

CHAPTER 2:

LITERATURE REVIEW I: THEORETICAL FRAMEWORK OF LABOUR-INTENSIVE WORKS TECHNOLOGY

2.1. Overview of the Chapter

This chapter discusses the theoretical framework on which labour-intensive works technology (LBWT) is premised and previous studies that have been conducted on the subject. It examines the various definitions and theories advanced by experts on LBWT and analyses its employment creation potential. Other related literature of importance that have relevance to this study have also been reviewed. The purpose of this review is to document and analyse findings of research and arguments supporting labour-intensive works as a poverty alleviation strategy and the aspects of its implementation and institutionalization.

No pronouncement will be made on the applicability, deficiencies and validity of the various theories and interpretations that evolved over time, as this falls out of the study scope. It would also be impractical to cite all experts and definitions; therefore it will be limited to those for which information is available, and those with a direct relevance to this study. Some of the experts omitted from this review may have had an equally significant contribution.

In particular, the literature review aims to:

- i) analyze research that has already been done to crystallise this study, and review and understand problems which directly or indirectly relate to the study;
- ii) establish what is already known and what remains to be investigated;
- iii) to gain an understanding of the research methodology previously used in such studies, and the tools and instruments which proved to be successful in similar previous studies;
- iv) to be acquainted with current information in the field of the study subject;

- v) to show in what way the reviewed literature is related to this study and to the problem being investigated.

This chapter is divided into three sections. The theoretical framework of LBWT is discussed in the following section. It includes the work of the ILO and the World Bank on the subject, and discussion on the technical feasibility and economic efficiency of LBWT. The next section discusses the role of infrastructure and its impact in poverty alleviation. In the last section the evaluation framework applicable to this study is described and aspects of the impact of labour-intensive works are briefly discussed.

2.2 A Historical Perspective of Labour-Intensive Methods.

There is nothing new about the use of labour-intensive methods. The great building feats of all centuries prior to the present ones were largely built by hand labour.

History tells us that the Great Pyramid of Egypt was built in about 2500 BC with either 300,000 men, according to Deodorus Siculus, or 100,000 men, according to Herodotus, in about 20 years. The size of the pyramid is 230 metres long, 230 metres wide and 147 metres high. It is estimated that it is constructed from 2,300,000 blocks of limestone of between 2.5 to 15 tonnes each. The labour expended in the building of the pyramid is estimated to be equivalent of lifting 136 million cubic metres of stone one metre high (Taylor, 1998). Whether labour was paid or voluntary appears to be unknown (Hancock, 1992, cited in Howe and Bantje, 1995). Another world monument that was built in about 20 year's period is the Great Wall of China. This is another example of massive engineering undertaking carried out by labour-intensive methods. The 2,250km long wall was built around 200BC and is estimated to have occupied 500,000 workers. The wall is 8 metres high and 6 metres wide and the total volume is about 100 million cubic metres (Taylor, 1998).

The building of water canals in Europe from the late eighteenth century was the beginning of an era of large-scale public works construction by labour-intensive methods (ibid). Initially companies formed for construction and operation of various

canals works recruited labour directly. Recruited labour was engaged in terms that bound them to the works for the required period. Labourers were paid on a “days worked” basis and companies relied on overseers to achieve high productivity by diligent supervision and the enforcement of long working hours. The nineteenth century saw a gradual shift to the use of contractors and “piecework”. The railway-building era of the mid-19th century saw the emergence of large civil engineering contractors. These introduced incentives to motivate high production from the labourers. There were many forms of incentives used, but the widespread and most successful incentive was the use of “piecework”; payment based on output. In the building of the Suez Canal in about 1864, the greater part of the excavation was done by piecework, with excellent performance results (Pudney, 1968, cited in Taylor, 1998).

With the use of “piecework”, interest was generated on the productivity of labour. In the building of the Blackstone Canal in North America, at about the same time, sand was removed by ox-drawn carts (Way, 1993, cited in Taylor, 1998). Six labourers loaded 50 carts per hour. Assuming the loaded volume of the cart to be about 0.25m³, the productivity of the team was about 2.1m³ per man-hour. This equates to 16.5m³ per man-day for an eight hours day. In another case, three (3) Irishmen dug 228m³ on the Erie Canal in five and a half work days. This was reported to have been about three times the normal average, which was approximately 4m³ to 5m³ per man-day. By contrast, slaves working on the Santee Canal in the 1790s were expected to move about 2m³ per day (Taylor, 1998).

One of the most successful British railway contractors of the 19th century, Thomas Brassey, is reported to have employed a total of 18,000 people at certain periods of his work. Each man excavated and filled an equivalent of seven wagons per day. Each loaded wagon contained just over 2m³. Hence each man loaded about 14m³ and the height of fill was about 1.8m. Some navvies¹ achieved 16.5m³ per man-day. This was the hardest physical work of the railway building under strenuous circumstances. During this time, the normal average productivity for labour in earthworks was reported to have been between 5.5 and 6.5m³ per man-day (Coleman, 1968, cited in Taylor, 1998).

¹ “Navvies” was the name given to the labourers engaged in the hardest physical work of railway building during those times.

In the 1930s, public works were used in the United States, United Kingdom, German and the rest of Europe to revive their economies and accelerate recovery from the economic crisis of the time (Taylor, 1998). Secondary objectives were the creation of employment and income redistribution. Thus, labour-intensive works have been used in many countries for years using such labels as public works, safety nets, community works, food-for-work, social funds etc. The objectives of each type were different and a wide range of practices were pursued. Some of these programmes were actually labour-extensive. Similar programmes, implemented using labour-intensive methods, in organized attempts to cope with the consequences of famine, disasters and poverty have been known for centuries.

The following sections reviews the evolution and consolidation of labour-intensive technology theory and its evolvment as an engineering discipline.

2.3. Theoretical Framework of LIW Technology.

2.3.1 The Theoretical Concept

Theories are by definition mental constructs, expressed and represented in a written or graphical form. Theory is concerned with describing the nature of things. According to the Oxford Advanced Dictionary of current English (2003), its general meaning is “viewing or looking at”. Thus to develop a theory is to develop a view, a description or a way of looking at it. Similarly to describe a theory is to discuss and analyse how the subject has been viewed and looked at. To talk about a better way in theoretical studies is to talk about a better view or description. A good theory is one that matches well our perception of what it is, and the closer the match the better the theory. That is the closeness the match between the mental constructs and the perception of the subject matter on which the theory is about. Theory is useful in as far as it serves to assist and give guidance to development of further understanding of practical activities.

A good description or way of looking at things not only depicts something but also explains and fosters its understanding. Theory is about explanations of why and

how a subject matter is developed and implemented. It is about models and creation of models, a graphic representation of processes and relationships of its parts. It is about “statements of principle” incorporating defining terms and offering some apparent truths about a subject. It is an analysis of issues and debates concerning the subject and its significance. Theory is hence that department of a subject which consists in the knowledge or statements of the facts, on which it depends or its principles and methods.

Labour-intensive works technology theory is therefore the body of generalizations and principles developed through research, in association with practice in the engineering field forming its content as an intellectual discipline.

2.3.2 The Use of Human Labour as Investment

The use of human labour as a factor of production was gradually put to test as advances were recorded in technology in the last two centuries. The invention of machines in the 19th century, the introduction of labour saving devices and the development of high capacity production equipment had a revolutionary effect in all production industries. Robotic technology and computerization have forced the problem of unemployment even more prominently into the forefront (Dunkerly, 1996).

Conventional civil construction methods also became increasingly capital-intensive in the last century. The proportion of expenditure on fuel-powered equipment increased substantially during that period while that of labour decreased. As a consequence, the increase in investment expenditure in construction generally resulted in the generation of less employment opportunities per unit of expenditure than was the case previously. The increase in capital-intensive nature of the industry also resulted in a system of construction that is oriented around the use of fuel-powered equipment in construction projects (McCutcheon, 2003).

The capital-intensive nature of the civil engineering construction industry means that in order to generate more employment per expenditure unit, the scope of operations has to be expanded, and expenditure increased at the same level of

employment cost. On the other hand, labour-intensive methods offer an opportunity to increase employment significantly without increasing expenditure, at the same level of efficiency and effectiveness. Since expenditure on infrastructure accounts for 3% -5% of the GDP and about 40%-60% of GDFI in developing countries (ibid), the use of labour-intensive methods in such an essential component of the economy could generate significant employment and directly contribute to poverty alleviation (ibid).

The theoretical basis of the use of labour as an investment in countries with a large surplus labour were put forward by R. Nurkse and W.A. Lewis in 1953 and 1954 respectively (Costa et al, 1977). It was argued during this time that labour-intensive schemes are not only aimed at short or medium term employment of those who have no jobs, but they are designed to alleviate the shortage of capital and to build up part of the infrastructure that is necessary for development. Such debate meant that manpower should primarily be set to work on productive activities rather than on social investments.

Although arguments and counter arguments on the theories advanced by Nurkse and Lewis focused more on the supply and mobilization of labour and the organization of employment intensive works, it was concluded that the efficiency and effectiveness of such schemes was dependent on the integration into national development programs and the step by step technical training of the mobilized unskilled workers employed in the schemes. These important conclusions are still relevant today and are necessary for success on large-scale employment intensive programs.

2.3.3 Technical Feasibility of Labour-intensive Works Technology

The intellectual basis of labour-intensive works began with the recognition that the conditions regarding the factors of production were different in developing countries from those in the industrialised world. A major thrust of the development policies of the 1950s and 1960s was the growth of the GNP and the promotion of rapid urbanisation and industrialization, the latter involving the transfer of technology from industrialized countries (Bastani, 1998). Government policies promoted the

use of machinery. Yet by the late 1960s unemployment and under-employment were increasing. It was realized much later that there was a need for a local technological capacity base for the transfer to be effective. However, the amount of training and mentorship necessary to accomplish technology transfer was rarely realized, which also depended on the type of technology and the background of the recipients.

The failure of the western development models and increasing unemployment in poor countries prompted the International Labour Organization (ILO) to seek ways of creating employment opportunities not only through economic growth but also in its absence. The ILO set up the World Employment Programme (WEP) in 1969 for this purpose (Singer, 1992, cited in McCutcheon, 2003; ILO, 1980, cited in Howe and Bantje, 1995).

One of the concepts explored by the WEP was the reverse substitution of labour for equipment. In the analysis of this feasibility two categories of product were identified; one in which the substitution of equipment for labour is essential and one in which it was not essential (Deepak Lal, 1978). It was considered that essential substitution of equipment for labour could result from any of the following;

1. The creation of a totally new product by an industrial complex, as for example in the petrochemical or bioengineering industries.
2. Where a system of machinery was such that;
 - it was more accurate than had even been achieved before;
 - a complete product came out of a linked system of machinery assembly line/mass production
 - no manual transportation was required from one part of the process to another, i.e. no possibility for delay or double handling”
 - orders of magnitude in productivity increase were achieved by comparison with traditional manufacture and
 - where the price of the product is related to the volume of production and the cost of construction to areas.

In these cases it would not be sensible to consider substituting labour for equipment.

By comparison, reverse substitution of labour for equipment would be technically feasible if the industry still involved;

- i) a product that is produced by machines which were essentially altered editions of old handcraft tools.
- ii) a product that is produced by the mere mechanical fitting together of partial product (with the consequent opportunity for delay and double handling).

It was concluded that the possibility for the efficient reverse substitution of people for machines was less likely in “process centred” industries and more likely in “product centred “ones (ibid).

From this perspective, civil engineering construction offered a perfect test ground. It depicted characteristics amenable to reverse substitution. The products were time honoured and mostly individual (“once off”) and bulky. Production used machines which were magnified versions of hand tools, while the process included the fitting together of partial products and was littered with possibilities for delay and double handling (McCutcheon, 1990). Earthworks operations; Excavation, Load Haul, Unload and Spread (also known as the ELHUS operations) were of particular interest in the above context and accounted for about 50 per cent of expenditure on civil construction. Other promising avenues included aggregate production and pavement construction. In building operations, mass production assembly had also been attempted. These attempts were however not successfully over the long run; cost competitiveness was elusive and industrialisation of building operations did not achieve the orders of magnitude of improvement that had been achieved during the mechanisation of other industries (ibid).

Civil engineering construction was also considered worthy of attention from a socio-economic perspective. *First*, it formed a definable portion of the economy and thus employed a significant proportion of the workforce. *Second*, traditionally the construction industry provided the unskilled poor employment and access to the moneyed economy (Kirmani, 1998, cited in McCutcheon, 2003). *Thirdly*, in the industrialised countries and the modern sector of developing countries, the civil engineering industry was capital-intensive; the opportunity existed to substitute people for machines. The building industry was, by comparison, still labour-intensive. A major opportunity in the building industry to increase employment generated per unit of expenditure and the use of local materials would be to examine materials production. *Fourthly*, 50 to 60 percent of most countries' capital formation is in the construction as a whole and the civil portion plays a key role in the infrastructure of the economy (roads, railways, harbours, airports, dams, irrigation, power stations). *Fifthly*, 60 to 70 per cent of civil construction in developing countries is carried out through the public sector and should therefore be amenable to influence by government policy (op cit).

Although major ILO studies had focused upon the road sector, the overall goal was to establish the potential and implications of labour-intensive methods within the construction industry as a whole and thus the implications in a macro economic context.

Another research programme was initiated by the World Bank in 1971, with a view of studying the substitution of labour for equipment in road construction, and the whole civil engineering discipline. The study was undertaken in three phases. The first phase in 1971 consisted of a literature review and economic and technical feasibility studies. A major conclusion from the first phase was that; *"it is technically feasible to substitute labor for equipment for all but about 10 to 20 per cent of the total road construction cost for the higher quality construction standards considered"*.

However, literature review revealed great variation in productivity data, and it was concluded that reliable productivity data should be obtained from direct

field observations (ibid). The remainder of the Phase I study concentrated on determining the main parameters that should be observed in field studies to explain variations in productivity rates. Preliminary cost comparisons were then carried out which showed that the financial viability of labour-intensive road construction would be dependent on the productivities used in the cost calculation from the cost comparisons used in the study.

Hence, the second phase of the World Bank study in 1974 concentrated on obtaining productivity data and analysing various combinations of labour and machines through field studies. Observations were made at road, dam and irrigation sites in India, Indonesia and Nepal. It was concluded in this phase that traditional labour-intensive techniques were not economically competitive with modern machine-based techniques even with labour priced at shadow prices, which were a fraction of market wage (McCutcheon, 2003): The conclusion was “...*the extremely low productivity of traditional labour-intensive technologies ... at the prices for equipment and fuel then prevailing (1973) could not be economically competitive with equipment except at extremely low wage*”. This conclusion was reached because traditional labour-intensive methods were employed in an atmosphere where the primary emphasis was employment creation rather than the efficient use of labour and because traditional labour-intensive methods were “primitive” (World Bank, 1974, cited in McCutcheon, 2003). However, this phase of the study also revealed that; “..*labor productivity can be improved very significantly by the introduction of certain organizational, managerial and mechanical improvements*”.

In particular, multiple improvements in productivity were possible through the linkage of payment to production by the setting of tasks. Another important conclusion of the second phase of the World Bank study was that *labour-intensive method should not be attempted without careful advance planning, organization and training, particularly in regions where these methods have not been commonly practised*.

On the basis of recommendations of the second phase, a third phase study was embarked on, with the aim to develop and demonstrate cost effective, labour-

intensive technologies in a number of different countries. Field studies were carried out in India, Indonesia, Honduras and Kenya. Quite early in the third phase the conclusion regarding technical feasibility was extended beyond roads. It was concluded that *“Labour-intensive methods are technically feasible for a wide range of construction activities and can generally produce the same quality of product as equipment based methods”* (World Bank, 1976 cited in McCutcheon, 2003).

It was also found in this phase of the study that improvements in labour productivity (by comparison with “traditional” labour-intensive methods) could be achieved in a number of ways, both to the organization and management of the construction programme and to the individual construction sites. Improvements in the tools and equipment and in the health and nutritional condition of the labour force also resulted in improved productivity.

Most of the studies undertaken during this time were on low volume low capacity roads. In respect of high volume high capacity roads, some useful information on productivities and work organization were reported in 1975 on the labour-intensive construction of a surfaced water-bound macadam road in India (World Bank, 1975, cited in McCutcheon, 2003). Further, during the same period, the ILO carried a feasibility study for the labour-intensive construction of the Indus Super Highway for the government of Pakistan. Although the study was limited by its assumption that the base course and surfacing would be constructed machine intensively, earthworks (except compaction) were carried out by labour and estimated to be slightly cheaper than using equipment (McCutcheon, 2003).

Other studies carried out in the 1970s focused upon the potential and implications of labour-intensive construction itself. Deepak Lal (1978) investigated the technical and economic efficiency of using labour-intensive techniques for road construction in the Philippines and carried out comparisons for various machine-labour combinations on earthworks and gravel layers. Productivities and costs on excavation and haulage were obtained from field studies on pilot projects, and shadow prices were derived for the various inputs.

The result of Deepak's work was that labour-intensive construction was found to be more economically viable than equipment-based construction at both market and shadow prices (ibid).

In 1981, the World Bank commissioned yet another study that evaluated the substitution of labour for equipment in rural roads construction. Allal and Edmonds (1978) concluded that certain road building operations provide little scope for the efficient use of labour-intensive methods. By the time the World Bank studies were completed in 1986, important basic concepts in labour-intensive works methods had been established. The development of the notion of technical efficiency clearly established that men could be substituted for machines in the majority of road construction operations without a serious penalty (Howe and Bantje, 1995). The following activities were delineated that they may be adapted to labour-intensive methods for rural roads: site clearance; excavation of earth; loading; hauling; unloading; spreading; laying and compaction. Other areas are drainage and storm water works, structures and gravelling operations.

2.3.4 Economic Efficiency of Labour-intensive Works Technology

Following the establishment of the technical feasibility of labour-intensive technology by the study in the Philippines, McCleary et al (1976) carried out a cost-benefit analysis using shadow prices for alternative technologies of gravel roads construction in Thailand. The aim of the study was to determine the economic feasibility of labour-intensive gravel road construction in Thailand. Shadow prices were calculated for the various inputs for economic analysis. The study concluded that labour-intensive methods could be competitive with machine-based methods at shadow prices and that labour-intensive methods could be cheaper if labour productivity was improved.

The social desirability of adopting labour-intensive methods in labour surplus countries was also investigated. Irvin et al (1975), cited in McCutcheon (2003), in his work on a proposed labour-intensive road construction in Iran, found that labour-intensive methods were in most cases profitable at both shadow and

market prices, but social profitability was always greater than the market profitability. It was concluded that the economic viability of labour-intensive road construction depended in part on the importance accorded by the government to reducing inequalities in the distribution of income (ibid).

Plant and labour are two of the main cost elements in road construction in both conventional and labour-intensive construction methods. The question is whether, given technological alternatives, it is socially desirable to adopt more labour-intensive techniques. During phases two and three of the World Bank studies, it was gradually realised that productivity and cost comparisons made used data which was highly biased in favour of equipment (McCutcheon, 2003). There were really two sides to the coin. The basis for comparison of benefits was highly efficient equipment, and the level of equipment efficiency paraded was not even tenable in industrialized countries, let alone in developing ones. It was a fact that the average productivities for a bulldozer for example, were 25 per cent of manufacturer's maxima (Loader: 65 per cent) in developed countries and the utilisation rates for equipment were also lower than anticipated. In developing countries, even on very large projects, the average productivities were of the order of 70% of manufacturer's rated productivities, i.e. the average productivity for dozers and loaders would be 17% and 45% respectively of the maxima shown in the manufacturers' handbooks. Additionally, equipment utilization rates were lower than the low rates obtained in industrialized countries (ibid). In smaller and more dispersed work operations, much lower productivities were observed.

A complex of factors severely limited the sustained long-term productivity of equipment in developing countries. Foreign exchange, fuel, spares, mechanics, workshops, trained operators, management systems etc were all a problem. The technological and system requirements of equipment were not matched by local technological and institutional capacities. In addition to low equipment productivities, the extent of the difficulties with equipment-based systems in developing countries may be illustrated by the road maintenance crisis of the 1980s in sub Saharan Africa. This crisis is well documented (Heggie, 1987). In

the long run, the use of this type of equipment had certainly not revealed the orders of magnitude of improvement expected by analogy with manufacturing.

Although the later phases of the World Bank study did take some account of the lower equipment productivities in developing countries, the main focus was with the improvements that could be achieved by the use of improved labour-intensive methods over the inefficient traditional ones. Hence it placed more emphasis upon the need to improve the productivity of labour than delineating the actual productivity of equipment. Drawing from one of the major conclusions of phase three studies, *with superior tools, high incentives and good management, labor productivity could be improved to the point that labour-intensive methods could be fully competitive with equipment based methods at certain wages rates*. The World Bank concluded that where the wage rates were less than US\$2 per day (in 1982 prices), labour-intensive methods could be distinctly competitive. The conclusion was as follows; “.....*wherever the basic wage actually paid ... is less than ... about US\$4 per day in 1982 prices, and labour is available in adequate quantities, the alternative of using labour-intensive techniques should be seriously considered*”² (World Bank, 1987, cited in McCutcheon, 2003).

While the break even point is now probably higher than US\$4 per day in 1982 prices due to the differences in the rates of increases of the price of equipment and wages of unskilled labour, it is also true that over 40% per cent of sub Saharan Africans have an income of less than US\$1 per day.

To conclude, the World Bank study made three main conclusions. *First*, depending on the wage rate, improved labour-intensive techniques could be financially competitive with machine-based methods for certain construction activities. *Secondly* strong and sustained government support is required for a successful labour-intensive construction programme. *Thirdly*, there is a need for a learning period prior to full-scale implementation. A period of at least three

² At an average 5% annual rate of inflation of the dollar since 1982, US\$2 and US\$ 4 in 1982 translate, respectively to about US\$7 and US\$12 in 2005.)

years should be allowed for, and suitable training programmes for managerial and supervisory staff established.

In other studies, the economic efficiency of labour-intensive techniques for certain road construction tasks was successfully demonstrated in the Philippines by Deepak Lal (1978). Using a full set of market and shadow prices for evaluation of gravel roads built by using labour-intensive methods, for an average gravel road, the social evaluation showed that labour-intensive methods were cheaper than capital-intensive methods. The study also showed that it was possible to substantially increase the labour cost in the conventional road building from about 10% to more than 50%. In his analysis, Deepak gave three possibilities for reducing capital-intensive bias in technology choice in developing countries.

The *first* is to implement intermediate technologies, researching into appropriate employment-intensive techniques. The *second* is to increase the substitution of labour for equipment in projects, increasing the overall labour to capital ratio, and hence increase opportunities for employment. The *third* possibility is to increase the labour-intensive component of the activities and processes where capital has been substituted, without compromising the quality of the product or increase costs. In this study it was concluded that it is not possible to transpose data from one country to another, and a detailed techno-economic evaluation would be required on a case-by-case basis.

To summarize, the motivation for investigating the potential of labour-intensive construction approach was as follows (McCutcheon, 2003);

- Unemployment and underemployment are serious problems in developing countries.
- Employment needs to be generated within the existing economy.
- The reverse substitution of labour for equipment is worthy of consideration under certain circumstances related to the product and its process of construction.

- Labour-intensive methods are technically feasible for a wide range of construction activities and can generally produce the same quality of product as equipment based methods.
- Under certain circumstances labour-intensive methods may be economically efficient and cost competitive by comparison with conventional methods.
- The construction industry has traditionally provided the poor and unskilled access to the formal moneyed economy.
- The need for technical feasibility and the economic efficiency provided the impetus for the investigation of labour-intensive methods.

2.4 Economic Infrastructure and Labour-intensive Works in Poverty Alleviation

2.4.1 The Role of Infrastructure

Economic infrastructure includes services from public utilities (power, water supply, telecommunication, sanitation and sewerage etc), public works (roads, dams, irrigation systems etc) and other forms of transport systems (airports, railways, ports etc). Social infrastructure includes facilities for education, health care etc. Infrastructure provides wheels of economic activities. Good infrastructure increases the productivity in the economy and lowers costs. Infrastructure represents about 20% of the total national investment and about 40%-60% of the public sector investments.

The exact nature and magnitude of the linkage between infrastructure and development is a subject of continuing debate. It is known however that the growth in infrastructure stocks is proportional to the growth in the economy. Various studies have concluded that the role of infrastructure on growth is substantial, and is greater than that of investment in other forms of capital. In addition, infrastructure is important for ensuring that growth is consistent with poverty alleviation. Access to infrastructure services is one of the essential criteria for defining the level of welfare. To a great extent the poor can be identified as those who have no access to economic and social

infrastructure within a certain minimum radius or mobility time (World Development Report, 1990).

Apart from physical infrastructure, labour-intensive works can also create valuable social infrastructure like schools and health centres. A growing recognition worldwide is that investment in human capital (education and health) is a prerequisite for the poor to escape poverty. In other words, social infrastructure also generates economic returns. The direct benefits are income transfer during construction, and other benefits are indirect and long term, with a poverty reduction potential.

2.4.2 The Potential of Labour-intensive Works on Poverty Alleviation

The creation of employment and the improvement of incomes are generally the best measures to overcome poverty (Demery, Adison, 1987). The alleviation of poverty depends on two processes. These are the attainment of sustainable development, indicated by the increase in GDP per capita and the equitable distribution of wealth.

The potential of labour-intensive works schemes in the alleviation of poverty is inherent in its immediate and long-term effects. Employment in the process of construction or improvement provides an immediate and direct source of income. Over a period of time the effects, if sustained, produce more lasting and structural changes or impacts. The impacts require that the new or improved infrastructure is sufficiently sustainable to induce positive changes to the community. Poverty is alleviated if the positive impacts of sufficient magnitude on the poor are long term and sustained.

The longer term or indirect influences are not only the manifest of the physical investment per-se, but through the extent to which accompanying changes occurs or do not occur. The secondary impact of training can be used as an example. Training is a necessary component of a successful labour-intensive scheme. If the trainees are selected from poor households, there will be a long-term contribution to poverty alleviation (MCutcheon,

2003) Where there is a formal training recognition system and the training given is applicable to the industry at large, trained persons are more likely to obtain work elsewhere in the economy. At the same time as far as enabling jobs can be created rapidly, labour-intensive schemes are a means of redistributing income in favour of the most needy areas and groups of population which have somewhat been neglected or by-passed by the development process.

Although targeted to the very poor, the existence of employment-intensive program in a rural setting increases the value of other employees in the area, for example agricultural workers, and elevates their bargaining position in the labour market, provided that the wage offered in the labour-intensive schemes is comparable to the wage paid in other employments of similar skill levels. As an instrument of job redistribution, labour-intensive schemes are preferable to programmes aimed at securing a transfer of incomes through the payment of unemployment benefits or grants to the very poor (DBSA, 1998).

Additionally, the role of labour-intensive schemes as a way of combating poverty is clearly evident when natural disasters occur. Relief works can be organized in the shortest possible time, in parallel with disaster alleviation activities to the affected population, while at the same time expediting reconstruction and rehabilitation work.

Based on the reviews of different stakeholders, views and opinions about long term impacts of LBW programmes differ. A complicating factor is the multiple objectives of these programmes which include employment creation, income distribution and creation of assets. Different and even conflicting conclusions occur depending on whether the programme has been reviewed by promoters, sponsors or by an independent party. An important conclusion reflecting the view of most experts is that made by the ILO. A special issue of the International Labour Review published in 1992 concluded that *“labor-intensive investment policies have already proved to be successful employment creation instrument, particularly when compared*

with the efforts and resources needed to design and implement alternative policies with similar impacts on the poor”.

2.4.3. The Impact of Rural Roads on Poverty Alleviation

The 1960's and 1970's saw a rapid investment on roads infrastructure in newly independent African countries, using capital-intensive technology. These projects were supply driven as opposed to demand driven. New roads were viewed as an economic opportunity in both qualitative and quantitative terms. It was assumed that they would have a catalytic development role that induced socio-economic changes in the population traversed by and using the new facilities. It was believed that the poor population would respond to the economic opportunity by developing and adopting attitudes towards economic change. Contrary to the beliefs of politicians and their development experts, these investments have had mostly negative effects on the poor (Howe, 1998).

Roads in rural areas are considered key to the attainment of sustainable development required to spur economic growth and improvement of the living standards of the people. Ironically, the experimentation and subsequent large-scale implementation of the LBW works technology in many countries was done mostly on rural roads. It is therefore appropriate that a meaningful enquiry into the impact of the LBW on poverty alleviation should be directed to the rural roads sub sector. However, a review of empirical research findings provides little support for the view that conventional investments in rural roads have a significant effect on poverty alleviation other than short-term employment opportunities during project implementation. The direct connection between the road infrastructure and poverty alleviation, has not been sufficiently proven. Roads are believed to encourage economic interaction, diversification and specialization, by lowering the costs of production and consumption. This has a positive, but indirect impact in poverty alleviation (Keddeman, 1998).

Many studies on the impact of labour-intensive roadworks has concentrated on social impacts; improved access to commercial, economic, social and service centres, and the shortening of travel distances and travel times. A study of the impact of the LBW programme in Lesotho revealed only social benefits in terms of savings in travel times to commercial services (ibid). Given the high level of unemployment in Lesotho, the savings in time is unlikely to be significant. Nevertheless, existence of a road is viewed as a critical pre-condition to poverty alleviation; without a road, no poverty alleviation measures would be possible in many areas. Regarding cost effects, it has been shown that labour-intensive methods may be 25 to 30% cheaper than equipment based methods for comparative outputs, and have significant other benefits to the poor (ibid). Cost savings in U\$/km ranges from 4-12% in Nigeria to 41-58% in Lesotho (ibid).

There are further contradictions in the findings of empirical research on the development stimulus and impact on poverty brought about by new roads. Wilson (1996), cited in Howe (1998), argued that a quick exploitation of an economic opportunity requires a dynamism that is not a characteristic of the population in which poverty is prevalent. In their review of the impact of the expansion of rural road networks in developing countries, Howe (1984) and Devres Inc (1980) for USAID, cited in Howe (1998), found some positive, but mainly negative socio-economic changes on the poor, largely confirming Wilson's conclusions. In respect of distributional effects reflecting the likely effects of the investment on the poor, the findings were negative because poverty alleviation and income distribution were never the criteria in the selection of road projects (ibid).

As new roads were often linked to the exploitation of major cash crops like coffee, tea, sugar, cotton etc, in developing countries, an area's potential contribution to agricultural output was the main factor in the process of road selection. This can be expected to reinforce existing social and economic structures and hence promote stratification, mainly because it would help the wealthier and the better-informed producers to expand faster than others. Other findings by Hirschmann (1958), cited in Howe (1998) were that roads

transport only plays supporting or lagging roles in development and poverty alleviation.

However, in a major study on rural roads in Bangladesh in 1982, it was affirmed that rural roads are a development catalyst (Ahmad and Hossain, 1990). These findings confirmed the long held view of the World Bank that investments in rural roads do indeed lead to a reduction in poverty (World Bank, 1990). These findings were widely publicized (World Bank; 1990, Ahmed; 1990, Creightney; 1993). The Study was considered to hold important lessons for Africa (World Bank, 1991, cited in Howe, 1998). The lack of consensus of empirical researchers is an indication of the failure or the impracticability of the modelling approach to forecasting the socio-economic change and the resultant effects, brought by investment on rural infrastructure, on those living in poverty.

Employment in the process of construction or improving of rural road provides an immediate and direct source of income. If suitably targeted, large numbers of the poor can benefit more directly through earnings. The maximization of these benefits depends on whether the activities are employment or capital-intensive, located in areas containing significant numbers of the poor and managed in a way that the poorest are targeted efficiently. Assuming that the developmental effects will be sustainable to produce long and lasting structural changes necessary to expedite poverty reduction, the challenge is to maximize immediate effect by employing large number of poor people.

Despite the lack of consensus by scholars, the initiation of the labour-intensive road works in the 1980s in developing countries strengthened the poverty reduction orientation of the sub sector. The effects however are not significant as yet as many sectoral investments remains capital-intensive and many labour-intensive activities are located in the potentially more productive and wealthy locations.

2.5 Conclusion

This chapter presented and discussed the existing intellectual basis of labour-intensive works technology. The existing knowledge on the subject has a direct bearing and relevance to the initiative in Namibia for the development of LBWT. In short, there was no need to reinvent the wheel.

It has been shown that labour-intensive methods were used many years ago in the construction of great historical structures like the Great Pyramid of Egypt, the Great Wall of China, water canals and railways in Europe and America. The shift to machines in developed countries was partly catalysed by the rising costs of labour. The challenge to human labour by machines in the 19th century brought the unemployment problem prominently forward, as work in industries, agriculture, mines, infrastructure development etc became more capital intensive.

The theoretical framework of labour-intensive methods has been presented and discussed. Research work done by the ILO and the World Bank on labour-intensive works technology has been highlighted. The potential of labour-intensive works on poverty alleviation and the role of infrastructure services in this regard have been argued and the impact of rural roads in poverty reduction has been evaluated. Existing knowledge shows that there is good evidence in support of labour-intensive methods in general and continued demonstration is no longer necessary.

In modern times, the technical feasibility and economic viability of labour-intensive methods have been proven by the World Bank, ILO and ascertained by many scholars in different parts of the world. The social desirability of labour-intensive works methods are premised on its potential for employment creation and poverty reduction.

While sustaining or increasing employment in capital intensive undertakings requires significant increase in expenditure, opportunities are abundant in developing countries (where labour is relatively cheap, unemployment and poverty levels are high, and the need for infrastructural services are pressing) for the use of unemployed labour to speed up development and create many job opportunities

without a corresponding increase in expenditure. This argument is more valid in infrastructural services, which account for 3%-5% of GDP and 40%-60% of GDFI in developing countries. The complex of problems which severely limit the equipment productivity in poor countries lends credence to increased use of labour-intensive approaches.

The following chapter will document international experience in the development of labour-intensive works programmes.