The Republic of Uganda

International Labour Organisation

An Opportunity For Employment Creation,

Labour-based Technology in Roadworks:

The Macro-Economic Dimension

Gary Taylor

Moses Bekabye

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Support to Labour-based Policy Promotion Initiative

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Danida

PREFACE

The present study[1] was carried out in order to evaluate the potential of using employment-intensive technology in the rehabilitation of feeder roads as a means of generating employment and combating poverty. The study concentrates on the economic aspects rather than technical ones, since it is assumed that most rehabilitation work on feeder roads can be carried out by labour as well as by the use of heavy machinery. The central hypothesis of the study is that labour-based approaches are viable and offer high employment potential, as well as greater indirect benefits to the national economy than the conventional, equipment-based technology. In order to test this hypothesis, empirical evidence from feeder roads rehabilitation projects carried out in Uganda between 1993 and 1997 was compared.

The hypothesis was confirmed at several levels. The main conclusions indicate that a switch towards more labour-based methods could generate very significant benefits for the poor in the form of employment opportunities, and for the country in terms of GDP and foreign exchange savings:

- Labour-based methods are cheaper than equipment-based methods: in direct financial terms they are 18% cheaper for full rehabilitation of feeder roads and 50% cheaper for spot rehabilitation
- In economic terms, labour-based methods are even more advantageous: 38% cheaper for full rehabilitation and 60% for spot rehabilitation
- In terms of costs, labour-based works are competitive as long as the unskilled daily wage does not exceed USD 4; the current rate in rural areas is USD 1.2
- The employment generation effect is much higher for labour-based than for equipment-based work: in the labour-based projects studied the proportion of the cost spent on wages, mostly for the unskilled, ranged between 44% and 60%, against 3% - 8% in equipment-based works.
- The macro-economic model showed that the indirect effects were even greater than the direct effects; for each job directly created another 2 jobs are generated elsewhere in the economy through a multiplier effect.
- 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 (the GOU current investment in feeder roads is estimated at Ushs 30 billion per annum)
- Due to the savings in foreign exchange from not having to import heavy equipment from abroad, the fiscal deficit of the investment would be 37% less with labour-based methods than with equipment.

The Ugandan labour market grows by at least 300,000 young people each year. With the formal sector being able to absorb less than 100,000 of them, the study concludes that there is a strong case for making the wider application of labour-based methods in infrastructure works a dynamic element in a strategy for employment creation and poverty eradication.

[1] The authors would like to thank John Ssekatawa, Fred Were-Higenyi, Erik Lyby and Farhad Ahmed for their contributions to the study, as well as all those who made information available on the individual projects.

CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ADB	African Development Bank
BADEA	Arab Bank for Economic Development in Africa
ERC	Economic Recovery Credit
EU	European Union
GDP	Gross Domestic Product
GOU	Government of Uganda
GTZ	German Technical Co-operation
ILO	International Labour Organisation
IMF	International Monetary Fund
KfW	Kredietanstalt für Wiederaufbau
LAPPCOM	Labour-based Policy Promotion Committee
MFPED	Ministry of Finance, Planning and Economic Development
NRM	National Resistance Movement
RDSP	Re-integration of Demobilised Soldiers Programme
SWRARP	South-West Region Agricultural Rehabilitation Project
USD	United States Dollar
UTRP	Uganda Transport Rehabilitation Project

EXECUTIVE SUMMARY

1. The Ugandan Economy has registered impressive success in the recent years achieving one of the highest economic growth rates in the sub-region. The impressive economic performance has however not been matched with positive social indicators. The high level of poverty indices and massive under employment indicate that a very large part of the population is yet to benefit from the country's economic recovery.

2. The under-employment – in reality a poverty problem – in Uganda is even more serious than it appears to be. The number of under/unemployed people is estimated at about 3.8 million. The growth in the labour force is at least 300,000 per year, out of which only 100,000 people are absorbed, mostly in the agricultural sector.

3. Key areas to address in reducing the incidence of poverty are contained in the country's Poverty Eradication Action Plan. These include, among others: increasing wage-employment and income generating activities as a way of stimulating local demand and production.

4. Accordingly, labour-based methods and less use of heavy equipment are considered as the best option for reconstruction and maintenance of badly needed infrastructure but also to provide productive employment.

5. A mere presentation of the idea of application of more labour-based methods is not sufficient to make the methodology attractive. However correct the arguments for it may be in theoretical terms, planners, project evaluators, engineers, politicians and the intended beneficiaries themselves need significant evidence on which to base their day to day decisions.

6. This report describes a comparative study of the use of labour-based and equipment-based methods for feeder road rehabilitation in Uganda. It was carried out as part of the Labour-Based Policy Promotion Initiatives and the broader context of poverty reduction through employment creation.

7. The study examined available data from various feeder road programmes carried out in Uganda between 1993-1997. Some of these programmes used labour-based methods and some equipment-based methods. The standard of the road works carried out was broadly similar, although some programmes involved full rehabilitation and others spot rehabilitation.

8. When financial costs were compared, the labour-based methods were found on average to be 18% cheaper than equipment-based methods for full rehabilitation. The cost advantage of labour-based methods was even greater for spot rehabilitation, some up to 50%.

9. An economic cost comparison was also carried out, costs exclusive of taxes were compared. Wages for labour were shadow priced to more accurately reflect their resource value to the economy. Based on available data for the rural sector in Uganda, a ratio of shadow price to market price of 0.54 was used. The results indicate an even greater cost advantage in favour of labour-based methods. The average cost of full rehabilitation by labour-based methods was found to be 38% cheaper than equipment-based methods. The figure for spot rehabilitation was 60% cheaper for labour-based methods.

10. The "break-even" wage rate between labour based methods and equipment-based methods was calculated at US$4 per day. This is the maximum limit to which wages can be raised

before labour-based methods become financially or economically uncompetitive compared to the equipment-based approach. This implies that it would still be beneficial to use labour-based methods up to a daily wage rate of US$4 for unskilled workers. The current average wage rate is US$1.2 in rural areas.

11. Finally a comparison of the macro-economic impact of using the two alternative methods was carried out. A simple macro-economic model was used to estimate the direct and indirect effect of GDP, household incomes, government revenue, budget deficit, trade balance, and employment creation.

12. Considering both direct and indirect effects, labour-based methods were found to generate more income to households, increase GDP faster than equipment-based methods, and have a stronger stimulus on local private investment. The employment potential is also much greater.

13. There are cases where equipment-based methods are suitable and they should not be replaced in such instances. But also there is a huge potential for increasing the scope of using labour-based methods such as in rural feeder roadwork. Therefore, where the financial and economic benefits of using labour-based methods are higher than equipment, labour-based methods should be used as an alternative to equipment.

14. The recommendations of the study for increasing the scope for the use of labour-based methods in feeder roads include:

- Partnership between government and private sectors to ease participation of small local contractors in public sector works.
- Extension of project evaluation criteria to include employment creation potential, shadow pricing of labour, and assessment of the indirect costs and benefits of public investments.
- Removal of existing bias in conditions of Tender and Contract provisions which favour equipment-intensive contractors.
- Promote the increased use of subcontracting to provide more work opportunities for small, local contractors.
- Ensure that feasibility studies and designs give due consideration to the use of labour-based methods as well as equipment-based methods.
- Relax tight construction time constraints where possible. The longer duration sometimes inherent in the use of labour-based methods can be more than compensated for by the greater benefits and faster mobilisation times.
- Change attitudes to labour-based methods through the inclusion of the concepts of appropriate technology in the formal training of civil engineers.

Chapter I

INTRODUCTION

1.1 Background:

The Ugandan economy has registered impressive economic success in the recent years, achieving one of the highest economic growth rates in the sub-region. This is due to the numerous economic reforms implemented since the country's Economic Recovery Programme launched in 1987 and largely supported by the World Bank, IMF, and other bilateral donors. However, despite the dramatic success of the economic reforms, economic growth has not fully translated into improved socio-economic welfare of the population in general. The massive under employment and high poverty indices indicate that a large part of the country's population is yet to benefit significantly from the economic recovery. The challenges that still face the country are twofold:

a) Maintaining a stable macro-economic framework necessary for the required accelerated economic growth, and

b) Translation of economic growth into increased opportunities to ensure that the majority of the people benefit from the broad gains of that growth.

However, with all major macro-economic reforms successfully implemented, any additional future reforms at that level will have increasingly less impact on economic growth, and on employment creation in particular. If left to itself, the current economic growth rate is unlikely to make appreciable impact on under- and unemployment and consequently on poverty reduction. Thus, the major challenge of creating a better livelihood for the large section of the population who are under-employed needs particular attention by the policy makers. Hence, emphasis has to be shifted to complementary sectoral or micro policies, while maintaining a sound macro economic environment.

The government recognises this challenge, as outlined in the country's Poverty Eradication Action Plan (1997). The key areas of emphasis include:

a) Provision of sound infrastructure and access to social and economic services.

b) Empowerment of the people through decentralized governance.

c) Increasing wage-employment and income generating activities as a way of stimulating local demand and production.

Within the above setting, a recent LAPPCOM Position Paper on Labour-Based Employment Creation in Uganda presents the use of Labour-Based[2] methods as the best option when compared with Equipment-Based[3] methods, primarily to provide the sound infrastructure that the country needs, but also to create productive employment to the people. The paper argues that given the country's wide

[2] Labour-Based methods in this study is used to describe a technology or method in which labour, supported by light equipment, is used as a cost-effective method of providing and maintaining infrastructure to a specified standard.
[3] Equipment-Based methods describes the opposite of Labour-Based methods in that most of the work is done by labour-saving equipment, supported by a small labour force.

spread poverty and massive under employment, there is an obligation to investigate the possibilities of utilizing more labour-intensive methods.

A mere presentation of the advantages of the use of more Labour-Based methods is not sufficient to make it attractive. However correct the arguments for it may be in theoretical terms, planners, project evaluators, engineers, politicians, donors and the intended beneficiaries themselves need empirical evidence on which to base their day to day decisions. To a small fraction of the decision-makers, there may be agreement on Labour-Based methods as the appropriate technology, but there must be presentation of the viable alternatives to the technology that is being presented. There must also be procedures and strategies for evaluating, assessing and taking advantage of the available alternatives. This study attempts to fill the above gap by providing information based on empirical evidence on the benefits and trade-offs between Labour-Based and Equipment-Based methods, against which rational choices may be made.

This Report is arranged as follows: the remaining sections of Chapter one outline the study objectives, purpose, and methodology. Chapter two gives an overview of Uganda's economic performance since 1990, the employment situation and the structure of the labour market. Chapter three presents the analysis of the financial cost of labour-based versus equipment-based methods, while Chapter four introduces the concept of shadow pricing in an economic cost comparison. Chapter five makes an assessment of the impacts of using either technology for feeder roads projects on Uganda's macro-economic framework and employment creation using a simple macro-economic model. The last Chapter presents a summary of the general conclusions and recommendations.

1.2 Study Purpose and Objectives

The hypothesis of this comparative study between labour-based and equipment-based methods for rural feeder road improvement in Uganda is that labour-based approaches are viable and offer high employment potential, as well as greater indirect benefits to the economy when compared with equipment-based methods. The outcome of testing this hypothesis will help in informed decision making between the use of labour-based and equipment-based approaches. This in turn will help in the policy formulation process regarding employment generation through infrastructure development. In other words, if the economic benefits of labour-based methods to infrastructure development can be demonstrated, this will help focus policymakers' attention on such methods.

The **objective** of the study, therefore, is to: -

Establish, based on empirical data on feeder roads in Uganda, the economic benefits to be derived through the application of labour-based technologies as opposed to equipment-based approaches. Specifically, the study involved:

i) an on-the-ground assessment of the financial and economic costs of carrying out feeder roads improvement and maintenance by Labour-Based and Equipment-Based methods in Uganda;

ii) a comparative analysis of a number of the potential macro-economic benefits to the economy of either choice of technology.

1.3 Methodology

The study involved both a desk review exercise and field data collection (both quantitative and qualitative). During the desk review exercise, macro economic data was compiled while the project specific data was obtained through both field visits and available project records.

The project specific data was used to estimate the financial and economic costs of each individual project and make an assessment of the comparative costs of labour-based and equipment-based methods in both financial and economic terms.

The macro-economic data was used to develop the parameters that were then used to establish economic relationships in a simplified macro-economic model. This was developed to simulate the effects on the economy as a whole of the use of either labour-based methods or equipment-based methods for publicly financed rural feeder road infrastructure. The model outputs provided an estimate of the direct and indirect impacts on employment, income, GDP, trade balance and public revenues.

The full Terms of Reference for the Study are given in Annex 1.

Chapter II

AN OVERVIEW OF UGANDA'S ECONOMIC PERFORMANCE SINCE 1990

2.1 Macro Economic Performance

The Real Sector

During the last 10 years, Uganda's economy has more than doubled. It is estimated to have had an average growth rate of about 6.0% per annum, reaching a peak of 10.5% per annum during fiscal year 1994/95. The main reason for the wide variation in the Gross Domestic Product (GDP) growth rates over the ten years has been the volatile performance of the agricultural sector, with heavy rains and prolonged drought affecting output. This affected overall growth because of the large share of the agricultural sector in total GDP.

The detailed performance of various sectors of the economy are shown in Table 2.1.

Table 2.1: GDP growth rates for the period 1990/91-1997/98

Period	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Agriculture	3.3%	-1.0%	9.3%	1.8%	5.9%	4.4%	1.3%	1.7%
Mining and Quarrying	106.1%	10.4%	10.4%	3.7%	9.1%	34.8%	50.2%	21.1%
Manufacturing	7.3%	15.7%	7.0%	15.1%	17.3%	19.7%	13.5%	13.0%
Electricity	6.4%	10.0%	5.6%	7.3%	11.4%	10.5%	9.9%	7.0%
Construction	6.7%	1.3%	10.1%	11.3%	23.8%	16.7%	14.3%	10.2%
Commerce	8.9%	6.6%	6.9%	9.4%	21.6%	10.7%	2.9%	5.3%
Transport and communication	7.6%	5.6%	7.2%	10.6%	14.3%	11.0%	13.3%	14.1%
Community services	8.8%	9.3%	7.9%	6.4%	7.2%	5.9%	6.1%	5.8%
Owner occupied dwellings	2.9%	2.9%	3.7%	4.3%	6.9%	8.0%	8.0%	8.0%
Overall GDP growth rates	**5.6%**	**3.1%**	**8.4%**	**5.3%**	**10.5%**	**8.1%**	**5.2%**	**5.5%**

Source: Statistics Department, Ministry of Finance and Economic Planning.

Albeit from a small base, the manufacturing sector has shown steady growth, increasing its share in total domestic output from 4.7% in 1986 to 9.0% in 1997. The sector, as measured by the index of industrial production, has had an average annual growth of 14.5% since 1990. Mining has also shown strong growth, but it has been much a more volatile sector.

Table 2.2 below shows the expenditure on GDP for the last 10 years. Uganda's total consumption has reduced from 110% of GDP in 1990/91 to slightly less than 100% in 1996/97. Despite an improvement in the terms of trade, especially for coffee, during the period 1992/93 – 1994/95, domestic demand continued to exceed domestic supply for much of the 1990s. The rehabilitation of the key economic sectors (including some industries) and the good infrastructure now in place has led

to increased production and consequent reduction in excess demand in the economy. While public consumption has remained stable at about 10.0% of GDP on average over the past decade, private consumption has reduced from an estimate of about 99% of GDP in 1990/91 to about 88% of GDP in 1996/97.

Table 2.2: Expenditure on GDP (as a percentage of GDP at market prices)

Period	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Consumption/GDP ratio	109.8%	106.4%	105.6%	103.7%	102.5%	104.1%	99.2%
Public	11.2%	10.2%	10.5%	11.2%	10.4%	10.8%	10.9%
Private	98.5%	96.1%	95.1%	92.4%	92.1%	93.4%	88.2%
Investment/GDP ratio	15.8%	16.9%	16.3%	15.9%	17.9%	18.3%	17.7%
Public	6.1%	7.9%	7.2%	5.9%	5.9%	6.9%	5.8%
Private	9.4%	9.0%	9.1%	10.0%	11.1%	12.3%	11.5%
National savings/GDP ratio	9.7%	10.1%	11.2%	16.5%	18.8%	20.9%	20.2%
(Excluding grants)	1.5%	2.3%	3.0%	11.3%	13.7%	16.1%	14.6%

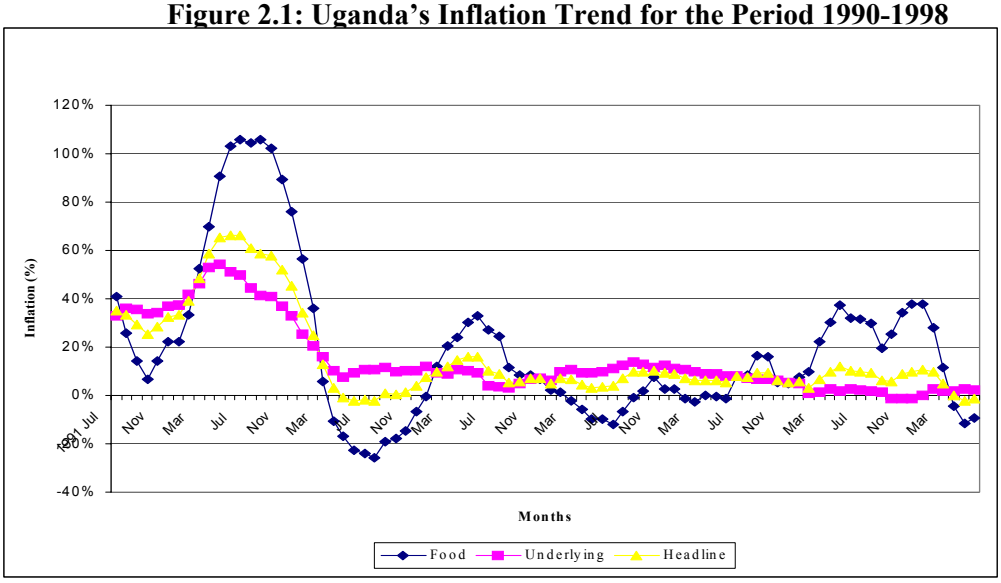
Source: Background to the Budget (1993/94-1998/99)

On savings, gross national savings have increased over recent years to about 20% estimated for 1996/97. These savings have largely come from increased official and private transfers from abroad. When transfers from abroad are excluded, domestic savings drop to about 15% in 1996/97. Nevertheless, as a consequence of the low domestic savings, Uganda has had to rely to a large extent on foreign savings to help finance domestic investment and growth.

Price Developments

One of the major successes of the Government of Uganda since the economic recovery programme has been the successful control of inflation. Inflation, which had been running at over 200% per annum in 1988, was reduced to below 10% for the last five years. The inflation trend for the period 1991 – 1998 is presented in Figure 2.1 below.

Figure 2.1: Uganda's Inflation Trend for the Period 1990-1998



Source: Primary data from Statistics Department, MFPED-Entebbe.

Figure 2.1 shows a disaggregated trend in underlying inflation (excluding food crops) and price changes associated with food crops. The chart clearly shows that price changes associated with food crops have been more erratic than for non-food items. This is a phenomenon that is associated with food supply constraints to the consumer markets.

Since the complete liberalisation of the foreign exchange market, the premium on the market exchange rate over the official rate has reduced sharply from over 50% in August 1990 to close to zero in the last one and a half years. This implies that the official exchange rate now reflects the economic price of foreign exchange. Since the early 1990s, the exchange rate has experienced large fluctuations, mainly on account of the coffee boom and the performance of other non-coffee exports. Seasonal changes in demand have also contributed to the fluctuations.

The rate of interest is one of the most important price indicators in the economy. Although interest rates have reduced from as high as 40% per annum in 1992 to about 21% per annum in 1998, this is still much higher than the annual rate of inflation. The major single factor for the high real interest rates has been the high intermediation costs of the financial sector. These costs have been driven by a large proportion of non-performing assets (bad debts) in the banks' portfolio. For this reason, therefore, financial intermediaries have tended to maintain high lending interest rates despite a downward adjustment of the deposit rates in line with inflation. Although the Government initiated a financial sector adjustment programme in 1991 to assist in the restructuring and development of the banking sector, their performance, especially the indigenous banks, has not improved as expected.

Due to a lack of reliable data on the developments in wages, it is not possible to analyse the wage trends over years in this study. However, the field data of this study reveal that there is no uniformity in wages. Some feeder road projects, such as in Eastern Uganda offer wages that range from Ushs 1,000 per day to Ushs 2,500 per day. In the Western region where labour is relatively scarce, daily wages are much higher, ranging from Ushs 2,500 to Ushs 3,500 per day. Some projects have deliberately offered lower than market wages rates to target the employment opportunities created at poorer people.

Public Finance

One of the most critical issues for long-term macro-economic stability is public revenue mobilisation. Despite revenue improvement since 1991, tax revenue to GDP ratio remains at about 11% of GDP. This is well below the Sub-Saharan average of 28 percent. The developments in public finances since 1988/89 are summarised in Table 2.3.

Table 2.3: Uganda's Public Finances for the Period 1988/89-1997/98 as a Percentage of GDP

Period	88/89	89/90	90/91	91/92	92/93	93/94	94/95	94/95	95/96	96/97	97/98
Revenue and grants	7.2	8.8	12.0	14.6	15.7	16.4	13.9	16.0	16.8	17.2	17.8
Tax revenue	5.6	7.2	7.9	7.2	7.6	9.6	10.0	10.8	11.0	11.8	11.6
Grants	1.6	1.6	4.1	7.4	8.1	6.9	3.9	5.2	5.8	5.5	6.1
Expenditure & net lending	10.6	13.4	15.5	22.1	18.9	20.5	16.9	18.7	18.8	19.4	18.8
Current Expenditure	7.1	7.5	7.4	12.3	8.3	9.9	8.9	10.2	10.1	10.3	10.4
Development expenditure	3.3	5.9	7.8	9.5	10.6	10.4	8.0	8.2	8.7	9.0	8.4
Overall deficit Excl. grants	-5.1	-6.1	-7.5	-15.0	-11.3	-10.9	-6.9	-7.9	-7.8	-7.6	-7.2
Incl. Grants	-3.4	-4.6	-3.5	-7.6	-3.2	-4.0	-3.0	-2.7	-2.0	-2.2	-1.1

Source: Background to the Budget, Ministry of Finance, Planning and Economic Development

Revenue collection in Uganda is low mainly for two reasons. Firstly, the transition from reliance on subsistence and informal economic activity to a commercial and formal activity has been relatively

slow, and is likely to remain so. Secondly, income levels are low and direct taxation of the large agricultural sector is limited. At the same time industrial and service sectors are small and hence formal employment is low.

Total public spending and net lending was estimated at 18.8% of GDP in 1997/98. While current expenditure increased from 7.4% of GDP in 1990/91 to 10.4% in 1997/98, public investment (development) expenditure has stagnated at around 9.0% of GDP. The shortfall on tax revenue required to finance public expenditure is met from official transfers from abroad and external borrowing. The overall public deficit, excluding grants, increased from 7.5% of GDP in 1990/91 to 15% of GDP the following year, before falling to 7.2% in 1997/98 (see penultimate row of Table 2.3). Including grants, the changes have been from 3.5% of GDP to 7.6% and then falling to 1.1% of GDP for the same years. This shows the dependency of the country's public expenditure programmes on donors.

The External Sector

Details of the recent developments in the external sector are given in Table 2.4. The overall balance of payments position improved from an overall deficit of 3.4% of GDP in 1991/92 (-Ush 119 mill) to a small surplus of 0.6% of GDP (Ush 39 mill.) in 1997/98. The balance of payments was much healthier during the peak of the coffee boom period of 1993/94-1994/95 – when an average surplus of over 2.7% of GDP was achieved. Exports have been rising steadily since 1990/91 but declined in 1997/98 mainly due to a reduction in coffee receipts.

Despite the poor export performance in 1997/98, non-traditional exports have proved to be an important potential source of foreign exchange. The value of non-traditional exports has increased from US $ 35 million in 1990/91 to $147 million in 1997/98. The ratio of coffee receipts to non-traditional export receipts has been steadily reducing, signifying a gradual diversification of the export sector. One important element that has helped to offset the large trade deficit has been the large and increasing current transfers from abroad, both official and private.

Table 2.4: Balance of payments (Millions US$) 1990/91-1997/98

Period	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1997/98
Total exports	198.3	195.0	237.8	333.1	649.2	725.8	608.5
Total imports	-684.5	-579.5	-766.9	-840.9	-1,366.7	-1,600.4	-1,821.3
Trade balance	-486.2	-384.5	-529.1	-507.8	-717.5	-874.6	-1,212.8
Factor Income (net)	-58.2	-85.9	-51.6	-51.1	-63.4	-48.0	-10.5
Current transfers	342.4	342.0	450.2	492.1	616.7	693.8	836.3
Official	261.9	206.1	240.9	188.6	261.5	272.6	349.1
Private	80.5	135.9	209.4	303.5	355.2	421.2	487.2
Overall balance	**-105.3**	**-119.4**	**-30.9**	**106.3**	**141.3**	**19.6**	**38.6**

Source: Statistics Department, MFPED; Central Bank of Uganda.

Although the debt burden has been reducing since 1990, it remains high. This is a constraint to the country's economic growth as well as to public investment in socio-economic infrastructure. The debt stock to GDP ratio remains close to 60%, while the debt service to export of goods and services is currently above 22%. Table 2.5 shows the trend in Uganda's debt burden since 1990.

Table 2.5: Uganda: Trends in Key Indicators of the Debt Burden (%)

Period	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98
Debt Stock (US$ m)	2,591.6	2,647.5	2,637.2	2,999.3	3,386.9	3,512.6	3,606.5	3,556.7
Debt Stock/Exports	1,306.9	1,357.7	1,108.8	900.4	521.7	484.0	437.0	584.5
Debt stock/GDP (%)	84.6	95.3	75.4	80.5	64.3	64.4	60.2	58.7
Debt Service/GDP	4.0	7.6	4.0	4.5	3.0	2.6	2.6	2.3
Debt Service/Exports	62.3	109.0	59.1	50.4	24.2	19.6	18.9	22.7

Source: Ministry of Finance, Planning and Economic Development; Central Bank of Uganda.

2.2 Structural Characteristics of Uganda's Labour Market

Population Characteristics

The composition, distribution and income levels of Uganda's population are detailed in tables A2-1 to A2-3 of Annex 2. Uganda's population growth rate remains high, estimated at 2.4% per annum, one of the highest in the world. About 80% of the population live in rural areas with an urbanisation of only 12.5%[4]. The central region has an urbanisation ratio of 23.5%, while the ratios for the Eastern; Northern and Western regions are much lower at 7.6%, 5.2%, and 4.4% respectively.

About 75% of the total population is below 30 years of age, which partly reflects Uganda's high dependency ratio. The ratio of men to women is about 45:55, both in urban and rural areas. There are about 3.7 million households, of which 3.1 million are rural. The average household size is 4.9 persons in rural areas and 4.3 persons in urban areas.

As regards the distribution of household income, 49% of the total households earn between US$0-50 per month while 32% earn between US$50-100 per month. These ratios are reflective of mainly the rural situation, since only 19% of the households in urban areas earn between US$ 0-50. This indicates the high income inequality in Uganda and the critical issue of under-employment, particularly in rural areas.

The percentage of the total population that completed primary education is estimated at 23% with about 18 % in rural areas and 46% in urban areas. These figures clearly indicate that Uganda's rural population is largely unskilled.

Unemployment and Labour Force Participation

Official reports put the unemployment rate at 1.0%[5], but the reality on the ground reveals that the situation is more severe than this figure suggests. For example, it is estimated that between 300,000-400,000 people join the labour force every year, and out of these, only about 100,000 get employed. Thus at least 200,000 people join the unemployed annually. This figure compares with a total current formal employment of 770,000 in both Government and the private sector. Moreover, unemployment in Uganda manifests itself in acute forms of under-employment, disguised and hidden unemployment and structural unemployment. The reason for the low official figure is the methodological difficulty of

[4] According to the Second Monitoring Survey carried out in 1994/95 by Statistics Department-Entebbe.
[5] Uganda National Integrated Survey 1992-93;The Household Budget Survey 1989-90.

measuring unemployment in a country like Uganda. A large part of the population has access to land and are, therefore, involved in subsistence activities. It is hard to find people who are completely idle, especially in the rural areas. Thus, the critical issue is labour productivity, which is very low, indicating a high level of under-employment.

The engagement of the labour force in economic activity is measured by the labour force participation rate. The total labour force participation rate was estimated at 83% using data from a survey carried out in 1993[6]. The participation rate was recorded at 94.4% for men and 73.0% for women. The most active labour force age range was between 30 and 44 years, with an overall labour force participation rate of 88.5% nationally, and 97.3% for men only.

The most comprehensive and reliable data on employment by sector relates to small-scale establishments and household enterprises in Uganda based on the 1992/93 National Integrated Household Survey carried out by the Statistics Department, MPED. A summary of the employment structure is presented in the tables A2-4 to A2-6 of Annex 2. The data shows that 89% of the labour force is employed in agriculture, 2.7% in manufacturing, 2.0% in commerce and 1.6% in the service sector. The proportion of paid employees to the total number of persons engaged in economic activity in each sector is 16.3% in agriculture, 9.6% in manufacturing, 11.6% in commerce, and 20.8% in the service sector. The implication of these ratios is that the majority of the labour force is either self-employed or unpaid.

This observation is consistent with the percentage of the self-employed in the most active age group of the economically active population. This was estimated at 73.2% in 1993 compared to those employed by both Government and the formal private sector of only 16.8%. The self employed in agriculture spend only about 35% of their time in farming and other gainful activities, while about 65% of their time is spent in other (unproductive) activities. This implies that there is potentially abundant labour that can be engaged in labour-intensive infrastructure projects in rural areas without seriously affecting agricultural output.

2.3 Impact on Poverty Eradication and Employment

The macro-economic performance of the Ugandan economy, as described above, has been impressive in the recent past. However, despite this performance, the welfare of the population in general has not made significant improvement, and this remains a critical policy issue. Recent developments in Uganda's poverty trends are summarised in Table 2.6.

[6] Report on the Uganda National Integrated Household Survey 1992-93, vol 1-Entebbe, Uganda (this is the most recent survey of this kind that has been officially conducted).

Table 2.6: Percentages of the Poor by Sector for Household Head for 1992 and 1996

Sector	Mean consumption per adult equivalent (1989 Ushs/month)		%age of those who are poor	
	1992	1996	1992	1996
National	**7,091**	**8,313**	**55.6**	**45.6**
Food crop	5,711	6,184	64.1	58.3
Cash crop	6,087	8,069	59.6	40.5
Non-crop Agriculture	6,947	8,773	51.7	41.0
Mining	8,471	6,044	43.4	74.2
Manufacturing	8,271	11,167	46.3	27.9
Public Utilities	9,203	15,007	43.3	10.9
Construction	11,311	10,083	38.3	34.6
Trade	12,384	14,377	26.4	16.7
Hotels	9,911	12,036	26.6	17.0
Transport and Communications	10,309	15,337	31.9	14.3
Miscellaneous Services	13,534	11,747	27.7	26.9
Government Services	11,161	12,755	33.5	26.2
Not working (unemployed)	6,835	7,975	59.8	62.1

Source: Background to the Budget (various); Appleton Report on poverty in Uganda (1998)

At a national level, the percentage of those who are poor has fallen from 56% in 1992 to 46% in 1996, a drop of 10%. The biggest reduction was in the cash crop sub-sector, which registered a drop of more than 19 percentage points. In contrast, the food crop sub-sector, which includes most of the rural poor, had a percentage drop of only 5.8%. The table also shows that poverty among the unemployed has actually increased from 60% to 62%. Hence, poverty in Uganda remains pervasive.

The prevalence of poverty in Uganda has a critical bearing on the employment situation. Although the number of people in formal employment appear to be on the increase in recent years, the current level of formal employment remains far below what would be necessary to achieve a meaningful impact on poverty. The number of persons employed in the public sector has reduced from above 300,000 in 1990 to about half that number by 1997/98. Total formal employment by the economy's major private companies was below that of the public sector in the early 1990s. However, although there is no reliable data on formal employment in the private sector, there are indications that it has surpassed that in the Public Sector, but is still below the desired level. The privatisation process, a key aspect of Uganda's structural adjustment programme, has not yet yielded significant gains in terms of employment creation. Hence, the number of people who are either underemployed or unemployed is still high, estimated at 3.8 million.. Given that Uganda's labour force is about 8.0 million, this represents a ratio of 47.5% of both the under and unemployed. Thus, employment creation is needed if economic growth is to translate into poverty reduction across the board.

2.4 Rationale for "re-thinking" Labour-based for Sustainable Economic Growth

As already mentioned, economic growth has not significantly translated into employment creation. Poverty, especially in the rural areas, is still high and has in fact increased amongst the unemployed. The extremely low labour productivity, caused by unemployment and under-employment, translates into low rural incomes and limits the potential for economic growth to reduce poverty.

One approach that could create employment is the adoption of more labour-based methods in public infrastructure investment projects, such as rural feeder roads. Such employment creation can ensure high and sustainable economic growth with a significant impact on poverty. Unfortunately, even in countries where labour is abundant and capital is scarce, people concerned with the planning and

design of roads generally have no clear idea of the scope for the use of labour-intensive methods in road construction. The scope is, in fact, considerable. However, such a policy cannot be pursued without due respect to cost efficiency. The following chapters consider the costs of labour-based methods for the development of rural road infrastructure compared to the costs of the more-commonly used equipment-based methods.

Chapter III

FINANCIAL COST COMPARISON IN RURAL FEEDER ROAD WORKS

In this chapter the cost of similar road works on feeder roads using labour-based and equipment-based methods are compared in terms of market prices.

3.1 Main Characteristics of Labour-Based and Equipment-Based Feeder Roads Projects

Due to neglect, mismanagement and lack of adequate maintenance as a consequence of civil strife and disruption of civil administration between 1974 and 1985, the rural feeder roads network deteriorated to a state of disrepair in Uganda. In some instances feeder roads became impassable - characterised by poor drainage systems with generally non-existent or blocked culverts and badly-eroded, potholed, or deformed carriageways.

In 1986 the Government embarked on the rehabilitation of roads as a priority in its economic recovery programme. In the first instance the strategy was the rehabilitation of roads in order to provide all-weather accessibility to the rural areas, rather than the provision of feeder roads with a high degree of carriageway smoothness. Priority was given to those roads which could unlock areas with a potentially high agricultural surplus. Social considerations such as improved access to schools and health centres were supplementary considerations.

Design Standards

Feeder roads in Uganda have been designed to accommodate a maximum traffic volume of 30 vehicles per day, speeds of about 60 km per hour and carriageway widths of 4.0 – 4.5 m (or, in exceptional cases, up to 5.4 m) with a gravel thickness of 100–150 mm. For some road sections in hilly terrain, lower geometric standards and consequently lower speeds have been applied. During rehabilitation, the existing vertical and horizontal alignments have been followed as much as possible. This has been to minimise the earthworks and land acquisition and to reduce the overall cost of the roads. Realignment has been carried out very rarely and only where essential for technical or safety reasons.

Both labour-based and equipment-based methods have been used. **The quality of the rehabilitated roads is comparable by either method** for the same level of intervention. The level of intervention has varied from the simple opening of roads by grading and reshaping, through spot rehabilitation by sectional gravelling of swampy areas and steep gradients, to full rehabilitation including full re-gravelling. By December 1997, about 11,415 km of rural feeder roads had been rehabilitated to various intervention levels. By far the most predominant was spot rehabilitation.

Construction Time

It is difficult to compare the actual time taken per road project using either equipment or labour-based methods. Firstly, this is because many of the projects studied had cash-flow problems, mainly due to

the slow disbursement of funds. This, rather than the type of technology used, was the main determinant of the speed of construction. This effect was more pronounced for projects carried out using force account. Secondly, the level of intervention varied from project to project. Some projects were rehabilitated with no gravel placed, while others had gravel surfacing lengths of between 30% and 70%. This was a significant factor in the speed of construction in terms of kilometres per month.

However, an estimate has been made of the average speed of construction excluding the effects mentioned above. Based on this, the average output for equipment-based units varied between 8 and 10 km per month, while that for labour-based units varied between 1.0 and 1.5 km per month. The different rates of construction reflect the different average size of construction units. The output using labour-based methods can be matched with the equipment-based methods by establishing more units at the same time. For example, several units can work simultaneously on different roads or different sections of the same road.

Cost Data Used for the Study

The sample projects whose roads provided the empirical data for the comparison study were: the Uganda Transport Rehabilitation Project (UTRP) funded by the World Bank; Masaka Roads funded by the European Union (EU); Kabarole roads funded by German Technical Cooperation (GTZ); Coffee Roads funded by the European Union (EU); and Re-integration of Demobilised Soldiers Programme (RDSP) financed by KfW. Other projects whose data was collected but which was found to be incomplete or not comparable were BADEA roads, SWRARP, ERC II and ADB roads. These were excluded from the analysis.

The UTRP and Masaka Roads, which were executed by contractors to higher standards than the other roads in the sample, were used for comparing full rehabilitation costs between labour and equipment methods. The Masaka Roads, which had spot rehabilitation but close to full rehabilitation, had their costs adjusted to full rehabilitation by a factor of 1.2. These roads were fully re-shaped but not fully gravelled. The factor was based on the cost of adjusting the gravelling quantity up to the equivalent of 100% assuming the same contract rates per cubic metre. This was necessary to facilitate comparison given the data limitations.

Many of the projects involved spot rehabilitation of feeder roads rather than full rehabilitation. With these spot rehabilitation projects there was no clear indication available of the amount of work carried out on each road section. It was therefore difficult to use these spot rehabilitation costs to compare costs per kilometre for different projects.

The main characteristics of the programmes considered in this study along with their data availability is presented in Table A3.1 of Annex 3. It can be seen from this Annex that the majority of the programmes used equipment-based methods (six out of nine). Also, most were spot rehabilitation programmes (seven out of nine). Only two programmes (UTRP and RDSP) used exclusively a labour-based approach, while another project (GTZ) used both labour and equipment-based approaches. Only one project was for full rehabilitation (UTRP).

Five of the nine programmes were implemented by force account; the other four programmes were implemented using contractors.

For projects implemented by contractors, the final contract price was used to calculate the per kilometre cost. For projects implemented by force account, the costs of equipment were not fully reflected in the cost data. For some force account projects only the cost of fuel and oils was available; for others the available equipment costs included fuel, oils and repairs. For this reason, the cost of force account works was adjusted by factoring up costs so that they represent the full equipment cost

(including depreciation, maintenance, oils and fuel). This has been done using the methodology suggested by World Bank (1983). A detailed breakdown of the calculation is shown in Annex 4.

3.2 Financial Costs per Kilometre by Labour and Equipment-Based Methods

Full Rehabilitation

The financial cost breakdown, along with costs per kilometre for full feeder road rehabilitation, are presented in Table 3.1.

The average cost per kilometre of the labour-based UTRP roads (Ushs 10.4 million) is some 18% cheaper than the equipment-based Masaka Roads (Ushs 12.7 million).

Table 3.1: Financial Cost Breakdown and Unit Cost of Rehabilitation Programmes

Programme	Method of Imp.	Cost Breakdown (Percentage)						Unit Cost Per Km (Ushs mill)	Man-days Per Km
		Super-vision	Lab-our	Mat-erial	Equip-ment	Over-head	Land		
UTRP	**Labour**	3.4%	44.4%	16.0%	31.9%	2.4%	1.9%	**10.4**	1,374
MASAKA[7]	**Equip.**	8.7%	8.4%	7.2%	50.5%	25.1%	0.0%	**12.7**	328

When individual roads within these programmes are considered, the unit costs range from Ush 6.0 to 16.5 million per kilometre for rehabilitation. There are two main reasons for this relatively high variability in cost. Firstly, all projects involved the rehabilitation of existing feeder roads or tracks and the existing condition of the roads varied significantly. Secondly, the projects were carried out in areas where the topography varied from gently rolling to hilly and steep. It is probable that the latter effect had the greatest impact on cost, but there was insufficient data available to confirm this. Table 3.1 indicate average costs of all the roads in the two programmes considered for the study.

The average percentage labour costs in the total costs of the UTRP and Masaka programmes are 44% and 8% respectively. These figures are not considerably different from the overall average figures for labour and equipment-based projects including also the spot rehabilitation programmes (50% and 5.5% respectively). Similar figures for the equipment component are 32% for UTRP and 50% for Masaka Roads. This compares with percentages of 23% and 60% when all programmes are included. The comparatively high overhead cost for the Masaka Roads – 25% compared to an overall average of 12% for all equipment-based programmes was due to the involvement of foreign supervision personnel in the project.

[7] Although Masaka was a spot rehabilitation project, the relevant costs have been factored up to represent the cost for full rehabilitation

Spot Rehabilitation

Table 3.2 shows that the average cost per kilometre for spot rehabilitation using labour-based methods is substantially cheaper (about 50%) than using equipment-based methods. However, this comparison must be treated with caution. This is because there was no detailed information on relative work quantities per kilometre for the different projects, and this probably varied considerably.

The cost per kilometre of spot rehabilitation for individual roads included in these programmes ranges from Ush 0.9 to 24.2 million. This illustrates the considerable variability between the different spot rehabilitation projects. The reasons for this are similar to those for the variability in the costs of the full rehabilitation projects with the additional factor of a high variation in the amount of work carried out on each road section. This ranged from virtually no work, where the road section was already in an acceptable condition, to near full rehabilitation on those sections where the road was badly deteriorated. Table 3.2 indicates an average of all the roads considered for the study in each programme.

Table 3.2: Financial Cost Breakdown and Unit Cost of Spot Rehabilitation Programmes

Programme	Method of Imp.	Percentage of Costs						Unit Cost Per Km (Ushs mill.)	Man-days Per Km
		Super-vision	Lab-our	Mat-erial	Equip-ment	Over-head	Land		
GTZ-Labour	Labour	39.9%	50.6%	4.9%	0.8%	3.8%	0.0%	4.80	2,027
RDSP	Labour	0.0%	61.6%	12.3%	6.7%	19.4%	0.0%	4.77	1,755
Average	**Labour**	**5.9%**	**60.0%**	**11.2%**	**5.8%**	**17.1%**	**0.0%**	**4.78**	
GTZ-Equip.	Equip.	27.5%	5.2%	2.5%	62.5%	2.3%	0.0%	9.37	400
Coffee	Equip.	22.6%	2.3%	4.6%	68.6%	1.8%	0.0%	9.92	459
Average	**Equip.**	**24.0%**	**3.2%**	**4.0%**	**66.8%**	**2.0%**	**0.0%**	**9.73**	

Table 3.2 also shows that the proportion of cost for labour wages for labour-based spot rehabilitation programmes averages 60%, and ranges from 50.6% to 61.6%. Similar figures for equipment-based programmes are 3.2% average and a range of from 2.3% to 5.2 %.

The proportion of cost for equipment averages 5.8% for labour-based programmes (range 0.8% to 6.7%) and 66.8% for equipment-based programmes (range from 62.5% to 68.6%).

The difference in cost breakdown between the labour-based and equipment-based spot rehabilitation programmes is even more significant than that between the labour-based and equipment-based full rehabilitation programmes. The very low equipment element in the labour-based spot rehabilitation programmes may suggest that little or no gravelling was carried out. The slightly higher ratio of equipment cost to labour cost in the equipment-based spot rehabilitation programmes compared with the equipment-based full rehabilitation programmes may suggest a large amount of machine-based grading in the spot rehabilitation works. Thus, for spot rehabilitation works in particular, the types of activities undertaken were probably influenced by the type of technology used.

The high variability in the percentage of supervision costs between different programmes suggests a difference in the way that the costs have been accounted. For example, it appears that the supervision costs for the RDSP programme have been included under overheads. However, if overheads, supervision and land costs are excluded, the general conclusions remain valid.

Significance in Cost Difference Between Labour-Based and Equipment-Based Methods

Given the variability of the data for individual projects, the question that remains is whether the difference in average costs per kilometre between the labour and equipment- based approaches is statistically significant.

To test this, a two-sample student's t-test was performed using all the data i.e. full rehabilitation and spot rehabilitation programmes together. At a 95% confidence level, an insignificant test value of 0.10 was obtained. However, a significant test value of 0.024 was obtained at a 90% confidence level. Therefore, the hypothesis that the means of the labour-based and equipment-based programmes are the same cannot be rejected at the 95% confidence level, but can be at the 90% level.

Simply put, although the overall calculated average cost per kilometre for labour-based programmes is lower (some 30%) than for equipment-based programmes, the data suggests that this difference is not statistically significant at a 95% confidence level. However, the difference is significant at a 90% confidence level. The conclusion is that the average financial cost per kilometre of labour and equipment-based approaches is significantly different at the 90% confidence level – labour-based methods are cheaper than their equipment-based counterparts.

Repeating the t-test for the spot rehabilitation programmes only shows that they are significantly different even at the 95% confidence level.

3.3 Financial Cost Breakdown by Labour and Equipment-Based Methods

Figure 3.1 and

Figure 3.1: Financial Cost Breakdown for Labour-Based Methods

show the proportional breakdown of costs for labour and equipment-based approaches based on all the data. It can be seen from the figures that just about half of the costs using labour-based methods goes for the payment of wages for labour and about a quarter for equipment (including depreciation, maintenance, oils & fuel). In the case of equipment-based methods, about two-thirds of the cost goes to equipment. Interestingly, the proportion of overheads plus supervision cost is significantly higher for equipment-based methods than for labour-based methods (29% against 12%).

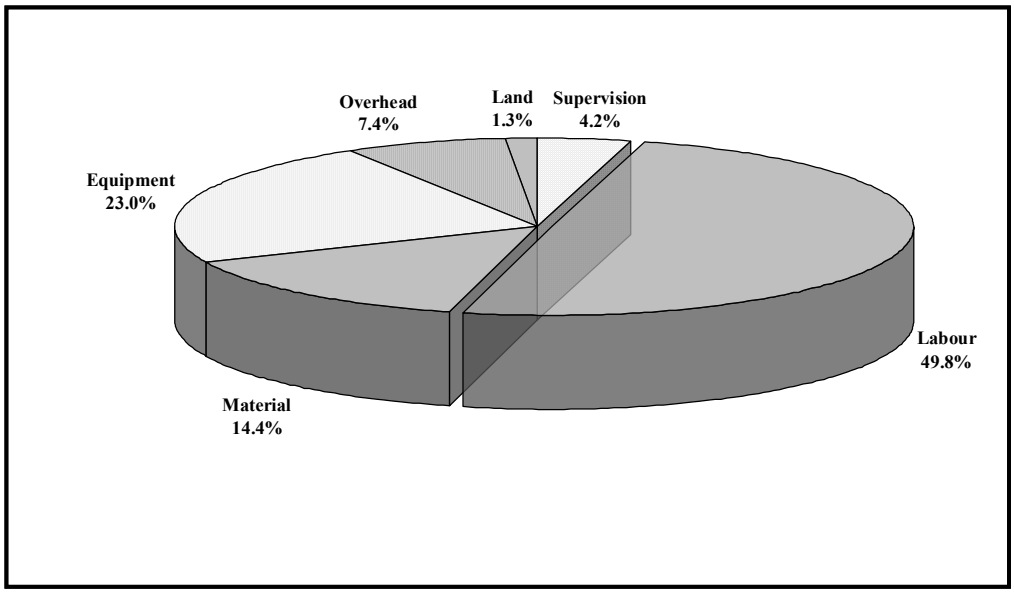


Figure 3.1: Financial Cost Breakdown for Labour-Based Methods

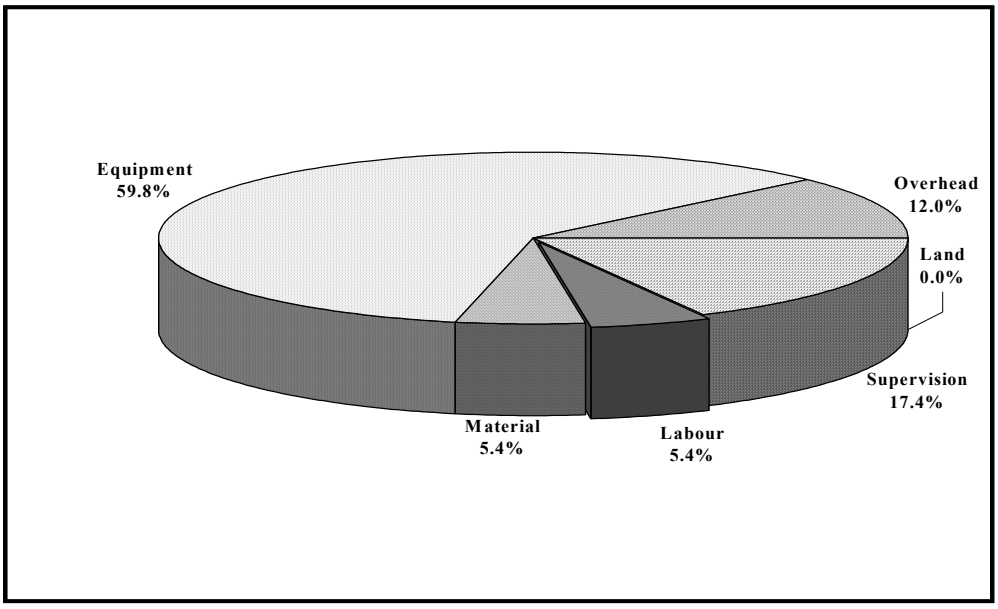


Figure 3.2: Financial Cost Breakdown for Equipment-Based Methods

3.4 Summary of Findings of Financial Cost Comparison

Based on the data available, the overall average cost per kilometre using labour-based methods for full feeder road rehabilitation has been found to be about 18% cheaper than equipment-based methods in financial cost terms (Ush 10.4 million compared to Ush 12.7 million). However, only two programmes could be compared, the UTRP and the Masaka Roads. For UTRP, data was available for 25 completed feeder roads covering 193 kilometres. For the Masaka Roads there were two contracts totalling 92 kilometres. However, because the same contractor carried out both Masaka projects, it was treated as one contract in the data. The variability in costs per kilometre between individual schemes in UTRP was quite large. Thus, the most reliable conclusion to be drawn is that **labour-based methods can accomplish feeder road rehabilitation to the same standard as equipment-based methods and at approximately comparable (or lower) financial costs.**

A similar conclusion can be drawn for spot rehabilitation works, except in this case the overall average cost per kilometre using labour-based methods was significantly lower than using equipment-based methods (Ush 4.8 million compared to 9.7 million).

There was considerable variability between the costs per kilometre of individual projects. However, the difference in the average costs of the labour-based and equipment-based programmes was statistically significant (at a 90% confidence level).

More consistency in the data between projects was found when examining the cost breakdown into labour, equipment, materials, etc. The average labour element of the labour-based rehabilitation costs was found to be 44% compared to 8% using equipment-based methods. The proportions for equipment costs were 32% for labour-based methods and 51% for equipment-based methods. The differences were even more pronounced if spot rehabilitation works only were considered.

Overall it was found that the difference in the breakdown of costs between labour-based and equipment-based programmes was significantly different. **On average, half of the costs for labour-based projects goes to the payment of labour wages compared to less than 10% using equipment-based methods**. About two-thirds of the costs for equipment-based projects go to the equipment related expenses compared to only about a quarter for labour-based projects. -

In summary it can be said that labour-based projects were found to be about 18% and 50% cheaper in financial terms for rehabilitation and spot rehabilitation respectively. The average difference in costs between labour-based and equipment-based programme was found to be statistically significant at a 90% confidence level.

Chapter IV

ECONOMIC COST COMPARISON IN RURAL FEEDER ROAD WORKS

The financial cost comparison in Chapter III is based on actual costs. These prices, however, do not reflect the true costs to the economy, as they are sometimes distorted and fail to represent actual resource costs. For this reason, decisions on public investment are usually taken on the basis of economic costs. This chapter considers the costs comparison between labour-based methods and equipment-based methods based on **economic** costs.

In order to reflect true economic costs, the usual procedure is to consider all costs exclusive of taxes and to shadow price labour and other items to represent their true cost to the economy. The classical approach to shadow pricing is quite complicated, requiring the solving of a number of simultaneous equations in a full input/output matrix. However, simplified procedures, as described below, are widely accepted and give a good approximation to the more elaborate methods.

If the exchange rate is distorted, then this has to be taken into consideration in the calculation of economic costs. In the case of Uganda, there is an open system of foreign exchange dealing. The assumption made in this study is that **the exchange rate is a fair reflection of the market rate for foreign exchange**. Hence, no adjustment of prices has been made for this. This is a simplification that favours the more import-intensive equipment-based methods. This is because, where the balance of payments is vulnerable as in Uganda, and all other things being equal, there is a tendency to prefer investments with a low proportion of foreign costs.

4.1 Shadow Pricing (Accounting Ratios)

It is the shadow pricing of labour that is most critical to this Comparative Study. However, all other costs need to be adjusted to take account of costs exclusive of taxes. Taxes are transfer costs and are not included in economic costings. Usually the shadow pricing is carried out via the use of accounting ratios. These are the ratios of the shadow prices to the market prices.

Shadow Pricing of Unskilled Labour

In its simplest form the shadow wage rate represents the opportunity cost of labour. This is "the loss of production which would arise by withdrawing a man from agriculture, or any other sector of the economy, if the rest did not work harder"[8]. Given the high levels of unemployment and underemployment in rural areas of Uganda together with the low labour productivity of rural unskilled labour, the shadow wage rate is significantly lower than the prevailing rates in the labour market.

For works carried out on feeder roads in Uganda, it is the loss of productivity in the rural economy that generally represents the opportunity cost of labour. For this reason the shadow wage rate for this study has been based on family labour productivity in small-scale and household enterprises, both agricultural and non-agricultural.

[8] Ref. "Project appraisal and planning for developing countries", Little and Mirrlees, 1974 (page 170)

According to the 1992/93 National Integrated Household Survey, it was estimated that the average labour productivity in this sub-sector was Ushs 139,000 per annum. This is equivalent to Ushs 567 per day, assuming 245 working days per year. Taking into consideration inflation since 1992/93, this is equivalent to Ushs 816 (US$0.63[9]) per day in 1998 prices. This figure is similar to the Ushs 880 per day estimated for the agricultural sector productivity alone during the more recent Farm Budget Survey of 1997.

Strictly speaking, the opportunity cost of labour should be based upon the **marginal** productivity in agriculture, which is usually less than the **average** productivity. It has been suggested that "if nothing else is possible, one can take half the average productivity as a measure of the marginal productivity, and this may not be far wrong"[10]. However, for this study the average productivity has been used, whilst acknowledging that this probably overstates the opportunity cost of labour.

The average market wage for unskilled labour for feeder roads works is Ushs 1500. Thus an **accounting ratio of 0.54** (Ushs 816/Ushs 1500) has been used to shadow price labour wages. Based on the findings of similar studies in other countries, the factor of 0.54 seems reasonable.

Shadow Pricing of Other Costs

For other costs of feeder road improvement and rehabilitation, a reduction has been made to remove taxes. The average levels of taxation assumed are shown inTable 4.1. The accounting ratios have been calculated as 1 / (1+tax), and are also shown in Table 4.1. For labour, it has been assumed that taxes are not significant.

Table 4.1: Assumed Levels of Taxes in Feeder Road Cost Components

Cost item	Average taxation	Accounting ratio
Supervision staff	10%	0.91
Materials	20%	0.83
Equipment:	26.6%	0.79*
Equipment purchase	*20%*	-
Equipment spares and repairs	*20%*	-
Fuels & Oils:	-	-
-diesel	*40%*	-
-petrol	*50%*	-
-lubricants	*40%*	-

Source: consultant's estimates
***See Annex 5 for derivation of the equipment accounting ratio**

[9] An exchange rate of US $ 1.00 = Ushs 1300 has been assumed throughout this study.
[10] Ref. "Project appraisal and planning for developing countries", Little and Mirrlees, 1974 (page 277)

4.2 Comparison of Economic Costs of Labour-Based and Equipment-Based Methods

Full Rehabilitation

The economic cost breakdown and per kilometre economic costs of full rehabilitation programmes are given in Table 4.2. These figures have been obtained by multiplying the financial costs in Chapter III by the accounting ratios derived above as well as shadow pricing labour costs. Table 4.2 shows that, in terms of economic costs, the equipment-based Masaka programmes is 61% more expensive than the labour-based UTRP programmes (Ushs 10.6 million compared with Ushs 6.6 million). This compares with a figure of 22% more expensive when considering financial costs (see Section 3.2). Thus, the adjustment to economic costs has a proportionately greater effect on the labour-based projects than the equipment-based projects. The higher proportion of labour cost in labour-based programmes is responsible for this effect.

Table 4.2: Economic Cost Breakdown and Unit Cost of Full Rehabilitation Programmes

Project	Method of Imp.	Percentage of Costs						Unit Cost Per Km (Ush mill)	Man-days per km
		Super-vision	Lab-our	Mat-erial	Equip-ment	Over-head	Land		
UTRP	**Labour**	4.4%	34.3%	19.1%	36.0%	3.4%	2.7%	**6.6**	1,374
MASAKA[11]	**Equip.**	9.5%	5.4%	7.2%	47.8%	30.1%	0.0%	**10.6**	328

Spot Rehabilitation

Table 4.3 shows that, in terms of economic costs, the average per kilometre cost of equipment-based spot rehabilitation projects is 141% more expensive than its labour-based counterpart (Ushs 7.92 million compared to Ushs 3.29 million). However, due to the variability in the work content of spot rehabilitation programmes, this can only be taken as an indicative comparison.

Table 4.3: Economic Cost Breakdown and Unit Cost of Spot Rehabilitation Programmes

Project	Method of Imp.	Percentage of Costs						Cost per km (Ushs mill)	Man-days per km
		Super-vision	Lab-our	Mat-erial	Equip-ment	Over-head	Land		
GTZ-Labour	Labour	50.3%	37.9%	5.7%	0.8%	5.3%	0.0%	3.46	2,027
RDSP	Labour	0.0%	48.8%	15.0%	7.7%	28.4%	0.0%	3.26	1,755
Average	**Labour**	**7.8%**	**47.1%**	**13.6%**	**6.7%**	**24.9%**	**0.0%**	**3.29**	
GTZ-Equip.	Equip.	30.7%	3.4%	2.5%	60.5%	2.8%	0.0%	7.65	400
Coffee	Equip.	25.2%	1.5%	4.7%	66.4%	2.2%	0.0%	8.07	459
Average	**Equip.**	**26.8%**	**2.1%**	**4.1%**	**64.7%**	**2.4%**	**0.0%**	**7.92**	

[11] Although Masaka is a Spot rehabilitation project, the relevant costs have been factored up to represent the cost for full rehabilitation.

Cost Breakdown

Figure 4.1 and Figure 4.2 show the overall breakdown of the economic cost components for labour and equipment-based approaches.

In the case of the labour-based approach, there is a considerable difference in the percentage breakdown between the financial and the economic costs (see also figure 3.1). For the economic cost breakdown, the proportion of the labour component reduces compared to the financial cost breakdown from 50% to 39%. The equipment component increases slightly from 23% to 26%.

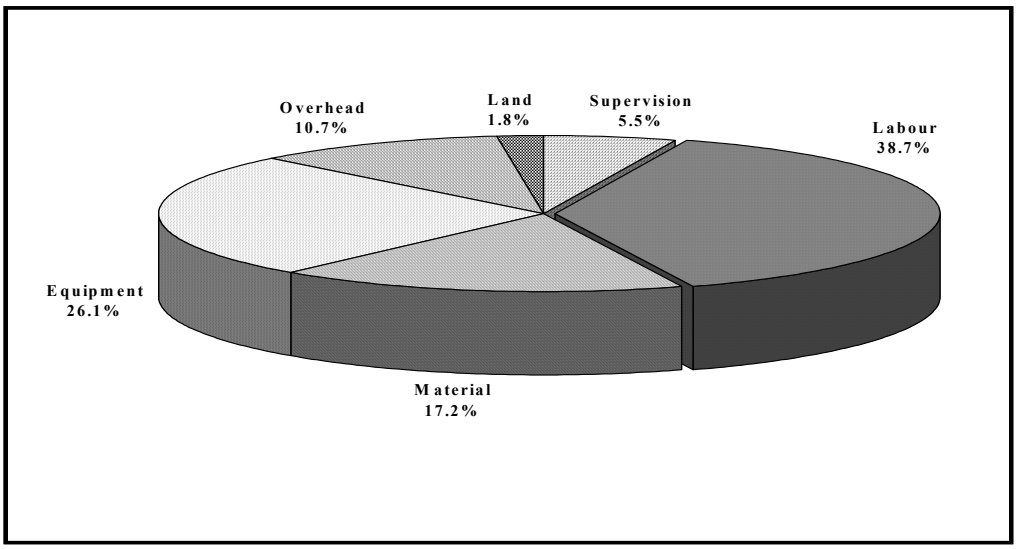


Figure 4.1: Economic Cost Breakdown for Labour Based Methods

In the case of the equipment-based approach, the change in the proportions of labour and equipment from the financial to the economic cost breakdowns is less significant. Labour reduces from 5.4% to 3.6% and equipment from 60% to 57%.

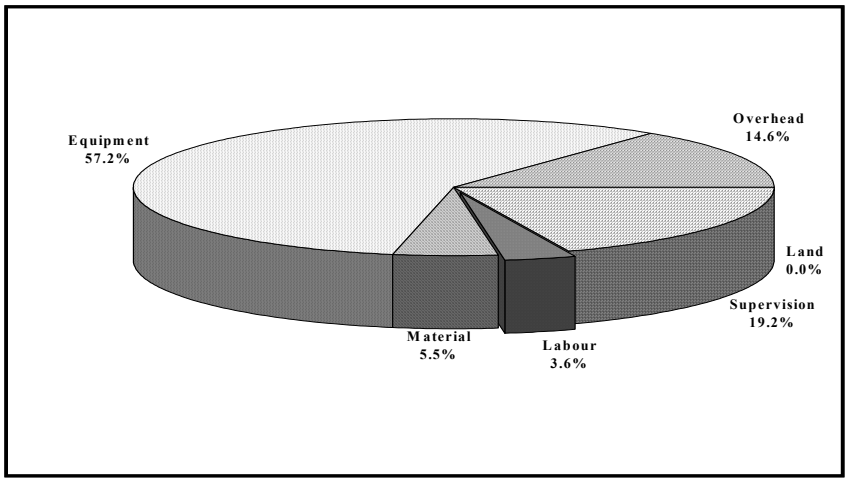


Figure 4.2: Economic Cost Breakdown for Equipment-Based Methods

Significance in Difference between Labour-Based and Equipment-Based Economic Costs

As for the financial costs, a test was carried out to determine whether the difference in average per kilometre economic cost between labour-based methods and equipment-based methods was statistically significant.

A two-sample student's t-test was carried out on all the data i.e. full rehabilitation and spot rehabilitation programmes together. This gave a test value of 0.033. This indicates that the hypothesis that the two sample means are equal can be rejected at a 95% confidence level. In other words, even given the variability of the cost per kilometre between individual projects, the difference between the average economic cost of labour-based and equipment-based programmes is statistically significant.

A similar result was obtained for the average economic cost per kilometre for labour and equipment-based spot rehabilitation programmes only. A test value of 0.016 was obtained confirming a statistically significant difference between the average economic costs of labour-based and equipment-based spot rehabilitation.

In summary it can be said that **the difference in average economic cost of labour-based and equipment-based programmes is statistically significant at a 95% confidence level.** There is a slightly greater statistical significance between the average economic costs of labour-based and equipment-based methods compared to their financial costs.

4.3 Cost Advantage Ratio

An attempt has been made to compare in slightly more depth the costs of similar projects using labour-based and equipment-based approaches. An assessment has been made of the extent to which the labour-based approach is financially and economically more competitive than the equipment-based approach. The comparison has been made between UTRP and Masaka[12] programmes (both of which are full rehabilitation) and also between the RDSP and Coffee Roads programmes (both are spot rehabilitation). These programmes were chosen due to the reasonable reliability of their data.

The average financial and economic costs per kilometre of these programmes are given in

[12] Although Masaka roads are spot rehabilitation but the cost has been factored up to represent full rehabilitation status

Table **4.4**. This table collects data from previous tables in this report and converts costs to US dollars. The percentage of labour cost in the total cost is also shown in the last 2 rows of the table. This percentage reduces for the economic costing compared to financial costing due to the shadow pricing of labour wages, which reduces the significance of labour costs.

Table 4.4: Economic Costs of Labour and Equipment-Based Methods

	Full Rehabilitation		Spot rehabilitation	
	UTRP	**Masaka**	**RDSP**	**Coffee Rd.**
Method	Labour-based	Equip.-based	Labour-based	Equip.-based
Workdays/Km	1,374	328	1,755	459
Financial Cost/Km (US$)	8,000	9,769	3,669	7,630
Economic Cost/Km (US$)	5,077	8,154	2,508	6,208
Financial Labour Component	44.4%	8.4%	61.6%	2.3%
Economic Labour Component	34.3%	5.4%	48.8%	1.5%

Source: Data from Tables 3.1; 3.2; 4.2 and 4.3. Conversion rate used Ush 1300 = US $ 1.0

Building on the figures in, Table 4.5 shows the percentage change from financial to economic costs. Both labour-based and equipment-based economic costs are below their financial costs. However, the percentage change is considerably greater for labour-based methods (36.5% and 31.8%) than for equipment-based methods (16.5% and 18.6%). This suggests that, **where financial costs are equal, labour-based methods would be significantly cheaper in economic terms.**

Table 4.5 also shows the cost advantage ratios of labour-based methods over equipment-based methods. This is calculated by dividing the difference in cost per kilometre between the labour-based and equipment-based programmes by the cost of the equipment-based programmes. For full rehabilitation, the cost advantage is 18% based on financial costs and 38% based on economic costs. Similar figures for spot rehabilitation are 52% and 60% respectively.

Table 4.5: Cost Advantage Ratios between Labour and Equipment-Based Methods

	Full Rehabilitation		Spot rehabilitation	
	UTRP	**Masaka**	**RDSP**	**Coffee Rd.**
Method	Labour-based	Equip.-based	Labour-based	Equip.-based
Workdays/Km	1,374	328	1,755	459
Net Adjustment (financial cost – economic cost)	2,923	1,615	1,161	1,422
% Adjustment (net adjust.+finan.cost)	36.5%	16.5%	31.6%	18.6%
Cost difference (EB-LB) financial $/km	1,769	-	3,961	-
Cost difference (EB-LB) economic $/km	3,077	-	3,700	-
Cost Advantage Ratio (Financial)	18%	-	52%	-
Cost Advantage Ratio (Economic)	38%	-	60%	-

4.4 Break-Even Wage Rate and Sensitivity Analysis

Finally, the question that has to be answered is, "how would this comparison change if there were a change in the relative cost of significant components?". Two types of sensitivity test were carried out to examine this. Firstly, a break-even wage was calculated. Then the effect of a change in the price of fuel and oils was examined.

Break-Even Wage

The break-even wage rate is the wage rate at which the cost of using labour-based or equipment-based methods becomes equal. It gives an indication of the maximum limit to which wages can be raised before labour-based methods become financially or economically uncompetitive compared to the equipment-based approach. As labour-based methods have been found on average to be cheaper in both financial and economic terms in this study, the break-even wage is higher than the current market wage.

Table 4.6 shows that the financial and economic break-even wage rates for rehabilitation projects are US$4.30 and US$4.18 respectively[13]. The equivalent figures for spot rehabilitation are US$4.66 and 3.73 respectively. The average market wage rate for labour was Ushs 1500 i.e. about US$1.15 per day. This implies that, if all other costs remain the same, the wage rate would have to rise by about 260% before labour-based methods would become more expensive than equipment-based methods for feeder road rehabilitation work. For spot rehabilitation, a rise of over 200% would also be required.

Table 4.6: Break Even Wage Rates between Labour and Equipment-Based Methods

	Full Rehabilitation		**Spot rehabilitation**	
	UTRP	**Masaka**	**RDSP**	**Coffee Rd.**
Method	Labour-based	Equip.-based	Labour-based	Equip.-based
Workdays/Km	1,374	328	1,755	459
Financial Break Even Wage US $	**4.30**	-	**4.66**	-
Economic Break Even Wage US $	**4.18**	-	**3.73**	-

Sensitivity to Price of Fuels and Oil

To test the sensitivity of the cost comparison to the relative movement of other prices, the effect of a 100% increase in the cost of fuel and oils was examined. Fuel prices were chosen for two reasons. Firstly, this is a cost that represents a significantly different proportion of the total cost of the two methods. Secondly, it is a commodity which is wholly imported and whose local price is, therefore, subject to volatility due to exchange rate fluctuations and other factors. Table 4.7 shows the resulting impact on costs. This is relatively small in the case of labour-based methods (5% or less). For equipment-based methods, a change in total cost per kilometre of the order of 7 to 10% results. From these results it appears that, even a significant change in fuel prices would only have a modest effect on the relative costs of the two methods.

[13] Details of the method of calculation of the break-even wage rate are given in Table A4-2 of Annex 4.

Table 4.7: Sensitivity Test – Fuel Price Increase of 100%

	Full Rehabilitation		Spot rehabilitation	
	UTRP	**Masaka**	**RDSP**	**Coffee Rd.**
Method	Labour-based	Equip.-based	Labour-based	Equip.-based
Workdays/Km	1,374	328	1,755	459
Fin. Cost Escalation due to 100% increase in fuel & oil price	4%	7%	1%	10%
Economic Cost Escalation due to 100% increase in fuel & oil price	5%	7%	1%	10%

The general conclusion to be drawn is that quite large changes in relative prices would be **unlikely to affect the conclusions of the cost comparison.**

4.5 Summary of Findings of Economic Cost Comparison and Sensitivity Tests

The comparison of the average economic costs of using labour based and equipment-based methods shows **a significant economic cost advantage in favour of using labour-based methods**. For full rehabilitation, the average economic cost per kilometre was Ushs 6.6 million using labour-based methods and Ushs 10.6 million using equipment-based methods – a difference of 38%. For spot rehabilitation the difference was even greater – some 60%. However, in the absence of more detailed information on the relative work quantities per kilometre for the different projects, the difference in spot rehabilitation costs per kilometre must be treated with caution.

Sensitivity tests indicate break-even wage rates for full rehabilitation of US$4.3 per day using financial costs and US$4.18 using economic costs. This compares with an existing average market wage of US$1.15 per day. Similar figures were obtained for spot rehabilitation programmes. This indicates that wage rates would have to rise by more than 200%, and other prices remain the same, before the average costs per kilometre using labour-based methods would become equal to those for equipment-based methods.

The equipment-based approach was found to be more sensitive to fuel and oil cost price rises than the labour-based approach. However, such impact was not great. The conclusion drawn was that **the cost comparison result was not highly sensitive to changes in either wage rates or fuel prices.**

Chapter V

COMPARISON OF MACRO-ECONOMIC IMPACTS

Chapters III and IV have compared labour-based and equipment-based projects in terms of their direct financial and economic costs. However, these comparisons are incomplete because they fail to take into account the full impact of the use of the two different methods on the national economy. This is because secondary or multiplier effects have not been considered.

Public spending on local resources (salaries, materials, tools, etc), directly and indirectly, increases household income, which may be consumed, saved or invested. Government also receives revenue from the taxation of salaries, locally supplied or consumed goods and services, and from imports for consumption as well as for investment. The increase in household income boosts demand for locally produced goods and services, thus increasing local economic activity. The chain goes on and the circle continues leading to "multiplier" effects within the economy that are often much greater than the initial impact.

Other studies[14] have shown that these indirect effects can be very significant. It is, therefore, very important for this comparative study to make an estimate of these secondary effects. For this reason a simple macro-economic model has been constructed for Uganda. This is of an input/output type, and is similar to that used for a comparative study carried out in Madagascar[15].

5.1 Explanation of the Model

The model, which illustrates the macro-economic impacts on the real sector, fiscal accounts, and the external sector, is built on the principles of the national income identity of a typical economy. It was designed in order to capture the key macro-economic variables in the economy such as gross domestic product (GDP), household income, private investment, public deficit and the trade balance. These are important, because no sound economic programme should put such key macro-economic variables into jeopardy, at least in the medium and long term.

The model assumes no change in foreign transfers and net factor income and therefore these are excluded from the model. Exports are exogenous; that is, they are determined outside the model. Total public investment expenditure in feeder roads development is also exogenous, as an economic policy variable. Other exogenous variables include average daily wage rates, labour component and expenditure on local resources.

In developing countries, public fiscal deficit is always a worrisome economic indicator because of the inability or limited instruments to raise non-inflationary finance. Similarly, because of the shortage of foreign savings, public investment programmes that save foreign exchange should be preferred. The model estimates the level of employment creation using either labour-based or equipment-based methods. Employment creation is crucial to sustain a high economic growth rate and for poverty reduction. In Uganda's case, a programme that creates more employment should be given priority

[14] Bertin Martens, Etude Comparée De L'Efficacité Économique Des Techniques à Haute Intensité De Main-D'oeuvre et à Haute Intensité D'équipment Pour La Construction De Routes Sécondaires au Rwanda-ILO, 1990.
[15] Mireille Razafindrakoto and François Roubaud, L'Approche à Haute Intensité de Main-d'Oeuvre (HIMO): Une Opportunité pour Madagascar. Essai de cadrage macro-économique, ILO 1997.

when making public investment decisions. The model establishes the direct and indirect linkages of public investment spending within the economy and builds various multiplier functions.

The model uses both macro-economic data, as well as data collected from sample projects for financial and economic cost comparison. Project costs were broken down into local costs (salaries and materials etc.) and foreign costs and the ratios used for the model to assess the direct and indirect effects of public spending on such investment projects. The model assumes that the direct impact on household incomes is related to the public investment expenditure on local resources. The model is linear so the change in an exogenous variable (public investment expenditure) is likely to give similar results.

5.2 Explanation of the Model Parameters

The specification of the model is presented in Annex 6 of this Study. The indirect effects of public investment spending are estimated using simultaneous equations, which link up the key sectors of the economy. In the model, household income is a function of consumption, private investment, public spending, and exports. Since part of household income is taken away by the state in form of taxes, the model calculates disposable income as a function of total household income, based on a given income tax rate. The parameters and the coefficients used in the model are explained below. A summary of the coefficients used for this model is given in Table 5.1 below.

Table 5.1: A Summary of Coefficients used in the Simulation Model

m=Marginal propensity to consume	0.82
$Marg_{imp}$=Marginal propensity to import	0.32
i=ratio of private investment to private GDP.	14%
t_c=tax rate on consumption	17%
t_m=Average tax rate on imports (VAT + Import duty)	21%
t_y= Income tax rate	10%
AL_p=Average labour productivity (Ushs/Manday)	3906

Data Sources: Statistical Abstract 1997 (Entebbe);
Background to the Budget (Various issues);
Finance Statute 1998;
Central Bank of Uganda quarterly reports (Various);
Report on Economics of crops and livestock production (1997)-Agricultural Policy Secretariat;
N.M.Henstridge, The Reconstruction of a Macro-economic Dataset for Uganda-WPS.98-3, University of Oxford.

Consumption, Savings and Investment

Consumption depends on the marginal propensity to consume of household disposable income. The coefficient for the marginal propensity to consume is estimated by a statistical regression method using published data on gross domestic product and consumption. Based on the regression results, the marginal propensity to consume coefficient was estimated as 0.82. The consumption function used to estimate this coefficient is given in Annex 6.

The model also assumes that not all household disposable income is consumed, but some part is also saved and some invested. The proportion of household savings that is invested ranges from 0% to 100%. The model assumes that private investment is determined by a fixed proportion of household income, which in this simple macro-economic model is equivalent to the gross domestic product of

the private sector. The coefficient for the proportion of household income that is invested is obtained by simple computation using data on the breakdown of GDP by expenditure (in this case for fiscal year 1996/97 as the latest published data available). An increase or decrease of either the private investment coefficient of household income will lead to a change in private investment in the same direction.

Uganda is an open economy, which depends on the external world for part of her consumption as well as investment requirements. To be able to capture this element in the model, a coefficient for marginal propensity to import was also estimated by statistical regression methods using quarterly data for the period 1987 to 1996. A net export equation was applied in this case[16]. Details of the regression results are also presented in Annex 6. Based on these results, the coefficient for the marginal propensity to import was estimated at 0.32.

Government Revenue and the Trade Balance

Government revenue or income is determined within the model and official transfers as well as net factor receipts are exogenous (determined outside the model). In the macro-economic model, official transfers and net factor receipts are assumed to remain unchanged. Based on these results the trade balance in the model is estimated by adding household fiscal savings to Government revenue (tax revenue) but subtracting private investment and total public investment expenditures.

The coefficients for the tax rates were derived from published fiscal data[17]. The value added tax (VAT) rate of 17% was used for the tax rate on consumption. The average tax rate on imports was computed by dividing tax revenue from imports (in Uganda Shillings) by the shilling total import value. This rate combines VAT, import duty, and excise on imports as a single coefficient. The lowest tax rate bracket of 10% was assumed for tax on income.

Estimation of Employment Creation

Employment creation (mandays) is estimated by taking total output generated indirectly (or value added) and dividing it by the labour productivity ratio. To get the equivalent number of full time employment days created indirectly, the mandays are divided by 245 days, the assumed average an employee would work in a full year. The labour productivity ratio used for the calculation of employment creation in this Study was taken as the average productivity in small scale enterprises in all sectors of the economy. This is because the employment creation through the indirect effects will be in all sectors, but much more confined to small scale enterprises. This average, therefore, includes a wide range: from the skilled, semi-, and un-skilled. Hence, it overstates the productivity of the unskilled labour such as in the agricultural sector, and perhaps understates that of the skilled, such as those in light manufacturing. Nevertheless, it reflects the national average.

5.3 Simulation Results of a Public Investment of Ushs. 30 billion

To quantify the comparative macro-economic impact of the use of labour-based methods and equipment-based methods, the model was used to simulate the effects of a public investment of Ush 30 billion in feeder road improvement. The results of the macro-economic simulation are presented in Table 5.2 below. The direct and indirect effects for the labour-based and equipment-based methods are presented in separate columns to aid comparison. The direct effects are those that arise directly

[16] Robert E.Hall and John B. Taylor "Macroeconomics:Theory, Performance, and Policy" Stanford University; PP-146.
[17] This is published in the Background to the Budget and the Finance Statute by the Ministry of Finance, Planning and Economic Development

from the public investment expenditures, while the indirect ones are those effects that are generated within the economy through the multiplier effects of an initial public investment expenditure.

Table 5. 2: Macro-Economic Simulation of Public Investment of Ushs 30 Billion in Feeder Roads Rehabilitation and Maintenance (figures in Million shillings)

	Labour-Based Method			Equipment-Based Method		
	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Gross Domestic Product (GDP)	27,430	64,121	91,551	17,764	33,043	50,808
Household Income	23,100	45,252	68,352	12,060	23,625	35,685
Consumption	17,100	33,498	50,597	8,927	17,488	26,416
Private Investment	0	9,569	9,569	0	4,996	4,996
Government revenue	4,330	18,869	23,199	5,704	9,418	15,123
Income tax	1,494	5,341	6,835	162	3,406	3,568
Import taxes	1,449	3,988	5,437	3,767	2,082	5,849
Value added tax	1,387	9,540	10,927	1,775	3,930	5,705
Public expenditure	30,000	0	30,000	30,000	0	30,000
Budget deficit	(25,670)	18,869	(6,801)	(24,296)	9,418	(14,877)
Trade Balance	(2,570)	(2,881)	(5,451)	(12,236)	(1,937)	(14,173)
Employment creation (full time jobs)	40,653	67,004	107,657	1,889	34,529	36,418
GDP Multiplier			3.3			2.9

Source: Study estimates from macro and feeder roads data

As shown in Table 5.2, the indirect effects are significantly higher than the direct ones for both methods. However, when the simulation results of the labour-based methods are compared with the equipment-based, the advantages of using labour methods are evident. Investment using labour-based methods results in a significantly higher effect than equipment-based methods for all parameters studied. The principal reason for this is that a higher proportion of the public spending remains in the local economy when using labour-based methods compared to using equipment-based methods. These effects are discussed in more detail below.

Gross Domestic Product (GDP)

In the real sector, labour-based methods generate about 2.0 times more gross domestic product (GDP) through indirect effects than the equipment-based methods. Overall, considering both direct and indirect effects, labour-based methods generate about 1.8 times more GDP than equipment-based methods (Ush 91.55 mill. Compared to Ush 50.808 mill.). A comparison of the components of GDP given in Table 5.2, i.e. household income, consumption and private investment, shows differences of a similar magnitude.

The GDP multiplier of public investment spending of Ushs 30 billion on feeder roads development programme is estimated at 3.3 for the labour methods as compared to 2.9 for equipment-based methods[18]. The GDP multiplier measures the change in GDP as a result of a unit change in public investment spending. Thus, this indicates that using labour-based methods instead of equipment-based methods has a higher positive effect on GDP.

Public Revenue

On the fiscal side, the direct benefits of labour-based methods are smaller than those of equipment-based. This is because of the significantly high revenues that accrue from the taxation on imports for public investment using equipment-based methods. These imports comprise mainly heavy roads equipment such as Graders, Bulldozers, Tippers etc. The income tax revenue for the equipment-based methods are, however, much lower than for the labour-based methods. This is because of the smaller labour component of total spending (salaries).

Overall, less revenue is generated directly using labour methods (Ush 4,330 mill. compared with Ush 5,704 mill.). This results into a slightly bigger fiscal deficit initially. But the results of the indirect benefits are interesting when the two methods are compared. The revenues generated indirectly by using labour-based methods are generally about two times more than those indirectly generated by the equipment-based methods. This more than offsets the larger direct fiscal deficit associated with the labour-based methods. The overall effect on the fiscal accounts shows that when labour-based methods are used the fiscal deficit is only 46% of that when equipment-based methods are used (Ush 6,801 mill. compared to Ush 14,877 mill.).

Trade Balance

The stronger indirect effects of using labour-based methods arise from the multiplier impact of more spending locally which increases household income and boosts demand for locally produced goods and services. This in turn triggers a supply response through increased private investment.

Overall there is a significantly larger negative effect on the Trade Balance when using equipment-based methods compared to labour-based methods (Ush 14,173 mill. compared to Ush 5,451 mill). There are no significant indirect benefits on the trade balance of using either method. The large difference on the trade balance is direct, where the deficit of using labour-based methods is much smaller than using equipment-based methods. This is due to the smaller proportion of foreign exchange spent on public investment imports when labour-based methods are used as compared to equipment-based methods (23% for labour and 60% for equipment).

[18] This is calculated as total change in the direct and indirect gross domestic product in the economy divided by the initial direct gross domestic product.

Overall therefore, there is a significant foreign exchange saving using labour methods (calculated at more than 62% using the macro-economic model). This foreign exchange can be used to import goods that have a higher social value to the poor like drugs, scholastic materials, etc.

Employment Creation

One of the principal reasons for advocating a policy of using labour-based methods is employment creation. The impact on the domestic economy of a higher public expenditure on local resources stimulates the production of goods and services. To produce more goods and services, more people have to be employed. This is especially the case in sectors where labour cannot be substituted, and in a situation where under- and unemployment are high such as in Uganda.

From the simulation results, **the employment created by a Ush 30 billion investment using labour-based methods is estimated at 107,657 full time jobs as compared to only 36,418 full time jobs that would be created using equipment-intensive methods; a ratio of 3:1**. If rural labour would be employed at the most economically efficient wage rate (i.e. the shadow wage rate), then the difference in employment creation would be even bigger. The empirical results also reveal that for every job created directly in the feeder roads programme using labour-based methods another 1.6 jobs would be created due to consequent indirect effects. This gives an indication of the strong link between public spending in the local economy and employment generation.

5.4 Sensitivity Analysis of the Simulation Results

As expected, the simulation results of the model are very sensitive to all the coefficients. But, for the purpose of this study, a sensitivity analysis was limited to the proportion of the total public investment expenditure on local resources, (measure of the labour-equipment mix), rural labour productivity, the labour component in total public investment and the daily wage rate. With the exception of the labour productivity, the rest are economic policy variables (instruments) which can be changed within a fairly short time in order to meet definitive objectives. Rural labour productivity, though an important determinant of employment creation, changes only in the medium to long term and is not available to government as a short term policy instrument.

An increase in the daily wage rate and average labour productivity have a downward effect on employment creation. Conversely, an increase in the proportion of public investment spend on local resources and an increase in the labour component have an increasing effect on employment creation. The results of the sensitivity test on employment creation of changes in daily wage rates and labour productivity for either choice of technology is summarised in Table 5.3 below.

For example, using the macro-economic model, the increase in labour productivity from Ush 3,906 per day to Ush 5,000 per day and daily wage rate from Ush 1,500 per day to Ush 2,000 per day reduces full-time employment from 107,657 to 82,833 persons using labour-based methods. This is a reduction of about 25,000 jobs. These trends hold true for the equipment-based methods as well, although in smaller absolute magnitudes. One of the major observations of this test is that employment creation by labour-based methods is more sensitive to changes in wage rates and labour productivity than equipment-based methods.

Table 5.3: Sensitivity Tests of Varying Daily Wage Rates and Changes in Labour Productivity on Employment Creation

	ALp=Ushs 3906/day		ALp=Ushs 5000/day	
Daily Wage rate	Labour based	Equipment Based	Labour Based	Equipment based
1,500	107,657	38,937	92,996	31,382
2,000	97,494	37,835	82,833	30,280
2,500	91,396	37,174	76,735	29,619
3,000	87,330	36,733	72,670	29,178
3,500	84,427	36,418	69,766	28,863
4,000	82,249	36,182	67,588	28,627
4,500	80,555	35,999	65,894	28,444
5,000	79,200	35,852	64,539	28,297

Source: Study estimates using the macro simulation model.
ALp=Average Labour productivity

5.4 Implications for Uganda's Macro Economic Framework

The implications on the country's macro-economic framework are clearly manifested in the results of the simulation model. Labour-based methods generate more income to households, increase GDP faster than equipment-based methods and have a strong stimulus on local private investment.

The overall implications of the choice of the technology choice in feeder roads improvement is that the macro-economic framework would be improved if the country adopted labour-based methods in infrastructure development wherever it is feasible, rather than the current conventional trend of using equipment.

5.5 Potential for using Labour-Based Methods in Uganda's Investment Programme in Feeder Roads

Based on the empirical evidence arising from the analysis of Uganda's case, labour-based methods have a great potential of employment creation. Firstly, the average financial cost of using labour-based methods is the same or slightly less than using equipment and the economic benefits both direct and indirect far exceed those of an equipment-intensive approach.

Government's current public investment in feeder roads is estimated at about Ush 30 billion per annum (approximately US$ 23 million). Given the labour immobility in rural areas in Uganda, it is unlikely that many individuals would remain employed on a feeder roads rehabilitation and maintenance programme for a full year. Therefore, assuming that each person would be employed for one third of the time in a year, employment would be created for about 121,960[19] people per annum using the results of the macro simulation model.

These figures clearly demonstrate the significant potential for employment creation using labour-based methods. The impact on poverty due to both direct and indirect effects (discussed below) would be significant with a GDP multiplier of 3.3 and an increase in household income of about US$68 million per annum, creating high indirect economic benefits for the population in general.

[19] Take 40,653 direct employment creation under labour-based method in Table 5.2 and multiply by 3.

The overall impact on the macro-economic framework of switching from equipment methods is even a stronger argument for the potential of labour methods. The use of labour and other locally available resources would reduce the level of foreign exchange required to procure imports in the form of heavy equipment, fuel, lubricants and spare parts. There would be no "indirect" foreign exchange advantages due to the fact that the foreign exchange saved would be used to finance a higher import bill for consumption goods, although these may perhaps be of a high social value to the poor.

The availability of labour for feeder roads is not a major constraint to adopting labour-based methods (except in some areas in western Uganda) because the labour force that is employed in agriculture is under utilised. Therefore the danger of reducing agricultural output as labour shifts to feeder roads construction is not significant. Moreover, intensive agricultural activities are cyclical, with long slack periods.

5.6 Implications for Poverty Reduction

In Uganda today, the major cause of poverty in rural and urban areas is a lack of productive employment. Since it has been established, using empirical material, that labour-based methods have a high potential for creating productive employment, this would translate into poverty reduction, directly and/or indirectly. The household population would have increased incomes which would enable them to purchase the basic requirement for a better livelihood, including paying school fees and improved access to health facilities (affordability factor). Since labour-based methods would provide a stronger stimulus to the local economy, the increased economic growth (assuming it would remain above the population growth rate) would directly increase per capita income and thus improve the national poverty indicators.

5.7 A Summary of the Findings

The analysis in this chapter shows that there are significant benefits to the economy as a whole of using labour-based methods in feeder road improvement programmes. The potential for employment creation is high, it is financially similar or cheaper than using equipment-based methods, has stronger multiplier effects on the economy, and would complement Government efforts to reduce poverty. The analysis also indicates that, because of the small foreign exchange required to import investment inputs and no significant indirect foreign exchange benefits of either choice of technology, the use of labour-based methods instead of equipment-based ones would have a positive effect on the country's balance of payments.

Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

This Study has compared the financial and economic costs of employing labour and equipment-based methods in public investment programmes for feeder roads using empirical evidence. It has also estimated the direct and indirect benefits of the choice of technology on the national economy. Based on these results, some important conclusions can be drawn, and key policy recommendations made. These are outlined in the sections below.

6.1 Conclusions

Employment creation: One of the most important conclusions of this study is that labour-based methods have a significantly higher employment creation potential when compared with equipment-based methods. They generate about 2.5-4.0 times as much employment of unskilled labourers as equipment-based methods. Based on an investment of Ush 30 billion per year in feeder road rehabilitation, it was estimated that using labour-based methods of construction would create the equivalent of 107,657 full-time jobs in Uganda, whilst using equipment-based methods would only create 36,418. Given the high level of unemployment and underemployment especially in rural areas, labour-based methods provide an opportunity to contribute towards solving the employment problem in Uganda. Consequently, therefore, they could provide a significant complementary effort to the eradication of poverty in the country.

Unit costs: Based on a study of the average costs of recent feeder roads programmes, labour-based methods are cheaper in financial terms as compared to equipment. When economic costs are taken into consideration, the cost advantage of labour-based methods over equipment-based methods is even more significant. In financial terms, the study results indicate that the cost advantage of labour methods over equipment is 18% for full rehabilitation and 52% for spot rehabilitation. In economic terms, the figures are 38% and 60% respectively.

Expenditures on local goods and services: Labour-based methods have a higher percentage of public investment expenditure that remains in the domestic economy than is the case for equipment-based methods. These percentages are on average 77% for labour and 39% for equipment. These are mainly expenditures on local resources such as labour and materials. The implication of this conclusion is that the local population derives more benefits from labour-based programmes than equipment-based ones.

Macro-economic impacts: The macro-economic impact of labour-based methods is also superior to equipment based methods. They generate about 2.0 times the additional national output compared to equipment. Over two-thirds of this is due to indirect effects. They have a similar impact on household income, consumption and investment. They put less pressure on the fiscal operations and save a significant amount of foreign exchange (which can be utilised to import items that have a higher social value to the poor).

Roads standards: Based on the findings of this Study (site observations and interviews)[20], and studies in other developing countries[21], it can be concluded that it is technically feasible to substitute labour for equipment, and the quality of work was in every way comparable, despite the lower cost of labour-based methods. The quality of labour-based rehabilitation under UTRP in Mbale (Eastern Uganda) was found to be of a quality at least equal to that of an equipment-based rehabilitation in Soroti (North-Eastern Uganda).

Competitive wage rates: For full rehabilitation of rural feeder roads, labour-based techniques would be competitive with machines for wage rates up to about US$ 4 per day. This compares with typical daily rates in 1998 of about US$1.20 per day. Therefore, the cost advantage of labour-based methods over equipment-based methods would remain even if there were quite significant increases in average wage rates. This competitiveness was found to be even higher for spot rehabilitation.

6.2 Recommendations

The recommendations in this section are of two types: those related to the socio-economic considerations derived from the findings of this Study, and those aimed at removing constraints or biases that inhibit the wider use of labour-based approaches. A separate Study on constraints to using labour-based methods in Uganda was commissioned by LAPPCOM in September 1998. The results of that Study should help policymakers and civil engineers to understand why, despite the fact that there is often a clear advantage in labour-based methods rather than equipment-based methods in feeder roads works, their use is still very limited. The recommendations below concerning the removal of constraints, therefore, focuses on the policy dimensions.

Social-Economic Considerations

The country's macro-economic framework envisages accelerated economic growth if per capita income is to increase meaningfully. The country has undergone sweeping economic reforms that have resulted into high economic growth rates since 1990, reaching a peak in 1994/95. Given the fact that all the major macro-economic reforms have now been implemented, and successfully so, the marginal impact of any additional macro policy reforms on the economy will be smaller in the years to come. Hence, further accelerated economic growth will need to come from the adoption of complementary policies at the micro or sectoral level.

A more labour-intensive approach to infrastructure development is one such policy that can create employment and help ensure sustainably high and broad-based growth. Because much infrastructure development, such as feeder road improvement, is located in rural areas and can absorb unskilled labour, these work opportunities are available to the poorest members of the community. This would have significant poverty reduction effects, not only at the national level but also at the household level. Moreover, persistently high unemployment and under-employment undermines efforts to achieve sustainable human development. Any form of unemployment is a denial of choices and opportunities for a reasonable quality of life. Productive employment improves the quality of life both economically and socially, not only because of income generation, but also in terms of human dignity, enhanced self-esteem, and hope for a better future.

[20] Due to data limitations, standards comparison between labour-based and equipment-based rehabilitation was by site observations and interviews of site engineers, labourers and road users.
[21] World Bank (1986); Edmonds and de Veen – ILO Report 1993; Mc Cutcheon (1996) on labour-based technology in Zimbabwe; Watermeyer and Band (1994) on Soweto's Contractor Development Programme in South Africa; and The World Bank (1998) on the Kenyan Rural Access Roads Programme.

Regarding the external sector, the implications of using more labour-based methods is that the economy would save foreign exchange as compared to using equipment-based methods. These savings can provide the opportunity to import items of a high socio-economic value to the poor. This is an important economic policy consideration in Uganda, which generates inadequate foreign exchange savings to finance all of its imports and other foreign exchange transactions.

Another important consideration while making technology choice for public investment programmes is how it will impact on the fiscal accounts. Uganda, like many other developing countries, is faced with the problem of lack of capacity to raise domestic revenue to finance the desired level of public expenditure programmes. Moreover, in order to control inflation, the fiscal deficit must be small enough to avoid recourse to inflationary domestic finance. It has been demonstrated in this Study, using a macro-economic model, that the total effect on the budget deficit of using labour-based methods is, in fact, smaller than using equipment-based methods. Therefore, the objective of maintaining fiscal balance would be met more easily by adopting more labour intensive methods.

Policies to Reduce Biases Against the Use of Labour-Based Methods

It should be stated at the outset that the recommendations below are not aimed at totally replacing equipment-intensive methods in road construction with labour. They are merely meant to increase the scope for using labour-based methods were they are most appropriate.

Partnership between Government and the private sector: To be sustainable, labour-based public works programmes require a partnership between government and the private sector through contractual arrangements and other appropriate modalities. If the private sector has to become an expanding engine of growth in the labour market, a more enabling environment should be created. A policy framework should be put in place to ease the participation of small local private contractors in infrastructure development. These would be contractors with little capital employing labour-based methods. They could participate in larger public works programmes through subcontracting. Subcontracting of big projects, or providing contracts to many small local contractors, would be effective in addressing the time constraint that some decision-makers advance while disputing the value of labour-based methods.

Project evaluation criteria: To take the fullest advantage of labour-based methods, road investment programmes and road designs, with their associated technological options, must be methodically reviewed in the light of the essential objectives of the national plan and of the roads themselves. Specifically, evaluation criteria should include employment potential, viability of substituting labour for equipment; economic cost evaluation using shadow pricing, and an assessment of the overall impact on the economy i.e. direct and indirect economic benefits/costs.

Capacity building in labour-based works: There is no doubt that the capacity of local private contractors to implement labour-based road construction programmes is currently less than adequate. Accordingly, a framework to build capacity for more labour-based programmes to complement already on-going efforts should be put in place, as part of the overall enabling environment. Capacity building could include, among others, training of supervisors and foremen in public works departments and practical training of local contractors by engaging them in actual assignments with specialised supervisors. This may be expensive initially but the long-run benefits would significantly offset the short-term costs.

Conditions of Tender and Contract provisions: The conditions of Tender and the provisions of contracts often provide such a strong built-in bias against labour-based methods that, unless changed, the advantages of labour-based methods alone will not induce policymakers and engineers to use them. To eradicate some of the biases involved in the selection of contractors, the minimum stock of equipment requirement should be waived for contractors who have proven skills in labour-based

methods. The criterion should not be whether the contractor has enough equipment to carry out the project, but his or her efficiency in the use of alternative approaches.

Sub-contracting to small local contractors: The size of contracts generally favours big foreign contractors over small local contractors. It is therefore desirable that, wherever possible, large projects should be divided into large numbers of small lots to facilitate tendering by small and medium sized local firms. Where the scope to split a large contract is limited, a big contractor could be required to subcontract a portion of the works to small contractors.

Road designs and feasibility studies: A detailed evaluation of alternative labour-based methods needs to be made first by consulting engineers at the design stage and then the appropriate specifications included in contract documents. The consulting engineers could make sure that the terms of reference for feasibility studies and engineering design promote the investigation of possibilities of substitution of labour for equipment in feeder roads construction. However, to ensure proper implementation and supervision, the government and the consulting engineers need to play a proactive role. The government, perhaps through local and community leaders, could act as watchdogs to ensure the efficient and effective implementation of labour-based methods.

Contractual time constraints: Most road construction contracts specify tight time schedules for work accomplishment, emphasising technical efficiency and ignoring other considerable benefits of utilising alternative approaches. In reality, however, mobilisation for equipment-based contracts can be very slow. Where it is clear, therefore, that labour-based techniques, though they may extend the duration of the work, are economically and socially the most efficient, consideration should be given to waiving the contract duration limit. The longer duration may be compensated by benefits such as greater employment and increased household income. Moreover, labour-based methods are often much faster to mobilise.

Institutional and attitude changes: In general terms, civil engineers are trained in capital-intensive technologies, which are labour-saving. Very few are trained in alternative technologies that are more appropriate in developing countries, where capital and not labour needs to be saved. The long-term policy option that could best serve to reverse this trend is to broaden the curriculum of institutions for the training of civil engineers to include concepts of “appropriate” technologies. This should include illustrations and exercises to show how such a concept is translated into concrete actions in the specific environment of Uganda. Special seminars and training courses could also be organised where specially designed material for demonstration of technological alternatives could be used in order to raise awareness of the benefits and enhance their acceptability.

TERMS OF REFERENCE

Comparative Study on the Impact of Labour-based and Equipment-based Methods in Rural Feeder Roads in Uganda

Background

The GOU strategy for economic and social development, supported by a large number of donors, puts strong emphasis on economic growth, privatisation and decentralised government. The strategy implies a radical change in the way in which government services are delivered, with new roles for central and local government, communities, and the private sector.

The Government's Poverty Eradication Action Plan recommends the implementation of labour-intensive techniques as a means to provide needed infrastructure while creating employment. The labour-based approach is particularly well suited as a means to implement the Government's Strategy for Poverty Reduction.

The history of the ILO/GOU co-operation in the promotion of employment in the infrastructure sector dates back to 1981, with the establishment of the Labour Intensive Works Unit (LIWU) in the then Ministry of Planning and Economic Development, which has led to a series of field projects being carried out. However, the need for a consistent policy in this field has become increasingly apparent and has led to the establishment of LAPPCOM - the Labour-based Policy Promotion Committee. A new joint GOU-ILO project in support of LAPPCOM was launched in September 1997. The present study is funded under that project.

A study carried out by the ILO in 1996 indicates a scope for the annual creation of about 100,000 full-time job equivalents in the infrastructure sector (which is a doubling of the current employment in that sector) through a change in technology towards labour-based approaches instead of equipment - without any extra investment except for training and capacity building. Under the same assumptions, about 38 million US dollars would be saved to the country in foreign exchange; instead of being used to import heavy equipment, this money would be ploughed into the rural economy in the form of wages where it would have a multiplier effect to stimulate demand for goods and services and indirectly lead to considerable additional economic activity and employment.

Objective of the Comparative Study

With specific reference to feeder roads, the project would like to study in more detail, and based on empirical material in Uganda, the economic benefits to be derived through the application of labour-based technologies as opposed to equipment-based methods. If these can be documented as being of important magnitude the study could provide strong arguments in favour of labour-based approaches.

The study will consist of two dimensions which will mutually reinforce each other, namely:

1. On-ground assessment of the economic costs of carrying out feeder roads improvement and maintenance by LB and EB methods in Uganda.

2. Through comparative analysis of a number of on-going and completed road projects in Uganda, show the potential macro-economic benefits to the economy (Gross Domestic Product, Balance of Payment and general poverty indices.

In addition to the above-mentioned ILO study from Uganda the comparative study will also draw upon other ILO country studies along similar lines, especially Rwanda (Martens 1991), Zimbabwe-Lesotho (Stiedl & Lennartsson 1995), and Madagascar (Razafindrakoto & Roubaud 1997).

Methodological Issues

Previous studies point to a number of difficulties in making meaningful comparisons.

Technical standards. No two roads are exactly the same, due to differences in terrain, water crossings, soils, degree of erosion problems, design parameters, as well as other factors. Some projects apply a mixture of labour- and equipment-based methods and escape easy classification.

Availability of data. Reliable data for comparable operations are often difficult to obtain. Technical departments often work according to standard specifications, as far as their budgets allow them to. Idle equipment and labour is not accounted for. The same applies to other parts of (especially) force account operations where true economic costs are not reflected.

Differences in timing of implementation of the projects being compared are bound to necessitate adjustments in terms of labour costs, equipment hire prices, and inflation in consumer prices.

Market rates and simple exchange rate calculations do not fully reflect the social costs to the country of high unemployment and foreign expenditure on imported equipment. Shadow pricing is required in order to adjust for these factors.

The most robust approach is considered to be one that compares the *average costs* of a number of similar projects carried out by labour-based and equipment-based methods, or a combination of them. The larger the number of projects - provided the quality of data is acceptable - this approach will take into account a wide range of different conditions. However, since the inputs in a number of individual works operations will also need ,to be defined in detail in the analysis, it should also be possible to examine the suitability of the labour-based and equipment-based approaches at the micro-level and make recommendations accordingly.

A number of roads projects have been pre-selected for possible inclusion in the study. The final selection will take place when the quality of available data on these projects has been ascertained. Some pre-selected projects may need to be excluded while others may still be identified as suitable.

The pre-selected projects are the following:

Project – Donor	Project Cost	System Used	Progress (km) LB	EB
SWRARP - IFAD/IDA **	US $ 13.3 million	Contracting		488
		Force Account		1,270
BADEA Rds – BADEA **	US $ 8.2 million	Force Account	50	106
JICA I **	US $ 2.0 million	Force Account		1,339
ERC II – EU	US $ 4.6 million	Force Account		4,700
Coffee Roads – EU	ECU 7.0 million	Force Account		553
RDSP - KfW **	DM 5.0 million	Contracting	795	
UTRP - IDA **	US $ 16.2 million	Contracting	167	
ADB Rds - ADF**	US $ 24 million	Contracting		
Masaka Roads - EU **	ECU 860,570	Contracting		96
UNCDF/UNDP/ILO	US $ 15.0 million	Force Account		618
MDP - ILO **	US $ 0.64	Force Account	40	

*Projects marked with ** to be given priority due to likely availability of data*

LEGEND: SWRARP: Southwest Region Agricultural Rehabilitation Project
BADEA: Arab Bank for Economic Development in Africa
JICA: Japan International Corporation Agency
ERC: Economic Recovery Credit
RDSP: Reintegration of Demobilised Soldiers Project
UTRP: Uganda Transport Rehabilitation Project
ADB: African Development Bank
MDP: Masulita Development Project

Scope of Work

The work will comprise but not necessarily be limited to:

1. An overview of the macro-economic framework of Uganda and identification of constraints to economic growth. This is likely to include:

   - GDP development since 1990
   - Balance of payment since 1990 including debt servicing
   - Public finance since 1990
   - Public investment programme with emphasis on the infrastructure sector
   - Prices and wages since 1990
   - Population distribution
   - Inflation and exchange rates in a 10 year perspective.

2. Main problems related to the labour market, including:

   - Employment structure by sector
   - Labour market participation by gender, residence and age
   - Unemployment pattern by education & residence
   - Hours worked, wages & under-employment in the labour market .

3. Presentation of the main characteristics of LB projects and their implementation:

   - Labour-based projects in Uganda since 1990
   - Presentation of selected labour-based and equipment-based projects
   - Cost breakdown in labour, handtools, capital equipment, materials
   - Breakdown of labour costs by function, daily wage and quantity (workdays)
   - Financial costs of roads LB and EB projects in 1998
   - Cost comparison LB-EB projects

4. Macro-economic study of the impact of labour-based projects on key indicators: employment, income, balance of payment, public finance.

   - Presentation of a macro-economic model which allows the simulation of some alternative economic policies and their consequences on the country's economy and employment
   - Daily wages in LB and EB projects
   - Cost structure in labour-based and equipment-based projects
   - Direct and indirect employment created through LB and EB projects
   - Macro-economic impact of labour-based projects through generation of public revenue, foreign exchange savings, local investment, employment and consumption
   - Macro-economic impact of an investment programme of 30 billion Ushs.

5. Conclusions and recommendations relevant to policy formulation.

- Identification of areas where the increased use of labour can be technically and economically justified
- Recommendations on policy measures which can help to increase the use of labour in infrastructure works (legal, technical, organisational, capacity building, policy implementation modalities).

Based on the scope of work, attached is a time table allocating time in days between National and International Consultants.

Composition of Study Team and Distribution of Work

The Study Team will consist of four people: an international consultant (Team Leader) with extensive experience (15 years) in labour-based infrastructure project analysis; a national consultant with a master's degree in economics and 10 years work experience including macro-economic modelling and the use of shadow pricing; and the Project Team, i.e. the Project Coordinator and the Project Engineer. Members of LAPPCOM will provide additional inputs to the study as required by the Team.

The contract for the Team Leader will be issued by ILO Geneva, whereas the contract for the National Consultant will be issued by ILO/Dar es Salaam.

The Team Leader is technically responsible for the study and will co-ordinate all the work. He will oversee the work of the National Consultant and work in close cooperation with the Project Team but report to ILO Geneva. As regards the development of the methodology and data collection frame, the Team Leader will mostly provide his inputs via email, telephone and fax. His assignment will however also include a mission to Uganda for the analysis of data and drafting of the report.

The national consultant will basically be responsible for part 2 of the study, i.e:

Through comparative analysis of a number of on-going and completed road projects in Uganda, show the potential macro-economic benefits to the economy (Gross Domestic Product, balance of payment, employment and general poverty indices) derived from use of LB other than EB.

Accordingly national consultant shall be charged with collection of data relevant to the objective above and provide fair copy of the report to the International Consultant who will be responsible for the final report.

Timing and Reporting

The stipulated time inputs are three weeks for the Team Leader and two months for the National Consultant. During the course of the study, the Project Engineer is expected to work 75% of his time and the Project Coordinator 50% of his time directly on the study.

The study will be carried out between August and December 1998. In parallel with the study, the Project will also be preparing a policy paper to which the comparative study should be able to give valuable inputs.

The study will fall in the following stages:

1. Methodology development. This stage will examine the data base of the proposed projects and identify those to be included. It will further describe in a brief paper the macro-economic data to be collected and propose the parameters of the model. The paper will be circulated by the Project Team to relevant GOU departments and to the ILO for comments. The comments will be considered and the methodology paper revised as necessary. This stage will take place between August 15 and September 15 including 10 days for comments.

2. Data collection. This stage will largely be carried out by the National Consultant and the Project Team. It should be completed by October 1998.

3. Data analysis and draft report. The Team Leader arrives in Kampala in November and the Team spends 10 days analysing the data and preparing the draft report which will be ready in November. The draft is circulated by the Project Team to GOU and ILO for comments which will be received before end of November 1998

4. Final report. The final report is prepared by the Team Leader, taking the comments into account and submitted to ILO through LAPPCOM/GOU on diskette and in 10 hard copies by December 15.

Care will be taken to ensure that the study results are relevant to the LAPPCOM policy paper. However, since the study is also relevant to other parts of the ILO's global programme in promotion of employment-intensive policies, ILO will reserve the right to publish the study report as a Working Paper or in any other form deemed suitable.

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Table A2-1: Total Population by Age and Rural-Urban Distribution by Sex

Age Group	Rural			Urban			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	1,399,448	1,417,193	2,816,641	166,431	170,051	336,482	1,565,879	1,587,244	3,153,123
5-9	1,132,504	1,132,821	2,265,325	114,061	127,605	241,666	1,246,565	1,260,426	2,506,991
10-14	1,032,009	966,506	1,998,515	98,227	123,626	221,853	1,130,236	1,090,132	2,220,368
15-19	771,100	804,114	1,575,214	94,680	132,366	227,046	865,780	936,480	1,802,260
20-24	593,910	686,256	1,280,166	116,303	129,370	245,673	710,213	815,626	1,525,839
25-29	504,599	571,984	1,076,583	105,624	101,100	206,724	610,223	673,084	1,283,307
30-34	391,227	417,226	808,453	74,445	62,689	137,134	465,672	479,915	945,587
35-39	291,473	314,740	606,213	47,960	38,339	86,299	339,433	353,079	692,512
40-44	229,353	255,937	485,290	31,472	24,286	55,758	260,825	280,223	541,048
45-49	202,639	216,218	418,857	22,036	16,870	38,906	224,675	233,088	457,763
50-54	190,827	205,514	396,341	16,884	14,947	31,831	207,711	220,461	428,172
55-59	129,029	121,982	251,011	8,969	7,255	16,224	137,998	129,237	267,235
60-64	127,121	140,601	267,722	7,200	8,772	15,972	134,321	149,373	283,694
65-69	84,592	82,089	166,681	4,205	4,556	8,761	88,797	86,645	175,442
70-74	76,072	79,306	155,378	3,194	4,581	7,775	79,266	83,887	163,153
75-79	43,458	37,977	81,435	1,800	2,114	3,914	45,258	40,091	85,349
80+	67,031	59,120	126,151	2,423	3,746	6,169	69,454	62,866	132,320
Not stated	2,709	3,398	6,107	732	703	1,435	3,441	4,101	7,542
Total	7,269,101	7,512,982	14,782,083	916,646	972,976	1,889,622	8,185,747	8,485,958	16,671,705

Source: National Integrated Household Budget Survey 1992-93, Statistics Department, Ministry of Finance and Economic Planning.

Table A2-2: Household Population by Region and Rural or Urban –1991 Population Census

Region	Rural			Urban			Total		
	Population	H/Holds	Av.size	Population	H/Holds	Av.size	Population	H/Holds	Av.size
Central	3,650,085	820,043	4.5	1,123,146	283,417	4.0	4,773,231	1,103,460	4.3
Eastern	3,791,548	766,818	4.9	313,547	75,826	4.1	4,105,095	842,644	4.9
Northern	2,941,495	576,827	5.1	161,176	37,482	4.3	3,102,671	614,309	5.1
Western	4,305,052	823,509	5.2	198,507	50,255	3.9	4,503,559	873,764	5.2
Uganda	14,688,180	2,987,197	4.9	1,796,376	446,980	4.0	16,484,556	3,434,177	4.8

Source: Statistics Department, Ministry of Finance, Planning and Economic Development.

Table A2-3: Distribution of Households and Persons by Monthly Household Income Classes in Uganda

Monthly Household Income class ('000 ushs)	Rural			Urban			Total		
	No of Persons	No. of H/holds	% of Total H/holds	No Of Persons	No. of H/holds	% of total H/holds	No of persons	No. of H/holds	% of total H/holds
0-50	6,635,759	1,709,549	54.3	269,832	100,056	19.2	6,905,591	1,809,605	49.3
50-100	5,962,917	1,031,211	32.8	607,165	153,291	29.4	6,570,082	1,184,502	32.3
100-150	1,534,904	237,953	7.6	435,679	104,644	20.0	1,970,583	342,597	9.3
150-200	589,866	79,819	2.5	242,046	52,472	10.0	831,912	132,291	3.6
200-300	545,455	58,296	1.9	271,085	49,620	9.5	816,540	107,916	2.9
300-400	65,843	9,593	0.3	144,376	23,976	4.6	210,219	33,569	0.9
400-600	116,460	12,569	0.4	133,001	20,842	4.0	249,461	33,411	0.9
600-800	33,399	3,145	0.1	44,796	6,838	1.3	78,195	9,983	0.3
800-1000	0	0	0.0	27,922	4,580	0.9	27,922	4,580	0.1
1000-1500	3,375	1,125	0.0	41,005	4,002	0.8	44,380	5,127	0.1
Above 1500	23,200	2,900	0.1	11,342	1,919	0.4	34,542	4,819	0.1
All Classes	15,511,178	3,146,160	100.0	2,228,249	522,240	100.0	17,739,427	3,668,400	100.0

Source: Third Monitoring Survey, Statistics Department, Ministry of Finance, Planning and Economic Development

Table A2-4: Main Economic Indicators Relating to Small Scale Establishments and Household Enterprises in Uganda

Activity Type	No. of Estab	Persons engaged	Paid Employees	Wages & Salaries	Gross Output	Value Added	Labour Productivity
					('000 Ushs)	('000 Ushs)	(Ushs p.a)
Crop farming	2,982,184	9,917,122	1,721,398	15,548,746	1,354,625,985	1,327,495,258	133,859
Other agriculture	473,310	1,136,243	81,028	14,936,889	143,565,388	103,783,402	91,339
Mining and Quarrying	2,243	4,450	555	23,008	250,396	180,506	40,563
Food processing	33,301	66,013	8,786	566,932	69,821,069	22,587,246	342,164
Manufacture of beverages	148,929	267,836	25,303	695,906	33,717,631	12,348,675	46,105
Other manufacturing	140,671	211,184	18,248	1,605,615	38,825,024	18,506,218	87,631
Construction	3,632	8,365	4,733	834,162	2,123,084	2,041,922	244,103
Repair workshops	15,103	20,352	1,615	157,466	7,967,367	6,453,469	317,093
Wholesale Trade	11,165	28,116	8,931	788,303	36,613,821	27,734,569	986,434
Retail Trade	181,359	297,273	28,728	6,008,612	126,348,261	99,662,234	335,255
Hotels/Rest.	40,742	79,312	12,208	1,890,200	66,937,451	24,403,358	307,688
Transport/commun.	14,598	24,016	8,292	2,650,537	51,111,685	22,463,872	935,371
Other services	23,604	41,708	9,732	1,562,332	40,637,174	16,258,792	389,824
Total	4,070,841	12,101,990	1,929,557	47,268,708	1,972,544,336	1,683,919,521	139,144

Source: Uganda National Integrated Household Survey 1992-93, Statistics Department, Ministry of Finance, Planning and Economic Development.

Table A2-5: National Percent Age Distribution of Household Population by Main Activity, Age Group, and Sex 1/

Age-Group	Sex	Self Employed in Agriculture	Self employed in other activities	Gov't employee	Private Employee	Un-employed	Students	Rentier Pensioner etc	Other Inactive Persons	All Activities
7-14	M	8.2	0.1	0.0	0.5	0.1	79.4	0.0	3.2	100.0
	F	8.0	0.1	0.0	1.4	0.0	75.7	0.0	2.7	100.0
	T	8.1	0.1	0.0	0.9	0.1	77.6	0.0	2.9	100.0
15-29	M	43.6	7.7	3.7	14.8	1.2	25.9	0.2	1.5	100.0
	F	51.9	4.1	2.2	3.9	1.0	13.5	0.0	0.5	100.0
	T	47.8	5.9	2.9	9.3	1.1	19.7	0.1	1.0	100.0
30-65	M	56.6	12.6	11.1	16.9	0.6	0.1	0.7	1.3	100.0
	F	70.5	6.8	3.3	2.4	0.1	0.0	0.1	1.7	100.0
	T	63.5	9.7	7.2	9.6	0.4	0.0	0.4	1.5	100.0
65+	M	61.7	2.5	2.6	3.9	0.0	0.0	1.0	24.5	100.0
	F	49.3	0.8	0.0	1.1	0.0	0.0	0.0	33.5	100.0
	T	55.5	1.6	1.3	2.5	0.0	0.0	0.5	29.0	100.0
Total	M	37.5	6.6	4.8	10.5	0.6	33.4	0.3	3.1	100.0
	F	44.6	3.6	1.8	2.6	0.4	27.0	0.1	2.8	100.0
	T	41.0	5.1	3.3	6.6	0.5	30.2	0.2	2.9	100.0

Source: Uganda National Integrated Household Survey 1992-93, Statistics Department, Ministry of Finance and Economic Planning.
1/ average for Eastern and Central regions taken as proxy for National figures.
M=Male; F=Female; T=Total.

Table A2-6: National Percent Distribution of Time Spent by Household Members per day on Different Activities

Activities	Self Employed agric	Self Employed Others	Govt Employee	Private Employee	Unemployed	Total
Self-employment-farming	20.4	3.3	4.0	2.1	0.3	9.8
Self-employment-non farming	2.4	52.3	2.0	3.2	0.0	4.6
Helping H/h farming	10.0	1.1	0.8	1.1	4.5	6.8
Helping H/h non-farming	0.8	3.3	0.2	0.2	0.8	0.8
Work as employee	0.9	2.0	53.8	54.1	1.1	6.6
Fetching water for household	3.5	0.9	0.7	1.2	1.1	3.7
Looking after children	1.1	0.4	0.3	0.8	2.0	1.2
Collecting firewood	1.7	0.2	0.2	0.3	0.3	1.5
Other domestic work	18.7	10.0	7.7	8.9	14.8	17.4
Education	0.1	0.0	0.4	0.4	0.1	10.1
Transport	3.7	5.3	5.7	4.1	8.2	3.6
Searching for employment	0.3	0.2	0.1	0.3	13.0	0.3
Rest, recreation etc	36.1	20.2	24.1	22.9	51.4	33.3
Others	0.7	0.9	0.4	0.9	2.7	0.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Uganda National Integrated Household Survey 1992-93, Statistics Department, Ministry of Finance, Planning and Economic Development.

Table A3.1: SUMMARY OF DATA SOURCES

Project	Length (Kms)	Month/ Year Started	Month/ Year Finished	No of Schemes	No of Schemes Data Available	Nos. of schemes with LB	Nos. of schemes with EB	Method of Implementation	Intervention Type	Cost Breakdown			Remarks
										By road	By activity	By resource input	
UTRP	228[22]	04/96	09/97	28	25	28	0	Contractor	Rehab.	✔	✔	✔	Complete data for 193 kms. Only
GTZ	95	06/93	11/93	4	4	2	2	Force Account	Spot Rehab.	✔	✘	✔	Full Equip. cost not included
Coffee Roads	107	07/97	06/98	5	5	0	5	Force Account	Spot Rehab.	✔	✘	✔	Full Equip. cost not included. Summarised by District only
Masaka	92	08/97	08/97	1	1	0	1	Contractor	Spot Rehab.	✘	✔	✔	Foreign/local cost breakdown available
ADB	86	08/97	02/98	3	3	0	3	Contractor	Periodic Maint.	✔	✘	✔	Periodic maintenance programme
SWRARP	243	04/94	09/95	10	10	0	10	Contractor	Spot Rehab.	✔	✘	✘	No breakdown by resource input available
RDSP	225	11/95	07/96	19	19	19	0	Force Account	Spot Rehab.	✔	✘	✘	Cost summarised by district only. No breakdown by resource input available. Data of 171.4 Kms. Available
BADEA	238	07/97	06/98	7	6	0	6[23]	Force Account	Spot Rehab.	✘	✘	✔	Full Equip. cost not Included.
ERCII	442	07/98	06/99	16	16	0	16	Force Account	Spot Rehab.	✔	✔	✘	Spot Rehabilitation with Equipment. Only equipment cost available. Budget estimate for 98/99

[22] Represents length of completed roads.
[23] One District used both labour and equipment

Table A4.1 Full Equipment Costs for Typical Items (US $)

Equipment	Description	Initial Cost (US$)	Duty (%)	Delivered Cost (US$)	Number of Tyres	Cost of 1 Tyre(US$)	Total Tyre Cost (US$)	Tyre Life (yr.)	Total Salvage Value($)	Depreciable Cost($)	Economic Life (Yr.)	Availability (000hr./yr.)
		1	2	3	4	5	6	7	8	9	10	11
Dozer	D5, 105HP	115,000	0%	115,000	0	0	0		0	115,000	10	1.25
Wheel Loader	1 cu m	61,000	0%	61,000	4	1,150	4,600	1.3	0	56,400	10	1.00
Grader	12G	115,000	0%	115,000	6	950	5,700	3.0	0	109,300	10	1.00
Tipper	7-8 ton, 6 cu.m	40,000	24%	49,600	4	385	1,540	1.3	0	48,060	10	1.00
Roller	8-10 ton	42,000	0%	42,000	0	0	0			42,000	25	1.25

Table A4.1 continued:

Operating Life (Yr.)	Capital Rec. Factor	Multiplier Factor	Repair Factor	Fuel Consum (l/hr.)	Oil Consum (l/hr.)	Depreciation Charge ($/hr.)	Tax/ Insurance ($)	Maint. Charge ($/hr.)	Tire Charge ($/hr.)	Hire Charge ($/hr.)	Fuel Charge ($/hr.)	Oil Charge ($/hr.)	Direct Rate. of hourly usage chg. ($/hr.)
12	13	14	15	16	17	18	19	20	21	22	23	24	25
8	0.201	0.57	0.12	13.2	0.3	18.49	2.62	13.80	0.00	34.91	9.24	0.693	44.85
10	0.177	0.57	0.1	9.1	0.3	9.98	1.74	5.64	3.54	20.90	6.37	0.693	27.96
10	0.177	0.57	0.1	18.2	0.3	19.35	3.28	10.93	1.90	35.45	12.74	0.693	48.89
10	0.177	0.57	0.1	8	0.2	8.51	1.41	4.81	1.18	15.91	5.6	0.462	21.97
20	0.133	0.57	0.1	6.8	0.1	4.47	0.96	4.20	0.00	9.63	4.76	0.231	14.62

Table A4.2: Percentage Breakdown of Cost Items for a Typical Equipment Fleet

Depreciation	Tax/insurance	Maintenance	Tyres	Hire cost	Fuel	Oils	Total cost
US$/hr	US$/hr	US$/hr	US$/hr	US$/hr	US$/hr	US$/hr	US$/hr
54.1	8.8	33.4	4.5	100.8	15.9	1.3	118
45.85%	7.46%	28.31%	3.81%	85.42%	13.47%	1.10%	

Table A4.3: Factors to Adjust Partial Equipment Costs to Full Equipment Costs

Multiplying Factor Total Equipment Costs for projects with Fuel, Lubricant and Maintenance Costs only: 2.16

Multiplying Factor Total Equipment Costs for projects with Fuel and Lubricant Costs only: 6.35

Table A5-1: Equipment Accounting Ratios
(Based on an analysis of the Masaka Roads Project Costs)

Cost Item	Cost including tax (Ushs)	Cost excluding tax (Ushs)	Tax (Ushs)
	a	b	c (a - b)
Diesel	164,500,000	117,500,000	47,000,000
Petrol	5,500,000	3,666,667	1,833,333
Oil	17,500,000	12,500,000	5,000,000
Heavy Equipment	227,900,000	189,916,667	37,983,333
Spares & Tyres	101,000,000	84,166,667	16,833,333
Equipment (Total)	**516,400,000**	**407,750,000**	**108,650,000**

Hence:

Tax on Equipment : c/b = **26.65%**

Accounting Ratio for Equipment: b/a = **0.79**

Table A5-2: Break-Even Wage Rate

The break-even wage rate gives an indication of the maximum limit to which wages can be raised before labour-based methods become financially or economically uncompetitive compared to the equipment-based approach. In other words, this is the maximum wage rate per day below which labour methods will have a competitive edge over using machines. For this Study, the Break-even Wage per day has been calculated using the following formula:

$$\mathbf{BEW = [COST_{EQ}*(1-LC_{EQ})-COST_{LB}*(1-LC_{LB})]/(MD_{LB}-WD_{EQ})}$$

Where,

BEW	= Average Break-even Wage
$COST_{EQ}$	=Unit per Km of equipment method
LC_{EQ}	=Labour component of equipment method
$COST_{LB}$	=Unit cost per Km of labour method
LC_{LB}	=Labour component of labour method
MD_{LB}	=Mandays per Km in labour method, and
WD_{EQ}	=Workdays per Km in equipment method.

The Macro-Economic Model

Exogenous Variables

$EXPFRDP_{TOT}$ = Public investment in Feeder Roads Programme.
$X_{EXPORTS}$ = Exports
w =Average daily wage rate
l =Labour Component
α =proportion of total public investment expenditure on local resources
AL_p =Average labour productivity

Endogenous Variables

GDP =National Income (Gross Domestic Product)
Y^H =Household income
Y^H_d =Household disposable income
Y^G =Government revenue
C_{TOT} =Total private consumption
C_{imp} =Consumption of imported goods and services
C_{loc} =Consumption of locally made goods and services
S^H =Household savings
I^P_{TOT} =Total Private Investment
I^p_{imp} =Proportion of imported intermediate resources in investment
I^p_{loc} =Proportion of local resources in investment
T_{imp} =Taxes on imports
T_{inc} =Income tax revenue
T_{cons} = Tax on consumption (or value added tax)
TB =Trade Balance
E_{TOT} =Employment (mandays)

Principal equations of the Model.

$$Y^H= (C_{loc} + I^P_{loc} + EXPFRDP_{loc})*(1-t_c)+ (C_{imp} + I^P_{imp})*(1-t_m)+ X_{EXPORTS}$$
$$Y^H_d=(1- t_y)*Y^H$$
$$C_{TOT}=m*Y^H_d$$
$$S^H= Y^H_d - C_{TOT}$$
$$I^P_{TOT} =i*Y^H$$
$$Y^G = t_m (C_{imp} +I_{imp}+EXPFRDP_{imp})+(t_y * Y^H)+ t_c (C_{loc} +I_{loc}+EXPFRDP_{loc})$$
$$TB= S^H + Y^G - I^P_{TOT} - EXPFRDP_{TOT}$$
$$E_{TOT}=(EXPFRDP_{TOT})*l)/w+[GDP-EXPFRDP_{TOT}*[\alpha + lt_y +(1-\alpha)\ t_m +(\alpha-l)\ t_c]]/ALp$$

Supplementary equations of the Model

$$C_{imp} =Marg_{imp}* C_{TOT}$$
$$C_{loc} =(1-Marg_{imp})* C_{TOT}$$
$$I^p_{imp} = Marg_{imp}* I^P_{TOT}$$
$$I^p_{loc} =(1-Marg_{imp})* I^P_{TOT}$$
$$T_{imp}= t_m *(C_{imp} + I_{imp} +EXPFRDP_{imp})$$
$$T_{inc}= t_y * Y^H$$
$$T_{cons} = t_c *(C_{loc} + I^p_{loc} +EXPFRDP_{loc})$$

Estimation of Marginal Propensity to Consume Coefficient

The marginal propensity to consume coefficient was estimated using the consumption function specified below i.e. consumption is a function of gross domestic product, plus other variables whose influence is captured by a constant.

$C = a + m \cdot GDP$

Where, C = Consumption
a = Constant
m = Marginal propensity to consume
GDP = Proxy for household income.

The above equation was estimated using annual data on consumption and gross domestic product published by the Statistics Department for the fiscal years 1980/81 – 1997/98. A linear regression statistical method was applied. The results of the regression are summarised below. The t-statistic is indicated in brackets below the coefficients.

C = 263.065 + 0.8225 GDP
(3.731) (25.484)
SE = 83.4 D.W = 1.399
No. of observations = 18.

Based on the above regression results, **the marginal propensity to consume coefficient was estimated at 0.82.**

Estimation of Marginal Propensity to Import Coefficient

The estimation of the marginal propensity to import coefficient was made using the same method as the one used in the previous estimation. A net export equation[24] from which the coefficient was derived is specified below.

$TB = b - n \cdot GDP$

Where, b = Constant
n = Marginal Propensity to Import
TB = Trade Balance (net exports)
GDP = Proxy for national income.

The above equation was estimated using quarterly data on exports, imports, and GDP for the period 1987-1996. Trade data was obtained from various statistical reports published by the Statistics Department and quarterly economic reports published by the Central Bank of Uganda. Quarterly GDP data was obtained from a Working Paper Series No.WPS/98-3 entitled " The Reconstruction of a Macro-economic Dataset for Uganda" Oxford University.

The results of a linear regression are summarised below. Again, the t-statistic is indicated in brackets below the coefficients.

TB = 72.863 – 0.3156 GDP
(4.216) (-10.218)
SE = 19.4 D.W = 1.756
Adjusted R-squared = 0.726
No. of observations = 40.
Based on the above regression results, **the marginal propensity to import coefficient was estimated at 0.32.**

[24] See page 146: Hall et al (1991) "Macroeconomics" Third Edition.

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