

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,
KUMASI, GHANA**

**Construction of Roads Using Labour Based Technology; Opportunities and
Challenges in Feeder Roads**

by

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Built Environment in partial fulfillment of the requirement for the degree of a

MASTER OF SCIENCE

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DECLARATION

I hereby declare that this submission is my own work towards the MSc Construction Management and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

The use of construction investments as a tool for governments to stabilize the economy shows the industry's key position in national development strategy. Construction of transport infrastructure specifically feeder roads provides a great stimulus for development. Labour Based Technology is seen not only as a sustainable approach to feeder road construction delivery but as a critical means of providing employment to the wider rural community. Despite this, literature shows that the adoption of this technology is on the decline. Against this background, this study sought to identify the level of experience of contractors in using labour based technology in feeder road construction, the opportunities for road contractors in the construction of feeder roads using labour based technology and to identify the challenges for road contractors in the construction of feeder roads using labour based technology. Following the literature review, quantitative research approach was adopted to collect data. The data was collected by administering questionnaires to the contractors based in the Upper East region with experience in Labour Based Technology. Adopting convenience sampling approach, a total of 25 contractors were surveyed. Relative Importance Index and Mean Score Analysis were used in analysing the survey data collected. The results revealed that the major challenge to using Labour Based Technology is the need for training and skills development of the workforce. The study also found that misconception about labour based technology poses a pronounced impediment to it being adopted and used. Moreover, employment was the most paramount opportunity provided by labour based technology. Key recommendations include provision of training programs to increase the skills and capacity of labour based road contractors.

Keywords: Feeder Roads, Labour Based Technology, Road Contractors

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*** * GOD BLESS YOU ALL * ***

DEDICATION

I dedicate this research work to the Deputy Director of the Department of Feeder Roads, the Regional Manager of Upper East Region and his Deputy for their support and encouragement throughout the research. It also goes to all those who contributed in one way or the other to enable me reach this level of my education.



CHAPTER ONE INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Empirical evidence points to the key input the construction industry has on economic development (Giang & Pheng, 2011). Major inputs of the construction industry to the economy come firstly from the connections between the construction sector and the economy as a whole, and the inter-sectorial linkages between construction and other sectors as well. The use of construction investments as a tool for the government to stabilize the economy also shows the industry's key position in a national development strategy.

Poor roads in many developing countries usually have undesirable effects not only on agricultural production but also on the entire socio-economic development (Ipingbemi, 2008). Burningham and Stankevich, (2005) averred that poor accessibility in rural areas often slows down the diffusion of new technologies and techniques, increases production and marketing costs, reduces spatial interaction and limits access to education and health facilities. It also constrains mobility and aggravates isolation (Burningham and Stankevich, 2005).

Feeder roads are generally low volume earth or gravel roads connecting one rural community to another or connecting a trunk road to a rural community (Ampadu, 2001). In many African countries these roads constitute over 50% of the total road network and in Ghana these are the class of roads that employ labour-based technology alongside the conventional equipment-intensive technology for their rehabilitation (Ampadu, 2001). The relative cost of constructing these roads is one of the important considerations for the choice of either labour-based or equipment-intensive methods for their rehabilitation (Ampadu, 2001). The use of labour-based methods for road works

has been an important part of the strategy to improve rural transport infrastructure in Africa over the past twenty-five years. Labour Based Technology in road construction is a process whereby inputs into production is largely based on labour using non mechanical tools and for particular works that cannot be done efficiently by labour simple equipment are used. Studies show that techniques best suited are applied with not only efficiency but high levels of effectiveness taking advantage of locally available resources to achieve the required specification. The use of this technology has not only been proven to produce road products that have equal standard and of the same specification of equipment-based methods but also lead to reduction in rural unemployment.

Stock and de Veen (1996) report that projects of smaller nature were started in low income countries to show how economical labour based methods were. Moreover, such methods took place between the late 1970's and 1980's and these smaller projects portrayed that the labour-based methods are economical (Stock and de Veen, 1996). Past studies have shown that the introduction of the labour based method in Ghana was engineered by the World Bank in early 1986 (Stock and de Veen, 1996). Financing of this project was supported by the International Development Association (IDA), the United Nations Development Program (UNDP) and the Government of Ghana and technically supported by the International Labour Office (ILO). The project involved the training and equipping of a group of small-scale contractors who constitute the Labour-Based Contractors (Stock, 1996). Ampadu (2001) provides that at the initial stage of the program a total number of about sixty contractors were fully trained and were registered with the MRT. It is generally argued that roads rehabilitated by labourbased methods cost less than those rehabilitated by the equivalent equipment-intensive technology.

1.2 PROBLEM STATEMENT

Jobs and skill creation have become a major preoccupation of African governments and Ghana is no exception. Despite strides towards improved economic performance one major challenge that seems to elude most governments is unemployment (International Labour Organisation, 2012). It is reported that unemployment rose by about 20% between the periods of 2005 to 2008 (International Labour Organisation, 2008). BaahBoateng (2014) avers that unemployment comprises the poor utilization of human resources and the consequential effect is loss of potential income tax revenue to a country due to such key resources being allowed to waste away.

Labour-based methods are justified socially because they would reduce rural unemployment by providing jobs on the road sites (Stiedl & David, 2003). Labour based methods are thus seen as a strategic tool in solving unemployment in developing countries. Studies show that work carried out by labour-based contractors are on average around 30% less expensive in financial terms than the equipment-based equivalent, and generates six times the employment for each dollar spent (Stiedl & David, 2003). Road products from labour based technology have been demonstrated to be of the same standard and quality of equipment based methods. Despite the advantages accrued from labour based approaches, this technology seems to have rather declined in used and even far less popular with both government and most road contractors. The study seeks to find out what opportunities and challenges presents itself to the road contractors in the construction of feeder roads using labour based technology.

1.3 AIM AND OBJECTIVES

1.3.1 AIM

The overarching aim of the study is to identify the opportunities and challenges for road contractors in the use of labour based technology in the construction of feeder roads.

1.3.2 OBJECTIVES

- To identify the level of experience of contractors in using labour based technology in feeder road construction
- To identify opportunities for road contractors in the construction of feeder roads using labour based technology
- To identify challenges for road contractors in the construction of feeder roads using labour based technology

1.4 JUSTIFICATION

This study by its orientation will provide pragmatic understanding of the opportunities and challenges inherent in the adoption of labour based technology for road construction. By understanding the obstacles faced and circumstances surrounding these hindrances the study will provide road construction companies with the impetus to quickly circumvent these issues, improve company performance and be better financially positioned. Findings from the study will thus enable contractors to better handle challenges encountered in the use of labour based technology. Research results will also help in the development of policy to guide in the use of labour based technology in feeder road projects. Finally the study will contribute to the understanding and knowledge area of labour based technology in Ghanaian road construction.

1.5 METHODOLOGY

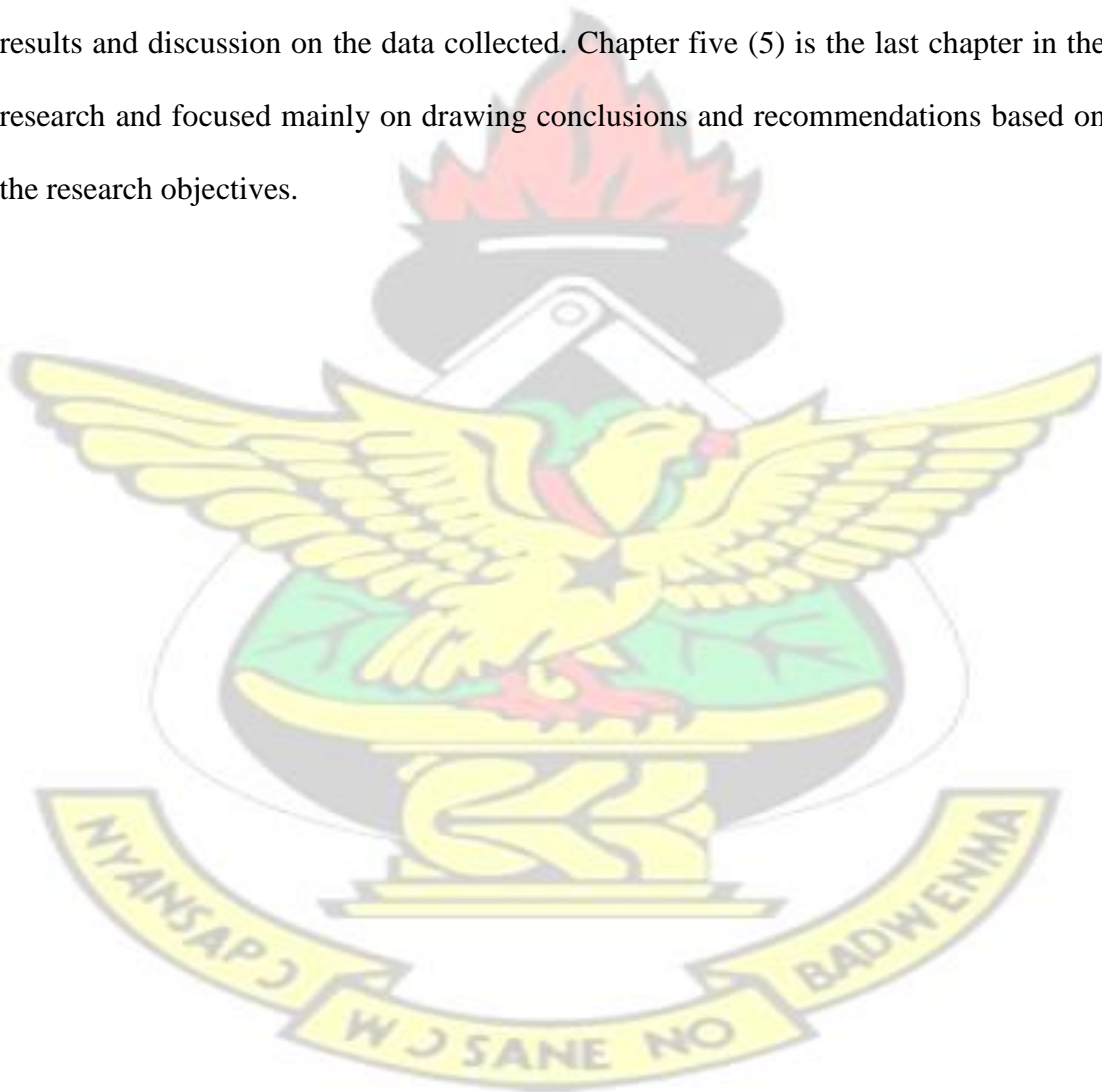
The research methodology involved the collation of both primary and secondary data. Secondary data was chiefly gathered using desktop study. The collation of secondary data provided the identification of key studies in road construction using labour based technology with its attendant opportunities and challenges. Having identified the required backdrop and understanding of literature in the said field a quantitative research method was adopted for the study. Data collection for primary data involved the use of questionnaires administered to road contractors and consultants. The questionnaire incorporated the use of close ended questions and a likert scale to rate, rank and answer questions posed to respondents. The mean score ranking and the relative importance index was used in analysing the data collected to identify key challenges and opportunities.

1.6 SCOPE OF THE STUDY

This study explored road construction using labour based technology of Ghanaian road contractors with a sharp focus on both A1B1 and A2B2 working on feeder roads projects in the Upper East Region of Ghana specifically the Nadom District. Two main reasons are advanced for the selection firstly the class of contractors by definition are companies that do not have a high responsibility placed on them to own capital equipment's thus have the liberty to incorporate a level of human effort in carrying out road based works. Secondly the selection of the area brings to fore the research needs of the study i.e. exploring feeder roads which is a rural based construction activity.

1.7 ORGANISATION OF THE STUDY

The study is arranged into five chapters. The first chapter provides background introduction of the study; the research problem; the aims and objectives as well as scope. The chapter which follows presents review of literature in the subject area under discussion. In chapter three the underlining research approach and method adopted for the study is discussed. This provided an appropriate framework for the selection and discussion of the quantitative study that will be used in the study. Chapter four present results and discussion on the data collected. Chapter five (5) is the last chapter in the research and focused mainly on drawing conclusions and recommendations based on the research objectives.



CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The construction of feeder roads is a key developmental tool in developing countries having both economic and social gains. Feeder roads links major roads to various agricultural products located in the rural areas. The need to ensure such roads are in top notch cannot be overemphasized. The lack of feeder roads has a negative effect on the economy. Due to the high importance placed on such roads, it is imperative to adopt approach that will ensure that these roads are not only well constructed but also maintained. This chapter reviews extant literature on road construction using labour based technology. The review captures various opportunities, challenges and drivers of using such technology. The review is also contextualised by exploring the various characteristics of labour based technology used on feeder roads in Ghana.

2.2 OVERVIEW OF ROAD INFRASTRUCTURE IN GHANA

For any developing country, road infrastructure is seen as one of the most important means of transport within that country. The case is no different for Ghana. The development and maintenance of roads in the country is done under the jurisdiction of the Ministry of roads and Highways. The ministry has under its umbrella, three main agencies responsible for developing and maintaining the three main different categories of roads within the land transport system of Ghana. They include;

- The Ghana Highway authority
- The Department of Urban Roads
- The Department of Feeder Roads
- For the purpose of this study a sharp focus is placed on the department of Feeder roads.

2.3 FEEDER ROADS IN GHANA

In Ghana, roads in the rural communities that feed into major roads are referred to as Feeder roads. They are usually characterized by culverts in cases where there is a river. The task of ensuring that feeder roads are properly constructed falls under the jurisdiction of the department called Feeder Roads within the ministry. Among many others the prime objectives of the department include; protection of investments made on improved roads through adequate maintenance system; implementing measures to mitigate the negative environment impact of road schemes. The principal function of the department includes the planning of the development and maintenance of feeder roads. Various reports show that the approved length for routine maintenance activities has increased steadily over the period 2004-2007; it however declined in 2008 to 23,600. In recent years reports show a decreasing trend in achievement of maintenance activities, minor rehabilitation and upgrading works. It is also reported that government expenditure has been on the increase with regards to feeder road projects. The report shows that there has been relative increase of expenditures on minor rehabilitations than on maintenance activities.

2.4 LABOUR BASED TECHNOLOGY

Labour based technology is not a new technology. Studies show that this has been in used during the colonial times. The technology involves the use of locally available human and material resources for the construction and maintenance of infrastructures (Majeres and de Veen, 2001). The construction of road involves a number of activities. Such activities usually require the use of both labour and equipment resource to provide the required products. The use of labour-based technology involves the application of labour in a large fraction and augmented with light equipment as and when necessary due to quality and cost reasons (Ampadu, 2001). A typical example for the inclusion of

light equipment includes activities such as long distance hauling and high quality surfacing works.

To put things in perspective, the use of labour-based technology hinges on the optimal use of labour as the major resource and ensuring that cost-value and the required specifications are achieved. Majeres and Veen, (2001) averred that it should be made clear the difference between the maximisation of labour and the optimal (and efficient) use of this resources. They explained that certain projects may require maximisation of labour such as projects where the major focus is on income generation and job creations. They cite activities such as disaster relief or food work as an example of such categories. ILO stresses on the sustainability of labour based approaches which requires the optimize use of labour and not necessarily make-work approaches where quality and cost effectiveness are snubbed (Stock, 1996).

However, it should be noted that labour based technology cannot be used in all situations especially works involving huge infrastructure. For works with high level of technical specifications required the necessary heavy equipment must be used. In such scenarios labour based methods will not be financially suitable as a replacement. Nevertheless, labour based technology can still be used for selected construction activities and the maintenance of the created assets. Ampadu (2001) reports that labour based technology brings in many compelling advantages in developing countries especially. This is attributed to many reasons one key being the abundance of labour.

2.4.1 BACKGROUND

The adoption of labour based technology by developing countries was an initiative embarked on by both the World Bank and ILO (Stock, 1996). This initiative was as a result of a research work carried by the World Bank and ILO. This was in response to population growth and increasing poverty in developing countries. Programmes were initiated to provide protection to the improvised. The rising unemployment, underemployment and low returns to labour in most African countries were considered as a leading cause of poverty. The World Bank (2002) argues that any policy that drives employment creation is essential for poverty reduction. Cross-country empirical evidence lends support to this view; the evidence shows that growing employment has a positive impact on wealth creation thereby reducing poverty (Islam, 2004). Studies show that the international community and some governments have been exploring labour based technology for employment creation in improvised areas.

Across Africa, Kenya and Botswana have recorded positive figures in the creation of jobs through labour based technology. Case in point, from 1974 to 1996, Kenya produced 24 million days of work. Moving across to Asia; India generated a billion worker days in the year 1995. Similar figures have also been reported in Latin America.

Devereux and Solomon (2006) report that one key policy instrument in low and middle income countries is employment creation thus labour based technology has played a very instrumental role. Both the World Bank and ILO have been providing financial and technical assistance towards labour based works (Stock and de Veen, 1996).

Many infrastructure works have resulted from the used of labour based technology including waste management schemes, irrigation works and roads. Kannemeyer et al. (2007) report that some concrete pavement works in South Africa is done with labour

based methodologies. Also gravel roads have been rehabilitated in Ghana using such technologies. The Asiatic regions have also explored this technology having repaired thousands of miles of road using labour based methods (Majeres and de Veen, 2001).

A critical backbone of labour based technology in severe fiscal constraints regions is the financing of such programs. Historically international donors or concessional loans from international financial institutions have often fully financed or in some cases cofinance such programmes by the offering of grants and the like (von Braun et al., 1992).

Technical support is usually offered by donors when they play a major role in financing (Devereux and Solomon, 2006). Due to new policies including that which favoured cost subsidies on imported equipment most developing countries became driven towards capital intensive construction works. The World Bank's Guide to Competitive Bidding on Construction Projects in Labour Abundant Economies (World Bank, 1997) contended that despite labour based technology being easily justified, administrative works and processes were tilted towards the use of equipment-based technology. The guide stated that by "neutralizing" the contract and administrative procedures, bidders would naturally select a more appropriate technology mix (Stock and de Veen, 1996). This took place even though labour was in abundance and capital was scarce. The long term effect on construction due to such policies was making equipment based methods cheaper than labour based. However Stock (1996) argued that labour based methods are justified in developing regions due to both social and economic grounds. Ampadu, (2001) also advanced that aside financial reason certain conditions made this type of technology more justified.

2.4.2 DRIVERS FOR LABOUR BASED TECHNOLOGY

It has already been established the pivotal role labour based technology plays in both the social and economic environment of many developing countries. During the 1990s this role became more apparent as the climate made it a fertile ground in pushing for labour based technology (Ampadu, 2011). The socio-economic environment at that time re-emphasized the need for novel job creation and prioritizing programs that had a positive impact on the community i.e. labour based method (International Labour Organisation, 2012). A natural outgrowth of such programs was skills transfer to the poor communities. These skills transfer made it possible for subsequent activities to be possible for the betterment of the community such as decentralised maintenance approaches relying mostly on both local funding and management.

Labour based technology are made possible with the right regulatory framework thus the support of government agencies is imperative. A look at best practices and lessons gleaned from such projects make it possible for various models to be developed. The required institutional and capacity building needs to be there to avert the long term failure of such worthwhile projects.

2.5 OPPORTUNITIES FOR ROAD CONTRACTORS IN FEEDER ROADS WITH LABOUR BASED TECHNOLOGY

Many opportunities abound in the use of labour based technology for feeder road projects. The World Bank and the ILO based on such justifications moved into designing programs that will facilitate the use of labour based technology in the public sector (McCord, 2005). The focus was on the public sector principally due to economic ramifications including distortion of factor prices which had the negative effect of making equipment based methods cheaper for contractors than labour based methods.

Also many African countries were still in the developmental stage of building their local private sector capacity for contracting road works. The World Bank and ILO argued that these methods had both social and economic benefits (International Labour Organisation, 2008). The section that follows looks at the various opportunities present in the use of labour-based technology.

2.5.1 COST EFFECTIVE

One of the most important considerations in the choice of either labour-based or equipment intensive technology for executing a given road improvement project is the relative cost of the project as executed by the two technologies (Stock and de Veen, 1996). Studies have already documented the cost effectiveness of labour based technology over capital intensive ones (World Bank, 2002; Devereux and Solomon, 2006; Stiedl and David, 2003). In general, the cost of road works by labour based and equipment-intensive methods may be compared either through the analysis of the unit costs of the component activities or through the analysis of historical data of completed projects.

A study by Ampadu (2001) did a comparative cost of the component activities between labour based and equipment intensive technology for a road construction project. This paper reported on data collected as on a research work at the Kwame Nkrumah University of Science and Technology (KNUST) which sought to generate comparative cost data for equipment intensive and for labour-based feeder road projects and to identify the factors that affect their relative costs. The paper also presented a first attempt at a predictive model for estimating the preliminary cost of gravel road rehabilitation based on the technical content of the project.

Based on the results of 12 labour-based and 10 equipment-intensive projects constructed between 1996 and 1998 in one ecological zone in Ghana, the following preliminary conclusions were made concerning the relative costs of rehabilitating feeder roads in Ghana.

1. At the operations level, the mean unit cost of clearing, reshaping and gravelling by equipment intensive methods are lower than by labour-based methods, but for culvert construction, and earthworks labour-based methods are cheaper than equipment-intensive methods.
2. The main difference in technical content between equipment-intensive projects and labour-based projects lies in earthworks and haulage. The average earthworks content on an equipment-intensive project of about 820 m³/km is about 3.8 times that on a labour based project. Also the mean haulage content of 1270m³-km/km of equipment-intensive projects is about 1.5 times that on the equivalent labour-based project.
3. Different linear regression models involving the cost per kilometre of projects as dependent parameters and the Clearing (X₁), Reshaping (X₂), Earthworks (X₃), Gravelling (X₄), Culverts (X₅) and Haulage (X₆) contents as independent parameters may be constructed for labour-based and for equipment-intensive projects and predicts fairly well the overall cost per kilometre of projects:
 - For rehabilitation projects involving only clearing, reshaping and gravelling equipment intensive projects are about 7% cheaper than the equivalent labour-based projects.
 - For normal culvert, earthworks and haulage contents, labour-based projects are about 5% cheaper than equipment-intensive projects.

- For normal culvert high earthworks and haulage content equipment intensive projects are about 12% cheaper than labour-based projects.

This study corroborates the argument that labour based technology is much more cost effective.

2.5.2 EMPLOYMENT

One of the social justifications for labour-based methods hinged on the fact that they lead to reduction of individuals deprived of jobs providing opportunities for employments on road construction sites (World Bank, 2002). There has always been the need to address rural unemployment but this was underscored more during the periods between 1960s and 1970s (International Labour Organisation, 2008). Edwards (1994) reports that lack of jobs in the rural areas motivated individuals to look for the employment in the cities and their inability to find occupation in many instances had led to societal unrest and breed other social vices. This compounded by the fact that rural areas are less attractive than urban areas principally due to concentrations of infrastructural development in the cities. The use of labour based technology meets two burgeoning problems; firstly creation of jobs which resolves the rural unemployment and secondly reducing the urban bias in infrastructure investment (Edwards, 1994). This approach leads to the creation of labour markets in areas where these were underdeveloped or non-existent and further produces employment for a substantial percentage for the local folks (most especially the rural poor). And since most of the rural inhabitants stay within their localities the wages earned will be spent in their communities, which will result in an important impetus for the local economy as well as subsequent multiplier effects for the greater economy (Stiedl and David, 2003). International Labour Organisation (2003) noted in Mozambique that the use of labour

based approach led to the creation of 8 million worker-days employment in the country between 1994 and 2000.

2.5.3 INDIRECT EMPLOYMENT

Labour based method takes advantage of resources at the community level and thus enhances democratic participation (Thwala, 2001). Similarly, it can also result in the generation of indirect employment for many rural people if certain percentage of the wages earned is kept as “Funds”. Such funds can be used for productive projects in the community such as poultry keeping, communal shops, purchase of livestock etc. This will result in additional indirect employment within the community. For instance, Contreras and Cartier (2004) observed in Peru that the Micro-enterprises used Social Funds to finance community activities such as cleaning works, painting of schools and the installation of drinking water. The communities in turn helped the micro-enterprises in certain road maintenance activities through community efforts. The Fund can also serve as a contingency fund to cover late payment of salaries/wages and as well as act as a type of health insurance fund. The transfer of funds has many multiplier effects on the local economy during economic recessions. It provides capital for use by poor households for consumption and stability in employment (Ravallion, 1990; Ninno et al., 2009).

2.5.4 ASSET CREATION

Most of the roads infrastructures constructed or maintained through the use of heavy equipment are not sustainable because it alienated the beneficiaries from actively participating in such infrastructure, hence their failure (International Labour Organisation 2008). However, labour based approach is less expensive method of producing appropriate road assets that are durable, sustainable and of good quality (International Labour Organisation, 2008). This is because the beneficiaries of the

development projects are allowed to actively take part in the identification, prioritization and execution of road infrastructure asset that addresses the access needs of members of the rural community (Stiedl and David, 2008). Also, the involvement of rural people in this type of programme promotes local participation; create sense of ownership as well as enhancing capacity building and local empowerment through skills transfers (Stiedl and David, 2008). It will also sharpen their technical abilities and entrepreneurial skills and enable them to initiate various productive projects. This is critical for maintaining and operating the asset for the future

An added advantage of this road assets created is that it makes key markets and public services including health facilities easily accessible (World Bank, 2002). This has an ensuing effect on reducing both transportation expenditure and time. The accessibility of public transport services will also increase. However, the overall benefits are rural roads sustainability and poverty reduction in the rural areas.

2.5.5 FINANCING CONSTRUCTION WORKS

The World Bank (2002) reported that labour-based methods are less expensive than equipment-based methods. They show that in direct financial terms, full rehabilitation of feeder roads are 18% less expensive and 50% less costly for spot rehabilitation. Attaching economic figures to these two major methods it is shown that labour based methods are still more advantageous: 38% cheaper for full rehabilitation and 60% for spot rehabilitation. Statistics also show that measuring the financial advantage in terms of employment generation effect is higher. Study reports that the proportion of cost spent on salaries, mostly for the unskilled, ranged between 44% and 60%, against 3% 8% in equipment-based works. An investment of US\$23 million in feeder roads rehabilitation would generate 107,000 jobs (directly and indirectly) if carried out with labour as against 36,000 jobs if carried out with equipment (Transport UK, 2002).

2.5.6 MACRO-ECONOMIC EFFECTS

The benefits of labour-based approach to the rural economy are numerous, however, only few of them will be considered here. In the same vein, where practicable and cost effective, the application of labour based approach to rural road maintenance results in a substantial savings in foreign exchange and an increase in the utilization of local resources which in turns stimulates the local economy; since it will not be necessary to import machine, material or personnel from abroad (Devereux and Solomon, 2006). Investing US\$23 million in feeder roads rehabilitation would produce 107,000 jobs (directly and indirectly) as against 36,000 jobs with equipment (Stock and de Veen, 1996).

2.6 CHALLENGES FOR ROAD CONTRACTORS IN FEEDER ROADS WITH LABOUR BASED TECHNOLOGY

2.6.1 POLICY

Policy plays a pivotal role in providing a conducive environment in which labour based road contractors can competitively work. Policy advice and decisions should be in the right direction to create an open market economy for such contractors. Collaborative research and development with various universities and learning institutions need to be on-going to expand knowledge of labour based technology. This will provide the empirical evidence in the creation of the necessary policies. Studies show that despite the fact that employment creation is a critical policy for the Ghanaian government it is not reflected in policy implementation. The Public Procurement Act, 2002 for example specifies that lowest price is not the only consideration in procuring works but economic development issues such as domestic investment is factored in. Provisions are also specified for preference for domestic contractors. Despite these there is lack of

clarity on these issues which should be assessed and weighted. Patol (2001) posited that road agencies should make a clear cut policy specifying the preference of labour based technology approaches wherever they are cost effective and technically feasible. The lack of the required programmes and support hinders the market growth of labour based contracting industry

2.6.2 LABOUR MANAGEMENT

One key aspect of labour based technology is the management of the labour resources (Anderson, 1995). Studies showed that conventional contractors expressed the opinion that the large workforce involved in labour based works made the management of such projects problematic and challenging (Devereux, 2002; McCutcheon, 1995). However trained contractors in the field had contrary view. The experience from such trained contractors showed that widely dispersed sites which were small in nature had lesser problems with labour than machine intensive sites. Reports also showed that labour management was not a challenge for small and medium firms as compared to larger construction firms (ILO, 2008, Stiedl, 2000).

2.6.3 LATE PAYMENT

A characteristic of road works mostly funded by the government is delay in payment. Studies have shown that payment of contract certificates could delay by an average of 8 months. Reasons attributed to this have been in the past linked with bureaucratic process. This has damaging effect on the payment of labourers. Whereas equipment contractors may be able to renegotiate payments or even defer payments with suppliers, inability to pay workers on time would lead to disaster on site (Taylor and Bekabye, 1999; Stiedl, 2000). Other sources of financing exist but are largely expensive with mostly high interest rates as compared to financing for equipment's (Stiedl, 2000). This

is viewed as a major impediment for use of labour based technology on Ghanaian construction sites (Ampadu, 2011).

2.6.4 SPEED OF IMPLEMENTATION

Another contending issue with the use of labour is the speed of implementation. Studies show that a labour-based contractor would be producing an output of 10 percent of that produced by an equipment based contractor on a typical rehabilitated road per month (Stiedl, 2000). This has raised concerns among DFR staff about meeting annual targets of the department. Some however have argued that delays are experienced by equipment based contractors in both mobilisation and completion (Stiedl and David, 2003). This angle raises concerns about whether the speed of output is more important than the overall completion time of the project.

2.6.5 SPECIALISED TRAINING

It is worthy to note that the use of labour based technology requires the need of certain skills that have to be acquired through the necessary training (International Labour Organisation, 2003). Labour based works requires skills such as labour management and organisation and engineering techniques which take time to be acquired through the provided training (McCutcheon, 1995). Some have argued that the need for such skills has led to several months being wasted in supported training programmes (Subbarao, 1997). Such programmes need to be taken before a contractor can even prequalify for a labour based contract. Whereas a conventional contractor needs to only demonstrate staff and equipment capacity in the usual manner with accompanying experience in similar works. Some have argued that this training programmed acts as a disincentive.

2.6.6 EQUIPMENT LOANS

Studies show that capital required for working in equipment based method is less as compared to labour based methods (Stock, 1996). For most emerging countries the less working capital required by equipment based methods makes them more attractive than labour based methods (International Labour Organisation, 2003). This presents an impediment to most road contractors.

Devereux (2002) aver that it is standard for equipment loans (in the order of 150, 000US\$) to be provided for labour based contractors. These loans are intended for the acquisition of light equipment as part of the training package. These lights equipment usually tractors/trailers and pedestrian operated rollers are less expensive than the conventional set of equipment which is usually made up of grader, dozer, loader and trucks. These light equipment's are scarce on the second hand market in Ghana and most contractors use donor supported projects to acquire the said equipment (Stock, 1996). For the loans to be paid off, most contractors are provided with additional work on a continual basis with rates negotiated. The intention being to be able to generate more cash inflow from these additional works to pay of the equipment. This has both positive and negative effects. The positive effect is the assurance of jobs being offered most often for a number of years under specific programmes. The assurance of jobs has created a reliance on such programmes leading to such contractors not bidding for works within the normal competitive bidding process. The absence of any initiated program with direct support for such arrangements makes it difficult for such contractors to survive the market.

2.6.7 MISCONCEPTION ABOUT LABOUR BASED WORKS

One major hurdle that slowed the implementation of the use of labour based works was the misconception held by most governments and engineers (World Bank, 2002). This groups of people had the conception that this method was a “backward” technology and not laudable from their perspective. The major international group pushing for the use of labour based works, ILO had a different approach to the use of this technology. They were of the opinion that the right mix of labour and equipment should be used for road construction and not of the view that ever African road be built with labour only. This approach translated into most governments using labour and lighter equipment for mostly haulage and compaction works.

Despite this misconceptions being cleared, a review of experience in most developing countries still show that labour based methods were still repelled. Various factors still fuelled the resistance by government officials in this country. Firstly road rehabilitation works with equipment was faster than using labour. Anderson (1995) reported that this was evidently seen in rehabilitation works with equipment being 1.5 times faster than labour based. Adding that the equipment based method achieved a higher quality surface significant for heavily trafficked roads. Secondly labour management problems associated with labour based methods made them highly unattractive for most government officials (Edwards 1974; Edmonds and Miles 1984). It is reported in Asia that this methods is inundated with issues of corruption, low supervision and lack of work motivation (Riverson et al., 1991). There was the other hurdle of ghost names being added to the payroll worsening the already challenging situation

2.6.8 CONTRACT DOCUMENTATION

One major hurdle in the procurement delivery of labour based works is design of specific contracts for such works. This is largely due to the unsuitability of standard

contracts for labour based contractors to bidders. A few examples can be drawn from the work of Von Braun et al., (1991) in their study various works involving funding from GoG, DANIDA, IDA and DFID were explored. Key observations include; only contracts for DFID funded work were announced in the national press under the competitive bidding procedures; despite bids being competitive, contractors who have taken equipment loans were given more preference. Other observations include the contracts did not clearly specify the choice of technology type and this was left to the discretion of consultants in charge of tender document preparation and technical detail differences between labour and equipment contracts were scanty. This had the resultant effect of not excluding any peculiar technology approach. It becomes glaring clear that contractors are left with little option in deciding to use capital intensive approaches in a major part of their works.

2.7 EXPERIENCE FROM OTHER COUNTRIES

Many countries have utilized labour based construction at various levels. Many benefits have accrued from this venture. However like any other venture the use of labour based methods as described earlier has had its fair share of pitfalls and challenges. This section details some of the experiences garnered from various countries with regards to using the labour based method. It is reported that in Kenya for example, between 1986 and 1993 the Minor Roads Program rehabilitated 3240 km of gravel roads and in fiscal 1990 alone, employed 20,300 casual labourers (ILO, 2004). Labour based method has offered an attractive complement to a bundle of development instruments for poverty alleviation (Von Braun, 1991). Poverty has been reduced in areas such as Ethiopia where there have been scarcity of food and widespread poverty and the impact of poverty reduction has been most felt during drought seasons. Bangladesh reports a similar incidence (Ninno et al., 2009). The macro-economic model showed that the

indirect effects were even greater than the direct effects for each job directly created another 2 jobs elsewhere in the economy through a multiplier effect.

Other areas also show the large infrastructural benefit accrued from the use of this method. For example in Madagascar this approach has led to the reconstruction and repair of damaged roads, small dams, bridges and irrigation canals following natural disasters. Teklu, (1999) reports that this method has led to the immediate response of providing timeously needed infrastructure such as roads and health facilities mostly targeted at underprovished rural communities (Ninno et al., 2009). Labour based methods provide training for small scale contractors and transfer of technology to the rural communities (Weyers, 1999). Cross-country experience in training of communities is rather limited.

2.8 CONCLUSION AND GENERAL SUMMARY OF CHAPTER

This chapter reviewed pertinent literature in the area of labour based technology and also explored feeder road construction in Ghana to identify its unique characteristics. Following the research agenda, literature on labour based technology was reviewed in three major themes; drivers; opportunities and challenges for labour based technology. The varied experiences across the globe from labour based technology was also presented.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

One of the fundamentals of any research activity is the research methodology adopted. The next important step in any research process after study of literature and identifying the research question is deciding on the most suitable methodology (Cooper and Schindler, 2003). The research method concerns the procedures, methods and philosophical underpinnings employed to collate the requisite knowledge for the research question in view. This section presents the various discussions that went into the selection of the research paradigm. Having identified the research paradigm the research design is presented. Issues on population, sample size selection and sampling techniques are presented and discussed. The analytical tool to be used is also briefly discussed. This chapter succinctly describes the reasoning behind the research method used for the study.

3.2 RESEARCH PARADIGM

Research is not conducted in a vacuum but must be placed in its appropriate perspective. Consequently issues regarding philosophical design and approach must be looked at. It is already known that the philosophical position a research takes has significant impact on the research design (Tashakori & Teddie, 1998; Koetting, 1996). Typical philosophical issues such as epistemology, axiology and ontology have to be adequately addressed as this subsequently guides in the selection of the appropriate research instruments. A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used.

Ontology seeks to answer questions related to the nature of reality, looking broadly at investigating the various dimensions by which existence can be manifested (Saunders, et al., 2007). The research's ontological position can be placed into two main categories; objectivism or subjectivism (Saunders, et al., 2007). For the purpose of this research, objectivism is the position chosen. This position is selected as it reflects the research question. The research question being explored here excludes the influence of the researcher and the factors being investigated exist as external facts. In addition to the above the factors influencing labour based methods are objective in nature and not affected by the researchers experience or influences. The ontological position objectivism influenced the approach used to answer the various research questions that was posed.

Epistemology relates to the subject under investigation and the researcher. This deals with “what is knowledge” and the nature of nature of knowledge by exploring the dynamic relationship that exist between researcher and the subject in question (Saunders, et al., 2007; Ahadzie, 2007). Epistemology is used to define the knowledge through which the research process is investigated and developed (Smyth and Morris, 2007). Epistemology can be placed into two main perspectives; positivism and interpretivism (Denscombe, 2007; Saeidi, 2002; Saunders, et al., 2007). Positivist view looks at the social world as an objective reality and that reality can be explained by certain laws. Methods employed in this perspective prevent human influence or bias from the researcher (Kheni, 2008; Fitzgerald & Howcroft, 1998; Bryman, 2004). Three key principles is emphasized by this perspective; objectivity, measurement and repeatability. However with interpretivist the view taken is that of subjectivity. Emphasis is placed on the context in question and the understanding and the interpretation from the researcher's perspective is imperative (Fitzgerald & Howcroft,

1998; Bryman, 2004). The research under consideration must be done without the influence of the researcher and conclusions must be drawn objectively based on the field data collected. Thus for the purpose of this research the positivist stance is adopted. Consequently the identification of factors that lead to opportunities and challenges of using labour based methods for road works will be done objectively and the methods used for measurements can be replicated.

On the other hand axiology seeks to establish whether values are attached to the research results. Saunders et al., (2007) explain that axiology deals with whether an objective criteria can be used to examine the study (value-free) or whether a subjective criteria is apropos (value-laden). Since the values of the researcher have no role to play in identifying the factors in the research question a value-free disposition is chosen as the axiological position. According to Denscombe (2007) research design refers to a strategy, blueprint or guide for data collation and interpretation-a set of rules that equips the investigator to conceptualise and observe the problem under the study''. The next section explored the research design and strategy adopted

3.3 RESEARCH STRATEGY

Having identified the various philosophical positions available and adopting the requisite philosophy for the research question there is the need for the right research strategy to be adopted for the purpose of data gathering and subsequent analysis (Bryman, 2004). A research strategy provides a roadmap for directing the research from a specific approach, to an appropriate method for collecting and analysing data (Denzin & Lincoln, 2000). The purpose of the study and the obtainability of data inform the strategy to adopt for a particular study (Saeidi, 2002). There are two main ways by which research strategy can be conducted; quantitative or qualitative (Creswell &

Clark, 2007; Saunders, et al., 2007). Quantitative research is a research strategy that emphasizes measurement and quantification in the collection and analysis of data (Bryman, 2004) while qualitative research is any type of research that produces findings not arrived at by statistical procedures or other means of quantification (Denzin et al., 2000). The research strategy consequently informs the data collection method to use and the selected method is also dependent on the requisite information needed from the selected sample (Denscombe, 2007; Saeidi, 2002; Saunders, 2007). Due to the nature of the research the quantitative method was adopted. According to Cresswell and Clark (2007), quantitative analysis method uses standardized instruments, so that the varying viewpoints and experiences of people can fit a limited number of predetermined response categories, to which numbers, pie chart, bar chart etc are assigned and measured statistically.

3.4 UNIT OF ANALYSIS AND DATA SOURCES

Data gathering is crucial in research, as the data contributes to a better understanding of a theoretical background (Denscombe, 2007). It then becomes imperative that selecting the manner of obtaining data and from whom the data will be acquired be done with sound judgment, especially since no amount of analysis can make up for improperly collected data (Saeidi, 2002). The data used for this research were principally of two main sources; primary and secondary. For the purpose of contextualizing the study, identifying research gaps and properly positioning the work in its appropriate backdrop a review of extant literature was conducted. The secondary sources comprise extant literature from scientific journals, technical papers, working papers, conferencing proceedings and the like. Primary data was sourced from road contractors in the northern region. This group of individuals were identified as the unit of analysis. The Ministry of Road and Housing was contacted for a list of registered

road construction firms in the Northern Region of Ghana. The registered A2 and B2 construction companies were approached.

3.5 POPULATION AND SAMPLE FRAME

In conducting the research a population needs to be identified from the said unit of analysis. A working population is the operational definition of the general population from which the researcher can reasonably identify as complete a list as possible of members of the general population (Denzin and Lincoln, 2000). Saunders et al., (2007) describe a population as the complete set of cases from which a sample is drawn. Both time and financial constraints makes it virtually impossible to survey the whole population thus identification of a sample frame is imperative. The sample provides a subset of the general population under investigation and this is used in acquiring information about the entire population (Saeidi, 2002). The total number of road contractors made available was forty-five (45), which constituted the sample size.

3.6 SAMPLING SIZE

The process of selecting a representative of a whole is referred to as sampling. Due to the large size of a target population in most studies it is not feasible and impractical to conduct a survey of the whole target group as this will be very expensive and time consuming. Thus, a sample size of forty-five (45) is selected.

3.7 THE SAMPLING TECHNIQUE

A number of sampling techniques exist for various purposes. For the purpose of this study two main sampling techniques are employed; purposive and convenient. Tayie (2005) explains a purposive sample as one that comprises of subjects who are selected based on certain specific characteristics needed for a study and rules out subjects who do not meet this standard. The nature of the project is such that privilege and sensitive

information is required. This necessitated the use of purposive sampling technique for the study. Purposive sampling is pre-informed by the need to include certain individuals in the research makeup and for this study this included individuals who have worked on feeder roads using labour based methods. This sampling technique was combined with the convenient sampling technique. Convenience sampling is a nonprobability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. This sampling technique is fast, inexpensive, easy and the subjects are readily available, hence data collection can be facilitated in short duration of time. This technique may lead to bias as individuals that can be easily contacted and willing to participate in the research are the target. This technique was adopted due to the study area and provides a quicker and inexpensive way of having individuals responding to the questionnaire when one is faced with both limited time and resources.

3.8 DATA COLLECTION INSTRUMENT

Questionnaire is a data collection instrument with particular set of questions that have been formulated beforehand for which answers are expected from various respondents (Sekeran, 2003). Oppenheim (1992) opines that setting of questionnaires is a critical part of the research design process. There are four major methods of questionnaire administration; self-administered questionnaire, mail questionnaire, internet questionnaire (use of emails, survey monkey etc.) and phone questionnaire (Frazer and Lawley, 2000). This study employs the use of both self-administered questionnaire and the internet. Questions were mostly close-ended questions which were simple and direct. Ambiguity in the questions were avoided by subjecting the questionnaires to review by five academic experts in the construction field. An academic expert here is

classified as an individual holding a Doctor of Philosophy in the field of Construction and has a minimum of five academic publications.

The questionnaire was the primary data collection tool and was designed to draw up the requisite information from the respondents. The questionnaire was designed in line with the research objectives and socio-demographic characteristics were also elicited. The questionnaire used in this research is divided in four main sections: Section 'A'; Section 'B'; Section 'C' and Section 'D'. Section 'A' sought to investigate demographics of the study and included questions like the years the construction firm has been in existence and the position held by the respondent. Section 'B' sought to measure the level of experience of the respondents in relation to labour based technology. The section that followed investigated the opportunities that existed in using labour based technology. A likert scale was employed here and the respondents were asked to rank based on a five point scale their agreement with various statements. Section D sought to find out the various challenges to the respondents in using labour based methods. This section also employed a five point likert scale. An open ended question was provided at the end of this question for any recommendations from the respondents in using labour based methods.

3.9 DATA PROCESSING AND ANALYSIS

Saunders et al. (2007) defined data analysis as being made up of three major activities; reduction of data, presentation of data and drawing of conclusion. These three major steps were captured in the analysis of the data collated for the purpose of this work. The data collected were arranged and organized in line with the research objectives. The Statistical Package for Social Sciences (SPSS version 16.0) and Microsoft Office Excel software were used for the analysis of the data collected. Data preparation was the initial step towards translating the raw data into structured format for the analysis.

Responsibilities in this stage included data editing, data coding and data entry. Analytical methods used for this work include descriptive statistics, Relative Importance Index and Mean Score Ranking. Descriptive statistics involved the use of percentages, frequency tables and the like to present the results. The results following the analysis provided the impetus for the discussion of the results. Common trends and deviations were explicitly discussed. Reasons for the outcome of the analysis were also presented in relation to previous research findings.

3.10 CONCLUSION

This chapter was concerned with the presentation of the methodology used for this study. The chapter discusses the various research paradigms that extant literature offers. Based on the research agenda the required philosophies were selected. This followed with the selection of a research strategy based on the chosen research philosophies. The sample size and sampling technique for the study were presented. A questionnaire survey was used to collect primary data from the identified contractors. The chapter ends with a brief discussion of the method of data analysis used for the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

In this chapter, the analysis of the data followed by the subsequent discussion is presented here towards achieving the stated aim of the study. The driving purpose of the study was to identify the challenges and opportunities inherent in the use of labour based technology. The demographic data is analysed first using descriptive statistics such as frequency. Relative Importance Index, Mean Score Analysis and standard deviation are adopted for analysing the rest of the collected data. Relative Importance

Index is adopted to analyze the level of significance of challenges to using labour based technology in feeder road construction.

As described in the preceding chapter, the questionnaire has been divided into four main sections. Section one explores the demographics of the respondents. Some of the answers solicited include age of organization, position held by respondents and their educational level. The second section looked at the level of experience in using labour based technology as a precursor to answering the questions. Out of the 45 questionnaires distributed during the survey, 25 were retrieved, representing 55.6% response rate. This formed the basis of the research findings. The limited available time for the questionnaire collection affected the percentage completed and retrieved despite most of the individuals surveyed were implored to immediately fill and return the questionnaire.

4.2 ANALYSIS OF DEMOGRAPHIC DATA

4.2.1 AGE OF ORGANISATION

The first question sought to establish how long the various organisations have been in existence. The results indicate that about 60% of the organisations have been in existence over 11 years with 28% being in existence for more than 21 years. The result is tabulated in table 4.1. The results from the study is thus emanating from organizations that have been engaged in the construction of feeder roads. This experience garnered from such organization comes to bear in answering the questions posed to the individuals.

Table 4.1: Demographic Data

Variable	Option	Frequency	Percentage (%)
Age of Organization	0-5	3	12

	6-10	7	28
	11-15	4	16
	16-20	4	16
	21 years and above	7	28
	Total	25	
Length of Stay with Organization	0-5	6	24
	6-10	7	28
	11-15	7	28
	16-20	2	8
	21 years and above	3	12
	Total	25	
Position	Project/Contract Manager	5	20
	Civil Engineer	9	36
	Materials Engineer	6	24
	Managing Director	2	8
	Others	3	12
	Total	25	
Level of Education	Postgraduate	4	16
	First Degree	7	28
	HND/Diploma	7	28
	Technician (CTC Level)	7	28
	Total	25	

Source: Survey Data (2015)

4.2.2 DURATION SPENT BY RESPONDENTS IN CURRENT INSTITUTION

The next question sought to investigate the duration of the individuals who responded in their various institutions. This question sought to find out the level of experience of the respondents in their various places of work. An individual who has spent a lengthy time at a particular place is better positioned to answer the research questions than one who is not. The result is displayed in Table 4.1. The results show that over 70% of the respondents have spent more than 5 years at their various places. This increases the quality of answers derived from the respondents as they have spent more time at their various place.

4.2.3 POSITION HELD BY RESPONDENTS

The succeeding question sought to find out the positions occupied by the respondents in the organisation. Due to the nature of questions asked on the questionnaire; individuals working in the capacity of middle management or above were the target for answering the questionnaires. The results showed that 36% of those who responded to the questionnaires were Civil Engineers and this represents the highest number of individuals answering the question. This is followed by Materials Engineers, representing 24% of the respondents. The result is displayed in Table 4.1.

4.3 LEVEL OF EXPERIENCE IN USING LABOUR BASED TECHNOLOGY

The next section of the questionnaire investigated the level of experience of the respondents in labour based technology. This is imperative in order to gauge the quality of answers being given. It is without doubt that an individual not actively engaged in the use and practice of labour based technology is not well positioned to answer the questions. The first question consequently asked was to whether the respondents had an experience in using this type of technology to which all the respondents answered in the positive. The succeeding question investigated the level of experience of the respondents in using the technology. The results is presented in Table 4.2.

Table 4.2: Experience Level of Respondents

VARIABLE	OPTION	FREQUENCY	PERCENTAGE
Level of Experience in such Works	Average	4	16
	Good	14	56
	Excellent	4	16
Years of experience with Labour Based Technology	0-5	4	16
	6-10	9	36
	11-15	4	16
	16-20	5	20
	21 years and above	3	12

Source: Survey Data (2015)

The results show that 56% of those who answered representing a total of 14 had a rated “good” experience in using labour based technology. The results also indicated that a total of 12 contractors have had more than eleven years working experience in labour based technology. The least represented number of contractors in terms of years of experience on this technology was however 21 years and above. The relatively high number of years of experience of the respondents pre-informs that the answers being provided are by individuals who have a level of practical experience using the said technology.

4.4 OPPORTUNITIES IN USING LABOUR BASED TECHNOLOGY

Aligned with the survey objectives, the next question sought to find out the opportunities available in using labour based technology. Through the literature review key opportunities were identified. The respondents were then tasked to rate their level of agreement with the identified opportunities from literature review. Five point likert scale was used; where 1 represents Strongly disagree, 2 represents Disagree, 3 represents No Opinion, 4 represents Agree and 5 represents Strongly Agree. The result from the analysis is displayed in Table 4.3. Based on the five-point Likert scale rating, a criterion is deemed significant if it had a mean of 3.5 or more. Where two or more criteria have the same mean, the one with the lowest standard deviation is assigned the highest significance ranking (see for instance Shen and Liu, 2003; Ahadzie, 2007). Standard deviation values of less than 1.0 indicate consistency in agreement among the respondents of the reported level of results (see for instance, Field, 2005; Ahadzie, 2007).

The highest ranked variable was “Provides Employment”. There is consistency among the respondents as the standard deviation for this variable was less than 1. There is

therefore no uncertainty with the fact that this kind of technology provides employment for the rural folks. This is not surprising as previous literature echo this similar finding.

Table 4.3: Opportunities in using Labour Based Technology

OPPORTUNITIES	MEAN	STD. DEV.	RANK
Provides Employment	4.52	0.589	1
Cost Effective	4.16	0.943	2
Provides Indirect Employment	4.16	0.702	3
Provides Opportunity for Skills Training and Transfer	4.08	0.64	4
Positive Effect at the Macroeconomic Level	4.04	1.207	5
Provides Easy Entry into Construction	3.88	1.332	6
Possibility of Asset Creation	3.76	0.974	7
Financing of Works is Easier	3.400	1.141	8

Source: Survey Data (2015)

The second ranked variable is “cost effective” which had a mean of 4.16 and a standard deviation of 0.943. Despite the standard deviation below 1 the figure shows that there is a bit of variability in the respondents agreeing to it. However it is important to note that this finding is also not surprising as most studies show a similar situation (Majeres and De Veen, 2001; Ampadu, 2001, International Labour Organisation, 2004),. What makes the study findings interesting are that the least ranked variable was “Financing of works is easier”. The standard deviation associated with this variable though greater than one is still worthy of discussion. The labour based technology is no doubt a cost effective method but the financing of such works as shown by the study has issues associated with it. Already financing represents a major impediment to construction

works leading to multiple effects such as construction delays and the likes (Fugar and Agyakwah-Baah, 2010). Thus the results showing that labour based technology does not make financing of the works easier are not necessarily based on only the technology used but as a result of environmental factors. The third and fourth variables were “provides indirect employment” and “provides opportunity for skills training and transfer respectively.

4.5 CHALLENGES TO LABOUR BASED TECHNOLOGY IN FEEDER ROAD CONSTRUCTION

Following the review of extant literature a number of impediments to labour based technology were identified. The respondents were asked to rate how significant these challenges are using the likert scale. Table 4.4 shows the results of the analysis. It has already been stated that a criterion is deemed significant if it had a mean of 3.5 or more. From the results six out of the eight identified challenges had a mean above 3.5 showing how significant the challenges are to the construction industry.

Table 4.4: Challenges in Labour Based Technology.

CHALLENGES	Mean	Std. Dev.	RII	Ranking
Need for specialised training	4.08	0.812	0.816	1
Difficulties in Labour Management	3.84	0.746	0.768	2
Misconception about labour based works	3.68	0.900	0.736	3
Slow speed of implementation of works	3.64	1.114	0.728	4
Late Payment	3.60	1.414	0.72	5
Lack of proper documentation for labour based works	3.56	1.044	0.712	6

Lack of policy	3.20	1.443	0.64	7
Easy access to equipment loans	3.22	1.536	0.592	8

Source: Survey Data (2015)

These variables include; need for specialised training, difficulties in labour management, misconception about labour based works, slow speed of implementation of works, late payment and lack of proper documentation for labour based works. The least rank variable in terms of mean is lack of policy. The Relative Importance Index analysis shows that the highest impediments to labour based technology was the need for specialised training. The second rank variable on challenged was difficulties in labour management. The former had RII value of 0.816 whilst the latter 0.768. With the second variable related to management and this challenge rooted in manpower training and development it can be argued that training and development remain at the heart of labour based technology development. The relatively high importance index lends support to the fact that training, skills and development is missing in labour based technology delivery in the Ghanaian industry. The Ghanaian contractors recognise that most of them do not have requisite skills in delivering this type of technology. It should be noted that labour based technology rides on skilled labour due to the technicalities of work involved. Consequently the lack of it is a critical challenge in taking advantage of this employment creation venture.

The next highest rated challenge after the two discussed is the misconception about labour based works with an RII of 0.736. Extant literature has already shown the high cost of such misconception leading to the abandonment of this technology. It should be noted that this misconception is still persistent in the Ghanaian construction industry. Another variable of challenge was the slow speed of implementation of works which is

ranked fourth. This is not surprising as equipment based methods have a upper hand of being undertaken in relatively short time. However, it is interesting to note that from the perspective of the road contractors this is neither the first nor the second most critical challenge to implementing the labour based technology.

The least ranked variables were lack of policy and easy access to equipment loans with RII values of 0.64 and 0.592 respectively. The results indicate that despite this being a challenge to the industry it is not very significant.

4.6 CHAPTER SUMMARY

This chapter focused on the analysis and discussions of the results obtained from the field survey. It began with a brief discussion of the survey questionnaires and descriptive statistics of the results obtained from the field. Analysis conducted included mean score analysis and relative importance index. The study showed that labour based technology unquestionably is a major employment creation avenue. The chapter concluded with relative importance index analysis of the challenges to labour based technology. The relative importance index ranked the need for specialised training as a major impediment to its delivery.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The current economic climate and the need for development underscore the need for innovative and sustainable approach towards construction. Labour based technology is a proffered solution. This study has focused on identifying the challenges and opportunities to the use of this technology by road contractors. The preceding chapters have been organized to achieve this aim by exploring and explaining the various

theoretical and practical approaches adopted to meet the research goal. In this chapter a succinct view is provided of the main highlights of the work. Furthermore, a summary is provided of how the individual objectives aligned with the aim were achieved and thereafter the resultant findings. Lastly the chapter ends with recommendations for further studies

5.2 ACHIEVING THE RESEARCH OBJECTIVES

This study has its main focus to identify the opportunities and challenges for road contractors in the use of labour based technology in feeder road construction.

Three objectives were developed in attaining the overarching aim of the study.

They include;

- To identify the level of experience of contractors in using labour based technology in feeder road construction
- To identify opportunities for road contractors in the construction of feeder roads using labour based technology
- To identify the challenges for road contractors in the construction of feeder roads using labour based technology

5.3 REVIEW OF OBJECTIVES

In line with the research agenda and to unearth the answers associated with the research question, an in depth review of literature was conducted. From the review eight (8) major opportunities were identified as related to labour based technology; cost effective, employment, indirect employment, asset creation, financing construction works, and macroeconomic effects. Eight main challenges were also identified as critical from the review of literature including policy, labour management, late payment etc. A close ended questionnaire was administered to the respondents. To make way for

the possibility of other opportunities or challenges not captured in the literature review options were given to respondents to indicate so. However none of the respondents included any new opportunities or challenges. As note earlier, the research aim was to identify challenges and opportunities in labour based technology. Consequently research objectives were developed to achieve this aim. The next section looks at the various stated objectives and how each was accomplished through the study.

5.3.1 OBJECTIVE 1: IDENTIFICATION OF THE LEVEL OF EXPERIENCE OF CONTRACTORS USING LABOUR BASED TECHNOLOGY IN FEEDER ROAD CONSTRUCTION.

To achieve this objective the survey questionnaire was employed. The respondents were asked to state whether they had any experience with labour based works, their years of experience and rate their level of experience. Simple descriptive statistics was used to analyse this data. The results show that 56% of those who answered representing a total of 14 had a rated “good” experience in using labour based technology. The findings indicated that a total of 12 contractors have had more than eleven years working on labour based technology. All the respondents surveyed indicated they had experience in labour based technology. It was concluded that labour based technology is not new to the contractors and all surveyed had practiced it to some extent in the past.

5.3.2 OBJECTIVE 2: IDENTIFICATION OF OPPORTUNITIES FOR ROAD CONTRACTORS IN THE CONSTRUCTION OF FEEDER ROADS USING LABOUR BASED TECHNOLOGY

The second objective as stated above was achieved through the use of the survey questionnaire. It has already been stated earlier that eight main opportunities were identified from literature. The mean score analysis was employed in analysing the data.

The findings from the study indicated that employment provision was ranked as the highest opportunity in labour based technology. There is therefore no uncertainty with the fact that this kind of technology provides employment for the rural folks. This is not surprising as previous literature echo this same finding. The study also found out that the least ranked variable was financing of the works. Here it was argued that already financing represents a major impediment to construction works leading to multiple effects such as construction delays and the like (Fugar and Agyakwah-Baah, 2010). Thus the results showing that labour based technology does not make financing of the works easier are not necessarily based on only the technology used but as a result of environmental factors.

5.3.3 OBJECTIVE 3: IDENTIFICATION OF CHALLENGES FOR ROAD CONTRACTORS IN THE CONSTRUCTION OF FEEDER ROADS USING LABOUR BASED TECHNOLOGY

The last objective as stated above was also achieved through the use of the survey questionnaire. Having identified eight main variables from literature review and having asked respondents to rank and rate using the likert scale, relative importance index was employed to analyse the results. The relative importance index analysis showed that the highest impediments to labour based technology was the need for specialised training. The second rank variable on challenged was difficulties in labour management. It was concluded that training and development remain at the heart of labour based technology development. The relatively high importance index lends support to the fact that training, skills and development is missing in labour based technology delivery in the Ghanaian industry. The Ghanaian contractors recognise that most of them do not have requisite skills in delivering this type of technology.

5.4 RECOMMENDATIONS

It has already been pointed out the pivotal role road infrastructure plays in developmental goals. This study shows the varying opportunities inherent in adopting labour based technology supporting what extant literature has said. Based on the research findings the following key recommendations are made;

- Training of labour based contractors
- Providing means for financing of labour based works
- Branding of labour based works

5.5 LIMITATIONS OF THE RESEARCH

The research like any other study is characterized by certain limitations. First and foremost the study was limited by the geographical region in which it was focused. Consequently the research only focuses on the Upper East Region of Ghana specifically the Nadom District. This focus and unavailability of time resulted in a smaller sample size. Definitely a larger sample size over a greater geographical region would bring to light more issues and help to avoid the data being skewed. The study also only zoomed in on challenges and opportunities from the perspective of the road contractors.

However there are more stakeholders involved in road construction but this was outside the scope of this study and restricts the findings of the study.

5.6 DIRECTION FOR FUTURE RESEARCH

This research exposes a number of areas, which need research attention. The following recommendations are therefore made for future research:

- Exploring how labour based contractors can be trained effectively and which training programs offers

- Identifying how financing affects the delivery of labour based projects

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APPENDIX - QUESTIONNAIRE

THE USE OF LABOUR BASED TECHNOLOGY IN THE CONSTRUCTION OF FEEDER ROADS

The researcher is a post-graduate student at the Kwame Nkrumah University of Science and Technology studying for a Master of Science degree in Construction Management. The researcher is conducting a study into labour based technology on feeder road contractors in Ghana. The aim is to identify the opportunities and challenges for road contractors in the use of labour based technology in the construction of feeder roads.

With this background, kindly answer the questions in this questionnaire as accurately as you possibly can. Your response to this research will be confident and will be used exclusively for academic purposes. The questionnaire is divided into four main sections.

SECTION A: BACKGROUND INFORMATION

Please tick as appropriate

1. Name of Organization (Optional):.....
2. How long have you been working in this institution?
0 – 5 yrs () 6 -10 yrs ()
11 – 15 yrs () 16 – 20 yrs () 21 yrs and above ()
3. What is your level of education?
Postgraduate () First Degree ()

HND/ Diploma ()

Technician (CTC I, CTC II, CTC III) ()

Others please specify.....

4. How long has your organization been in existence?

0 – 5 yrs ()

6 -10 yrs ()

11 – 15 yrs ()

16 – 20 yrs ()

21 yrs and above ()

5. Position Held:

Project/Contract Manager ()

Civil Engineer ()

Materials Engineer ()

Managing Director ()

Others please specify

SECTION B: LEVEL OF EXPERIENCE IN USING LABOUR BASED TECHNOLOGY

Please tick as appropriate

6. Does your company have any experience with labour based technology?

Yes ()

No ()

7. If yes, how many years have u been using such works?

0 – 5 yrs ()

6 -10 yrs ()

11 – 15 yrs

()

16 – 20 yrs ()

21 yrs and above ()

8. How would you rate your level of experience in such works?

None ()

Poor ()

Average ()

Good ()

Excellent ()

SECTION C: OPPORTUNITIES IN USING LABOUR BASED TECHNOLOGY

The following statements are identified opportunities in the use of labour based technology on feeder road construction. Please answer the following questions by indicating to what extent which you agree with the statement

Strongly Agree– (5); Agree - (4); No Opinion – (3); Disagree– (2); Strongly disagree– (1);

Labour Based Technology		1	2	3	4	5
3	It is cost effective					
4	Provides employment					
5	Provides indirect employment					
6	Possibility of asset creation					
7	Provides easy entry into construction					
8	Financing of works is easier					
9	Provides opportunity for skills training and transfer					
10	Has positive effect at the macroeconomic level					
	Others please specify and rank					
11						
12						
13						

SECTION D: CHALLENGES TO LABOUR BASED TECHNOLOGY IN FEEDER ROAD CONSTRUCTION

How significant are these challenges in using labour based technology in feeder road construction. Please tick as appropriate

Not Significant – (1); Slightly Significant - (2); Moderately Significant– (3); Very Significant– (4); Extremely Significant –(5)

Challenges in Human capital development		1	2	3	4	5
1	Lack of policy					
2	Difficulties in labour management					
3	Late payment					
4	Slow speed of implementation of works					
5	Need for specialised training					
6	Easy access to equipment loans					
7	Lack of proper documentation for labour based works					
8	Misconception about labour based works					
	Others; Please specify and rank					
9						
10						
11						

Please do you have any recommendation for the use of labour based technology in the road construction industry? Kindly indicate below

.....

.....

.....

.....

THANK YOU VERY MUCH FOR YOUR TIME!!!

