is the contract period long enough to transfer life-cycle risks to private operators?
- Is it sufficiently long for private investors to earn a return on any investment?

2.LITERATURE REVIEW

2.5. FUNDAMENTAL FEATURES OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS

The performance criteria's;

- **Road User Service and Comfort measures**- road Roughness, lane width, rutting, skid resistance, vegetation control, visibility of road signs and markings, availability of each lane-km for use by traffic, response times to rectify defects that compromise the safety of road users, attendance at road accidents, drainage off the pavement....

- **Road Durability measures**- longitudinal profile, pavement strength, the extent of repairs permissible before a more extensive periodic maintenance treatment is required, functionality of drainage facilities...

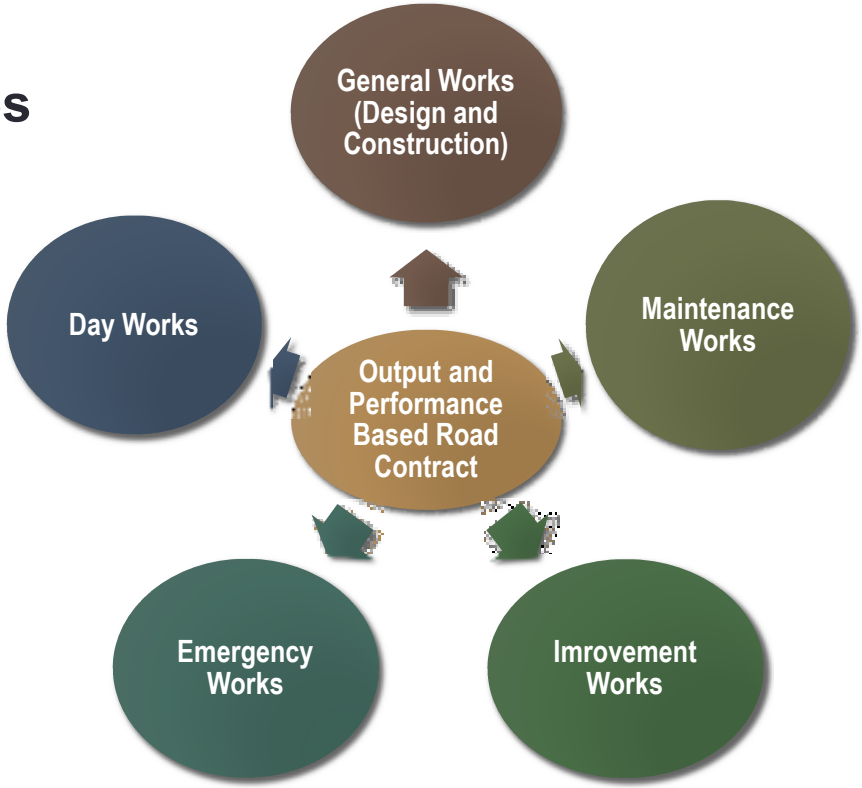
- **Management Performance Measures**, delivery of regular progress reports, inventory updates and other data sharing requirements, maintenance history (so subsequent tenders can price the work), compliance with social and environmental standards

2.LITERATURE REVIEW

2.5. FUNDAMENTAL FEATURES OF OUTPUT AND PERFORMANCE BASED ROAD CONTRACTS cont….

Contractors bidding for the Output and Performance based Road Contracts are expected to present their financial offer for

- The **Management and Maintenance Services**
  monthly lump-sum payment
- The **Rehabilitation Works**
  lump-sum amount,
- The **Improvement Works**
  lump-sum amount
- Unit prices for **Emergency Works**
  traditional bill of quantities.



2.LITERATURE REVIEW

2.6. KEY OBJECTIVES FOR IMPLEMENTING OUTPUT & PERFORMANCE BASED ROAD CONTRACTS

The main reasons for contracting out road maintenance implementing Performance Contracts are to:

- Reduce maintenance costs
- Provide transparency for road users, road administrations and contractors
- Improve control and enforcement of quality standards;
- Improve overall road conditions;
- Helps to insure variation orders are minimized.
- lead to cost savings;
- ensure stable financing for the maintenance program over a longer-term.
- To satisfy comfort and safety of road users

2.LITERATURE REVIEW

2.7. CHALLENGES FOR IMPLEMENTING OUTPUT & PERFORMANCE BASED ROAD CONTRACTS

There are many challenges in introducing performance based road contract in developing countries. The challenges are including:

❑Cultural change (change of the tradition project delivery systems)	❑Lack of experience and knowledge on OPRC,
❑Insufficient Contractor's capacity	❑Lack of planning, Challenges in estimating the cost,
❑Fear of risks	❑Fear of losing job,
❑Inability to achieve sufficient competition	❑Performance and attitude of contractors,
❑Support from the government,	❑Monitoring the cost savings,
❑Dependency on external funding,	❑Loss of competition, and
❑Political influence and corruption,	❑Loss of control of the network

2.LITERATURE REVIEW

2.7. ADVANTAGES AND DISADVANTAGES OF OPRC CONTRACTS FROM STAKEHOLDERS PERSPECTIVE

ADVANTAGES	DISADVANTAGES
CONTRACTOR	
▪ Creates innovation ▪ provide a more stable business environment and for establishment of true Public Private Partnership ▪ minimize waste through increasing efficiency	▪ Higher risk is shifted to the Contractor (Design and Construction risks) ▪ Since the delivery system requires high capacity, Insufficient Contractors capacity is a limitation. ▪ very difficult for local contractors to participate ▪ difficult to get familiar with the system and know the clear roles and responsibilities ▪ maintaining cash flow will be a higher problem
SUPERVISION CONSULTANT	
▪ The supervision is simpler ▪ longer service duration/stable job opportunity	▪ close verification of the Contractors method of testing the compliance of the service levels is required ▪ difficult for local consultants to compete

LITERATURE REVIEW

2.7. ADVANTAGES AND DISADVANTAGES OF OPRC CONTRACTS FROM STAKEHOLDERS PERSPECTIVE cont…

ADVANTAGES	DISADVANTAGES
EMPLOYER/PROCURING ENTITY/PUBLIC BODY	
Improved quality shifting the risk of design and design related problems to the Contractor No maintenance problem Provide stable financing for the maintenance program Lower chance of unpredictable costs occurring. Easy for budgeting Reduction in administrative expenses and road agency overhead due to better packaging of contracts	Higher project cost due to higher risk transfer to the Contractor making sure that all information/data to be supplied to the Contractor specially those specified in the Employers requirement of the works contract are accurate since they might lead to claims and disputes Affordability
ROAD USER	
the required service levels are met for the extended service duration No traffic interruption and closing of the road Improve the road condition for longer duration of the Contract rather than ad hoc repairs.	

2.LITERATURE REVIEW

2.8. KEY LESSONS LEARNED IN IMPLEMENTING OPRC FROM EXPERIENCE OF OTHER COUNTRIES

- Successful output-based contracts require sufficient dedicated fiscal resources and realistic performance expectations
- Private operators may need training and capacity building to bid for and implement output-based contracts
- Clear baseline data is needed to establish and monitor performance indicators and standards
- Simple performance indicators and user monitoring can improve contract performance

3. RESEARCH DESIGN AND METHODOLOGY

- The research will start with literature review of Output and Performance based Road Contract to identify the advantages of the delivery system in lieu of commonly practiced project contracting systems and gaps of the delivery system from other countries experiences will be collected.

- After that the Contractual and progress (i.e. current status) review of the case study project contracts in Ethiopia (i.e. Nekemte - Bure Road project) will be made to investigate the advantages and potential gaps of the delivery system with respect to contractual provisions.

- Subsequently, questionnaire will be prepared based on the literature and the contractual review. The target populations are;
  - **Client (Ethiopian Roads Authority**),
  - **Contractors (i.e. IL and FS Transportation Networks Limited - Elsamex S.A. and JMC Projects LTD)**,
  - Consultants (**RENARDET sub consultant UNICON, LEE sub consultant UNICON and KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultantancy ETHIOINFRA Eng PLC**)

3. RESEARCH DESIGN AND METHODOLOGY

3.1. DATA COLLECTION

a. case study

Description		Project Name		
		Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
Design Standard/class		DS4	DS4	DS4
Length (Km)		86	87.65	84.56
Financer		World bank	World bank	World bank
Contractor		IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)	JMC Projects (India) LTD	IL and FS Transportation Networks Limited - Elsamex S.A. (ITNL-Elsamex Joint Venture)
Consultant (Employer's Representative)		RENARDET sub consultant UNICON	LEE sub consultant UNICON	KUNHWA Engineering and Consulting Co.ltd JV with Koerea express way corpo. In sub consultancy ETHIOINFRA Eng. PLC
Contract signing date		18-Mar-16	18-Mar-16	18-Mar-16
Type of Contract/project delivery system		Output and Performance Based Road Construction (DBM)		
Original Contract Amount including VAT	Local (ETB)	1,048,885,237.35	537,642,867.11	1,262,498,327.02
	Foreign (USD)	37,312,292.91	59,708,347.48	38,012,408.41
	Exchange Rate (USD to ETB)	20.36	20.56	20.36
	Total Amount	1,808,395,615.68	1,765,186,782.95	2,036,259,906.41
Current Progress		10% (Suspended)	27% (on progess)	12% (Suspended)

3. RESEARCH DESIGN AND METHODOLOGY

3.1. DATA COLLECTION

b. Questionnaire

- **Section A- General Background Information –** prepared to Identify the correspondents Working Company/Stakeholder, working experience of the company and the correspondent, exposure to OPRC contract
- **SECTION-B –** Studying effect of proper selection of the best project delivery system on the projects successfully accomplishment
- **SECTION C -** Identifying Specific Features of Output and Performance Based Road Contracting System
- **SECTION D -** Challenges of implementing Output and Performance Based contracting system in developing countries
- **SECTION E -** Procurement stage effects on the implementation of Output and Performance Based contracting system
- **SECTION F -** Output and Performance Based Contracting System Contractual Indicators

3. RESEARCH DESIGN AND METHODOLOGY

3.2. SAMPLE SIZE AND RESEARCH POPULATION

- The questionnaire was distributed to 26 professionals 10 to the Employer, 10 to the Consultant and 6 to the Contractor. Subsequently, 19 questionnaires out of the 26 (**73% response rate**) are collected back.

Contracting Party	No of Correspondents based on the Nature of Company		Position of Correspondents
	Local Company	Foreign Company	
Employer	8		4 Senior Project Engineers, 3 Team Leaders and 1 Director
Contractor		5	3 Project Managers, 1 Contract Engineer and 1 Assistant Project Manager
Consultant	2	4	3 Resident Engineers, 1 General Manager and 2 Contract Engineers
	10	9	
Total		**19**	

4. DATA ANALYISIS

4.1. CASE STUDY

- The contract duration of the projects is eight (8) years. For the purpose of setting the time for completion of the annual construction periods for the improvement works **(3 years)** and maintenance services **(5 years)**
- The mile Stone criteria's and payment schedule for the projects Improvement works for the three lots is shown below

Contract Year	Lot I (Nekempt - A.Gutin-Andhode)	Lot II (Andhode Agamsa)	Lot III (Agamsa-Bure)
	Total Length of improvement works (km)		
1	**17**	**17**	**17**
2	**34**	**35**	**34**
3	**35.1**	**35.65**	**35.1**
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
Project Length	**86.1**	**87.65**	**86.1**

4. DATA ANALYSIS

4.1. CASE STUDY cont….

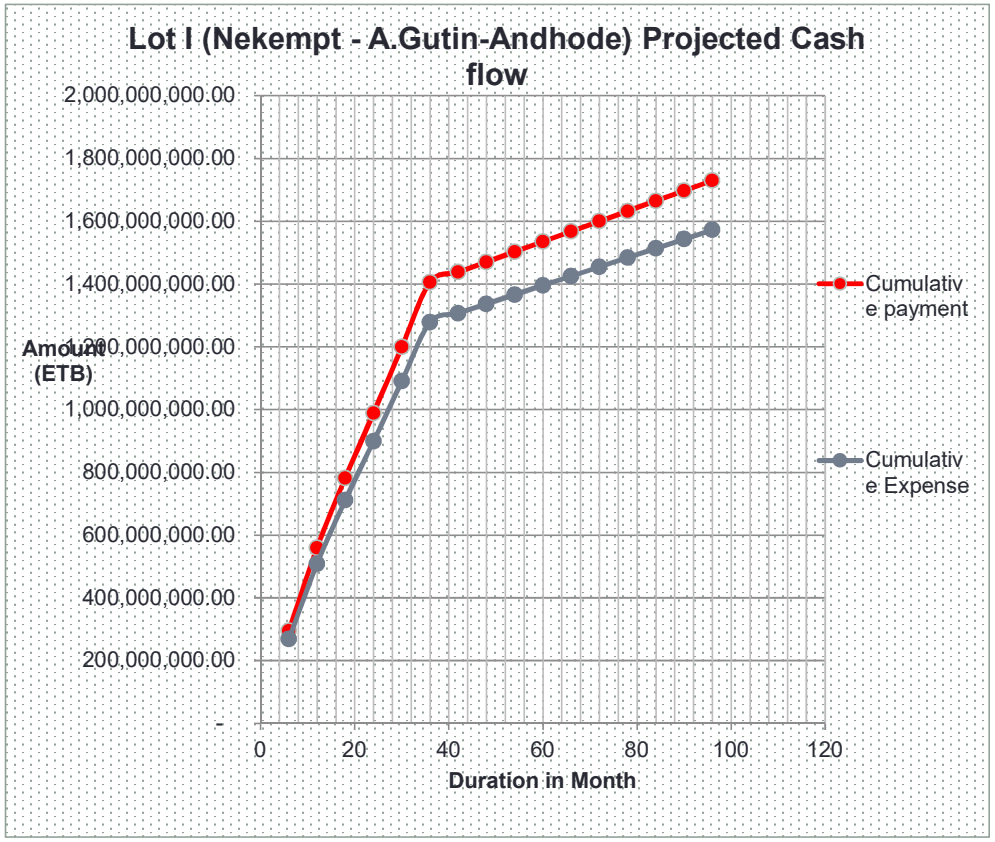
The payment modality of the projects is classified into three parts and the Contractors (Contract amount) to conduct the projects is presented below;

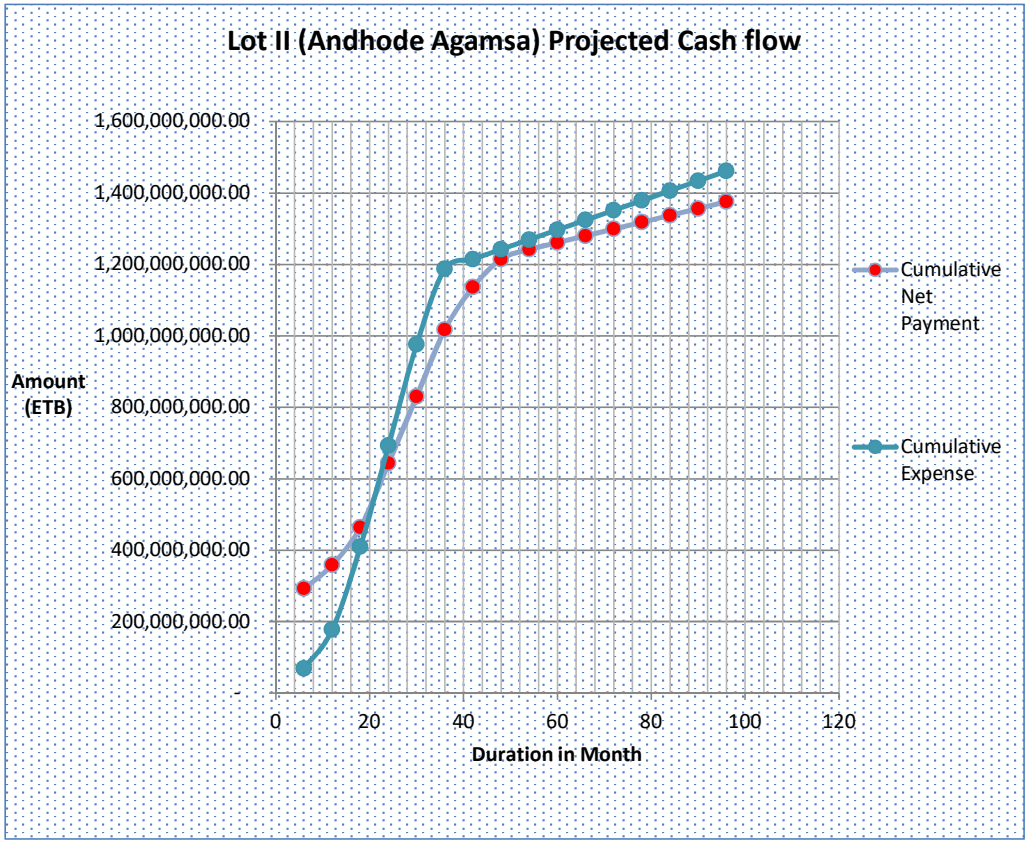
- A-1- Design and Construction of Improvement works- 70%
- A-2 – Management and Maintenance services – 30%
- B – Emergency works – Bill of Quantity based

Project Name						
Item	Lot I (Nekempt - A.Gutin-Andhode)		Lot II (Andhode Agamsa)		Lot III (Agamsa-Bure)	
	ETB	USD	ETB	USD	ETB	USD
A-1	610,572,605.92	21,720,072.99	311,537,926.5	34,598,087.15	737,103,381.4	22,193,355.96
A-2	261,673,973.97	9,308,602.71	133,516,254.2	14,827,751.63	315,901,449.2	9,511,438.27
B	39,827,539.55	1,416,796.39	22,461,355.96	2,494,463.39	44,819,801.69	1,349,473.95
Sum	912,074,119.44	32,445,472.09	467,515,536.62	51,920,302.17	1,097,824,632.19	33,054,268.18
VAT	136,811,117.92	4,866,820.81	70,127,330.49	7,788,045.33	164,673,694.83	4,958,140.23
USD/ETB Conversion rate		20.36		20.559		20.3555
Total Amount (ETB)	1,808,395,615.55		1,765,186,783.27		2,036,259,906.35	

4. DATA ANALYSIS

4.1. CASE STUDY cont…





4. DATA ANALYSIS

4.1. CASE STUDY cont…

Findings of the Case Study

contractual gaps observed;

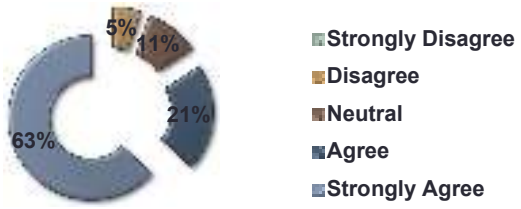
- The Contractors Projected Cash flow diagram is not presented considering the scope of the work and features of the Output and Performance delivery system
- The Cash flow capacity of the Contractors is not in line with the demand of the project,
- For OPRC contract the Contractor has to carryout Engineering and Design before the submission of the bid to be competitive and responsive. However, the time allotted for the preparation and submission of bid is not sufficient.
- The lack of expertise on the OPRC delivery system and lack of capacity of winning contractors
- Delay in Right of Way Removal processes by the Employer,
- No coordination and Cooperation between the Zonal, Regional and Federal Administrations in tackling project hindrances
- The mode of payment is creating cash flow problems on the Contractors,
- The burden of risk transferred to the Contractor is found very high based on the capacity of the Contractor,

4. DATA ANALYSIS

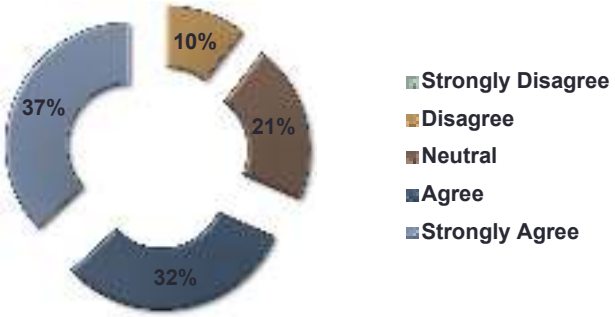
4.1. QUESTIONNAIRE

- As can be seen in the figure below, most of the respondents reaffirmed that the selection of the best project delivery system will increase the impact of the projects accomplishment towards the Cost, Time and Quality triangles of the project.
- It is well known that triple constraints (i.e. Time, Cost and Quality) shall be managed in Projects delivery. Each Constraint as expressed in the Project Triangle are connected and interrelated to one another and affecting or changing one parameter will obviously affect the other two.

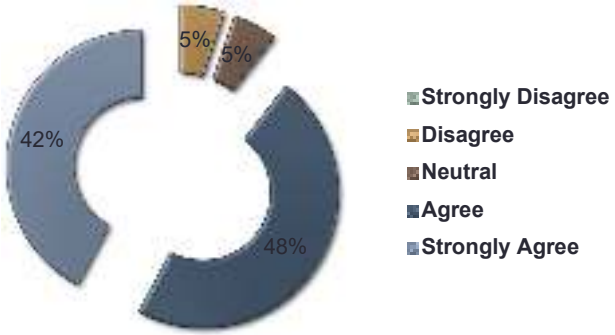
Finalizing the project within the anticipated cost



Finalizing the project as per the scheduled time frame



Finalizing the project complying the desired quality



4. DATA ANALYSIS

4.1. QUESTIONNAIRE cont.…

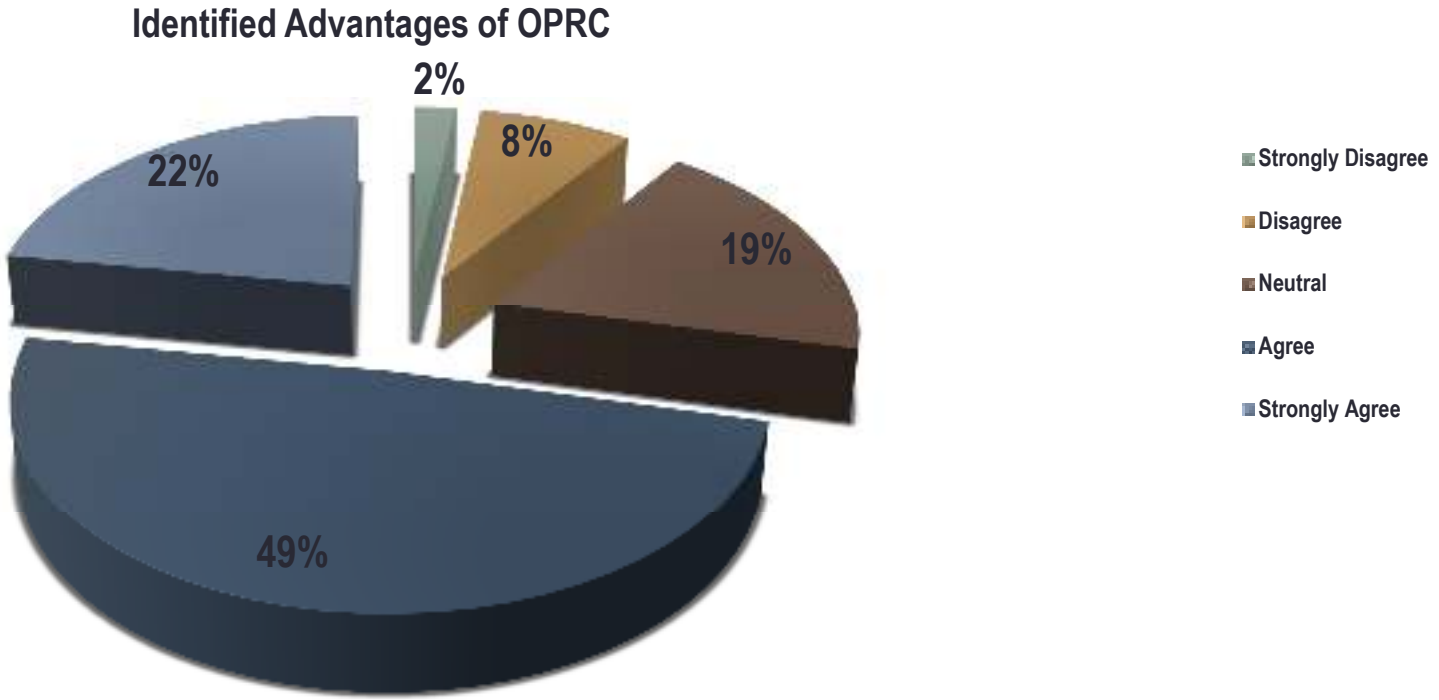
Additional findings

- The project delivery system shall be evaluated at the contract formulation stage.
- The selection of the best project delivery system has a high impact for opening rooms for Public Private Partnership and maximizing or minimizing design deficiencies that affect the projects service life.
- Dealing with complex Projects requires the selection of the best project delivery system,
- The lack of expertise on the OPRC delivery system and lack of capacity of local contractors was identified as a major gap
- Delay in Right of Way Removal processes from the Employer's side shall be mitigated through delivering the possession of site before commencing the work,
- The rules and regulations of the country are challenging and unattractive for new Contractor's,

4. DATA ANALYSIS

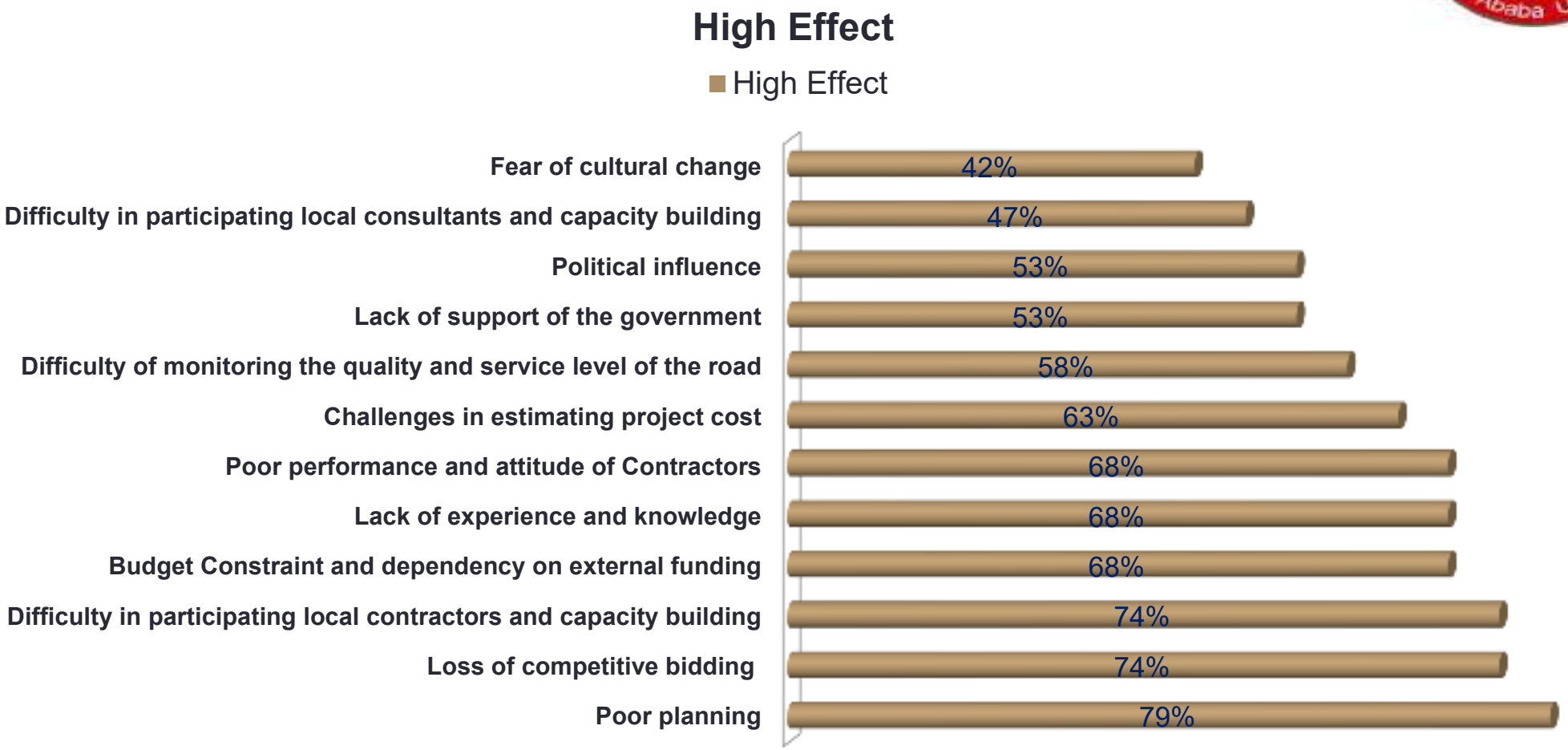
4.1. QUESTIONNAIRE cont…

- Amongst the identified advantages of OPRC system from the Desk Study as compared to other commonly used/conventional project delivery systems, 71% strongly agreed and agreed that OPRC have the identified advantages over the conventional project delivery system,19% stayed neutral on the concept and the rest disagreed as shown below



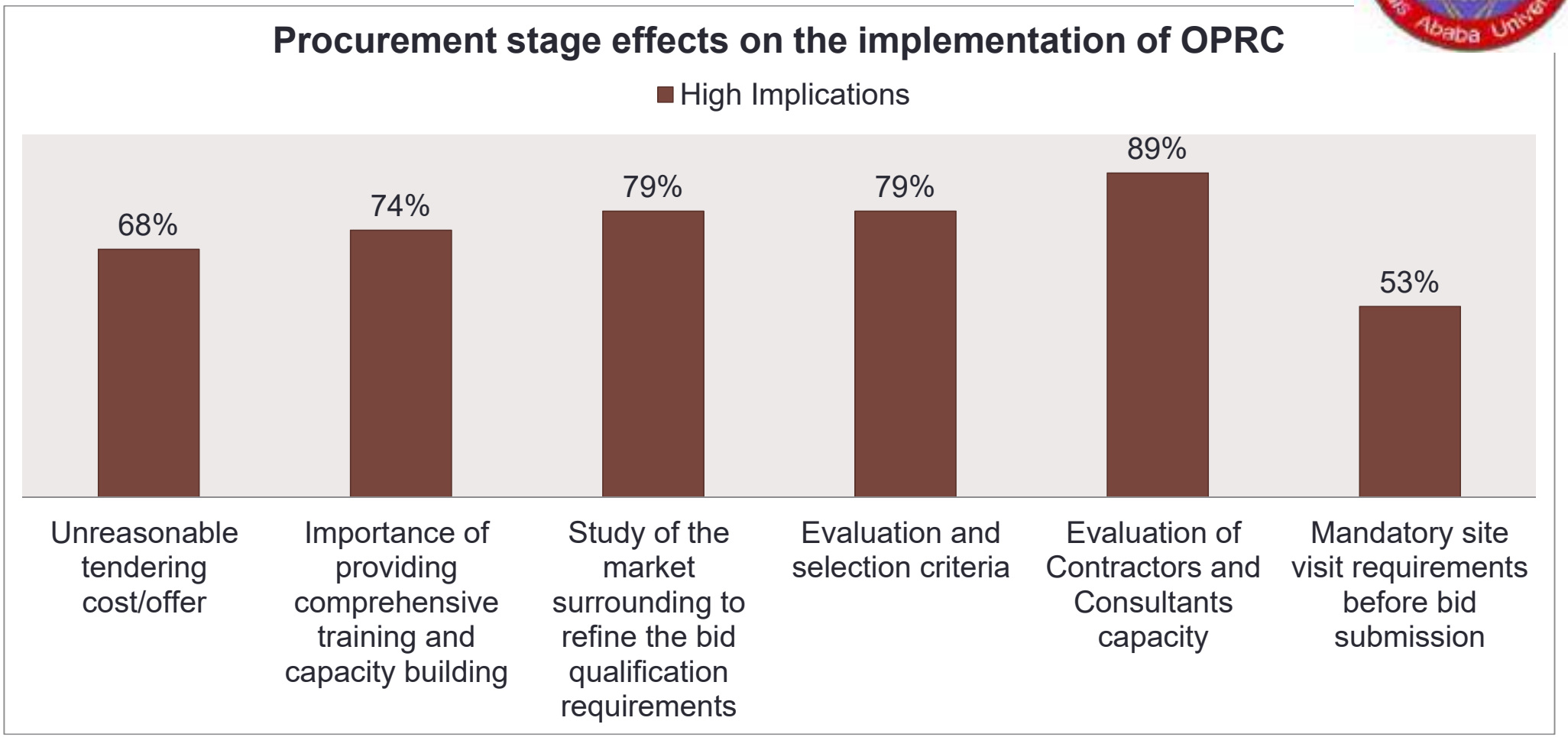
4. DATA ANALYSIS

4.1. QUESTIONNAIRE cont…



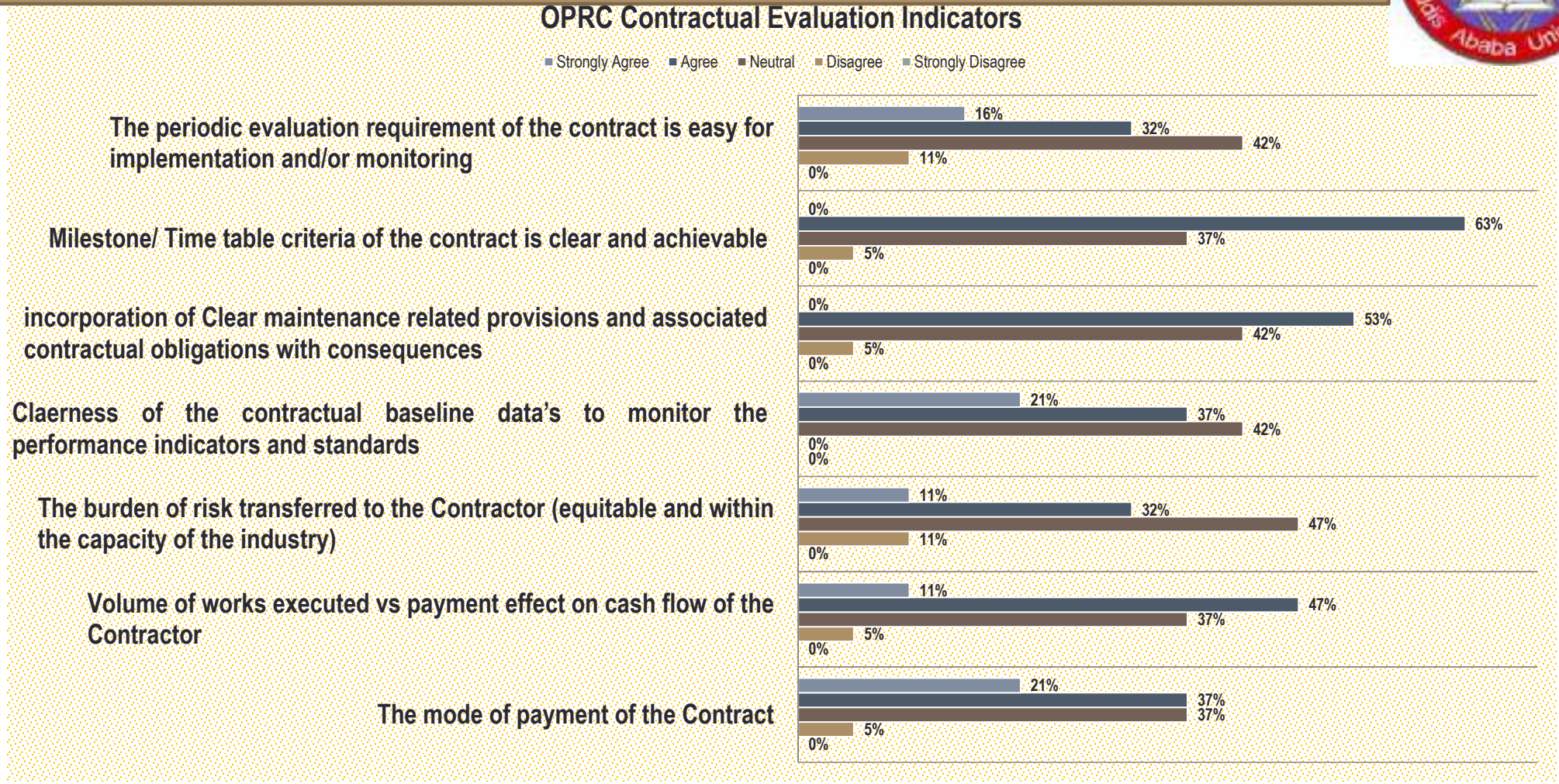
4. DATA ANALYSIS

4.1. QUESTIONNAIRE cont…



4. DATA ANALYSIS

4.1. QUESTIONNAIRE cont…



4. DATA ANALYSIS

4.1. QUESTIONNAIRE cont…

Other comments provided by respondents;

- Lack of clear contractual measures for the Contractors failure to attain maintenance and improvement work requirements of the contract,
- The Contract lacks rooms for means of correcting any contractor defaults,
- As a PPP model, the Employer must understand his obligation,
- The Financial Model of the Contractor shall be part of the prequalification and post qualification criteria,
- It is observed that most Contractors and the Employer do not have any Financial Models,
- Contractor's fail to have a realistic program ,
- The Contractors lack of understanding of the project needs and resource requirements, wrong perception towards enforcement of the contract provision and rely on support from the Employer during implementation despite clear obligations of the Contract,
- The Projects that qualify for OPRC contract must be identified in advance. Long list of potential projects for OPRC Contract should be debated in advance,
- financial risk to the Employer due to the payment modality,
- The reduction of the supervision engagement creates risk of quality,
- The Financial Institutions capacity to avail loan must be carried in Advance,
- Project formulation and development must be carried in advance,

4. CONCLUSION

- The selection of the suitable project delivery system have a paramount impact on projects success accomplishment from every Engineering parameters,
- Though introduction of OPRC was an appropriate decision to the road sector to curb the common phenomenon of cost overrun, time overrun and quality and mainly avoiding maintenance headaches (asset management) headaches of the Employer, selection of the right project suitable for the delivery system shall be taken into consideration in advance at planning stage,
- Even if theoretically OPRC project delivery system has significant advantages over the conventional project delivery systems, the current performance of the pilot case study projects (Nekempte – Bure) is unsatisfactory due to a number of attributable reasons,
- Lack of expertise of the Employer, the Consultant and the Contractor on the OPRC delivery system supported by lack of technical and financial capacity of Contractors is majorly identified as a gap,
- The Contractors Projected Cash flow diagram submitted along the tender is not presented considering the scope of the work and features of Output and Performance delivery system as verified during the implementation phase. And, the Cash flow capacity of the Contractors is not in line with the demand of the project. Further, Contractor's fail to have a realistic program that takes into account the physical works in tandem with the cash flow requirement,
- Employers defaults with respect to timely removal of RoW obstructions should be avoided/minimized

5. RECOMENDATION

- The Ethiopian Roads Authority should evaluate the pilot Output and Performance Road Contracting project contract documents thoroughly to rectify the unattainable conditions, provisions and ambiguous obligations of the contract noted for future procurement of similar projects.
- The Contractors Financial Model shall be part of the prequalification and post qualification criteria and shall be present with the tender with adequate evidences to assure the capacity of the Contractors and the successful accomplishment of the projects,
- Projects that are suitable for Output and Performance Road Contracting project delivery system must be identified in advance and long list of potential projects for OPRC Contract should be debated in advance by professionals and experts to assure the successful accomplishment of the projects,
- The supervision Consultants engagement to monitor the day to day quality of works and limiting the role of supervision to only evaluating end products and service levels will create loss of control of the quality of works and might lead to risk of quality and hence the Supervision consultants role should be revisited so as to engage the Consultant in controlling the process of works also,
- The Contracting parties must identify all the associated problems that contributed for the unsatisfactory accomplishment of the case study pilot projects so as to resolve the identified defaults on this independent project (but not limited to) for the successful accomplishment of the projects. Further, the defaults must be avoided for any future projects to be implemented with the delivery system.
- comprehensive researches without limitations shall be conducted on Output and Performance Based Project delivery system to identify is importance's, challenges and suitability for different scope of projects prior to proposing the delivery system further,

6. ACKNOWLEDGEMENT

This research work comes to an end with due support from different individuals and organizations.

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Thank
you!!