Employment Creation in Large-Scale Public Works Programmes

Labour-intensive Construction and Maintenance in Sub-Saharan Africa:
The World Bank played a critical role during the 1970s and 1980s;
What are the prospects for the future?

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Introduction

In his *Lives of the Caesars* Suetonius records the following of Emperor Vespasian:

To an engineer who offered to convey some lofty columns to the Capitol at a small expense, he gave no mean reward for his device, but declined his services with the remark: "You must let me feed my poor commons".¹

The issues raised are still with us.

In many countries one of the foremost problems facing government is the extremely high level of unemployment and its accompanying poverty. Thus, there is a justified demand for the generation of employment opportunities. At the same time there are great pressures for the construction and maintenance of housing and public works, both urban (water supply, sewerage reticulation and treatment, stormwater drainage, streets, electrical supply and waste disposal) and rural (dams, irrigation canals and roads). These problems are set within a low-level of individual and community capacity in both technical and institutional terms.

During the past 34 years, in several countries in sub-Saharan Africa, a contribution to addressing this complex of factors has been achieved by large-scale, long-term programmes of labour-intensive rural road construction. Implementation was based upon the intellectual framework provided by the World Bank and the International Labour Organisation; and the Bank was a major donor. It resulted in the generation of hundreds of thousands of years of productive employment and the construction and maintenance of thousands of kilometres of rural roads.²

² Research in the School of Civil Engineering at the University of the Witwatersrand and associated field implementation has demonstrated that the principles apply effectively to the construction of high standard,
The question which the author poses is what are the prospects for the Bank’s future advocacy of such successful job creation programmes, especially in the light of the critical role it played in formulation and implementation during the 1970s and 1980s?

**Structure of this Paper**

“Labour-intensive” will be defined. There will then be a short discussion of the role that job creation has played in public works programmes. Following this, the author will first outline the principles of labour-intensive construction and the scale and scope of the national programme in Kenya with some mention of those in Botswana, Malawi, Lesotho and Ghana. The major lessons learned are pertinent not merely to labour intensive construction but to national employment creation/public works programmes.

Drawing on the theory and practice of labour-intensive construction, the author will argue that in many countries employment could be generated --and thus poverty could be alleviated (but not solved)--, public works constructed, and individual and community capacities created, through a well planned large-scale employment creation programme using labour-intensive methods for the construction and maintenance of public works.

The paper will close with an outline of the process that should be adopted for a large-scale employment creation programme. And pose the question asked above.

**Definition**

“Labour-intensive” is a phrase in economics to describe an operation in which proportionately more labour is used than other factors of production.\(^3\)

\(^3\)Penguin Dictionary of Economics (1972), South African Concise Oxford Dictionary (2002): “needing a large work force or a large amount of work in relation to output”.

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heavily trafficked roads. As will be shown below this should result from the Bank’s findings.
Labour-intensive construction may be defined as the economically efficient employment of as great a proportion of labour as is technically feasible, ideally throughout the construction process including the production of materials, to produce as high a standard of construction as demanded by the specification and allowed by the funding available; labour-intensive construction results in the generation of a significant increase in employment opportunities per unit of expenditure by comparison with conventional capital-intensive methods. There are several stages of employment intensity depending upon the type of project and the parameters used to define economic efficiencies. The first stage of labour intensity is cost-competitive with conventional capital-intensive methods. This is achieved partly through the creation of individual, community and institutional capacities by the establishment of large, carefully planned, long-term national programmes.

A corollary to this definition is what it is not: It is not the use of large numbers of people on relatively unplanned emergency or relief projects to construct something of ill-defined quality and value; that is labour-extensive.

Since the 1970s, “labour-intensive” has been the term used in the major research and field studies carried out by the World Bank and the International Labour Organization. A serious problem with the phrase “labour-intensive” is that decision makers tend to focus upon “labour” and its negative connotations of “picks and shovels” (and “slave-”). This ignores, as we will see below, the array of factors which need to be in place long before any labour can be productively employed. These factors include: appropriate policy, legislation, institution, suitability of project, contract documentation, sanction, quality and efficiency, organization and training at site and managerial levels, including that required for proper contractor and sub-contractor development. The South African National Productivity Institute found that management is responsible for 85 per cent of the improvement in labour productivity; labour for only 15 per cent. For these reasons the authors now prefer to use the term “employment-intensive”.4

4 There has been further debate as to the terms “labour-intensive” and “labour-based”. Some authorities
Having said that, the phrase “labour-intensive” will be used in this paper because of its intellectual pedigree in the 1970s. It was the phrase used during all the path-breaking research. More importantly in relation to contract, it is the term used in South African legislation.

**Public Works Programmes: Product versus Job Creation**

In the case of the USA it has been reported that:

Unemployment relief, aid to agriculture and public works designed to promote employment together account for $26.0 billions, or nearly 50 per cent of the total federal expenditures in 1934-40.\(^5\)

A major conclusion the author has reached about the vast majority of public sector job creation schemes elsewhere in the world is that they have generally concentrated upon "job creation" with little concern for either the quality of the product or the economic efficiency of the work. In most emergency job creation schemes there has been no interest in the quality of the product and little concern for the economic efficiency of the work.

While the majority of job creation schemes have concentrated upon "job creation" at the expense of quality of product, several famous projects including those in the USA and Germany in the 1930s were more concerned with product than employment creation. Despite the image of manmade autobahns, research has revealed that they were *not* built labour-intensively.\(^6\)

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\(^5\) Hansen, 1941.

\(^6\) Larmer 1975
The tendency to concentrate on employment creation at the expense of concern for the quality and cost of the product may be seen within a UN agency. In 1969 the International Labour Organisation (ILO) established its World Employment Programme. Within this programme there were two divisions: Special Public Works, and Technology and Employment. The former was a much larger operation than the latter. Special Public Works devoted its energies to emergency job creation, while Technology and Employment concentrated upon the production of a good product by methods that employed as many people as possible in an economically efficient manner. Over the years there was increasing dissatisfaction with the lack of quality and high cost of the Special Public Works Programmes. In 1987 the two divisions were amalgamated so that the dual perspective of the Technology and Employment Branch could be brought to bear on the ILO's much larger Special Public Works division.

Much of the author's experience was derived from his association with the Technology and Employment Branch. Through this work the author became convinced that the use of labour-intensive methods during the construction of infrastructure was economically efficient and could alleviate unemployment. However, this can only be achieved with the adoption of a dual perspective that lays as much emphasis upon the product as upon employment. The successful realisation of this dual perspective requires an understanding of the socio-economic environment within which it will be implemented; and persistence. In face of the difficulties that will be encountered, an understanding of the theoretical principles and practical achievements of labour-intensive construction is essential. These will be sketched in the following sections and then the implications for future programmes will be derived.

**Labour-intensive construction**

The definition has already been given. Its intellectual base 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 Gross National Product and the promotion of rapid urbanisation and industrialisation, the latter involving the transfer of technology from industrialised countries: government policies promoted the use of machinery. Yet by the late 1960s un- and under-employment were increasing. "Take-off" into self-sustained economic growth, as predicted by Rostow, for example, had simply not taken place. Technology transfer became problematic. Much later it was recognised that there was a need for a local technological capacity (a major theme of this paper).

In 1969, as mentioned above, the ILO set up its World Employment Programme (WEP), which was devoted to seeking ways of creating employment opportunities not only through economic growth but also in its absence. Research was carried out into the employment potential within the existing economy. One of the concepts explored seemed bizarre in the context of the late 20th Century: the reverse substitution of labour for equipment.

Civil construction was identified as worthy of attention. Firstly, it formed a definable portion of the economy and thus employed a significant proportion of the work force. Secondly, in the industrialised countries and the modern sector of developing countries, the civil engineering industry was capital-intensive (building by comparison was labour-intensive) thus the opportunity existed to substitute people for machines. Thirdly, 50 to 60 per cent of most countries' capital formation is in construction as a whole and the civil portion plays a key part in the infrastructure of the economy (roads, railways, dams, ports, power stations, irrigation, airports). Fourthly, 60-70 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.

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7James 1985  
8Rostow, 1963  
9Bruton in James and Watanabe 1985.  
11Edmonds 1979; Edmonds and Miles 1984.
The feasibility of the reverse substitution of labour for equipment was analysed. Two categories of product were identified: one in which the substitution of equipment for labour was essential - and, therefore, not amenable to reverse substitution; the other where the substitution of labour for equipment was not essential.

Essential substitution would result from any of the following:

(i) the creation of a totally new product by an industrial complex, as for example in the petrochemical or bio-engineering industries;

(ii) where a system of machinery was such that (a) it was more accurate than had ever been achieved before; (b) a complete product came out of the system; (c) no manual transportation was required from one part of the process to another, i.e., no possibility of delay or double handling; and (d) orders of magnitude in productivity increase were achieved by comparison with traditional manufacture.

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

(i) a product produced by machines which were essentially altered editions of old handcraft tools;

(ii) a product still produced by the mere mechanical fitting together of partial products (with 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.\textsuperscript{12}

Looked at from this perspective civil construction was promising: the products were time-honoured and mostly individual, production included the fitting together of partial products and was littered with possibilities for delay and double-handling, and the machines were magnified versions of hand tools. Earthworks operations - excavation, load, haul, unload and spread - were of particular interest and accounted for about 50 per cent of expenditure on civil construction. Other promising avenues included aggregate

\textsuperscript{12} Deepak Lal 1978.
production and pavement construction.
In 1971 the World Bank initiated a research programme: ‘Study of the substitution of labor for equipment in road construction’ later broadened to ‘... civil construction’. The research was formally completed fifteen years later in 1986 and comprised three main phases. A major conclusion from the first phase was that 'it is technically feasible to substitute labour for equipment for all but about 10 to 20 per cent of total road construction cost for the higher quality construction standards considered'. This conclusion was later generalised to:

Labor-intensive methods are technically feasible for a wide range of construction activities and can generally produce the same quality of product as equipment-intensive methods.

In relation to economic efficiency early conclusions were that '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 wages’. However, Phase Two studies showed that 'labour productivity can be improved very significantly by the introduction of certain organisational, management and mechanical improvements'. Ten to twenty fold improvements in labour-productivity were noted: from 1/8th of a cubic metre to 3 to 5 m$^3$ (5 to 7 tons). In particular this was achieved through the linking of payment to production by the setting of tasks. Later the skill of the site supervisor was recognised as a major contributory factor.

During this phase of research it became apparent that there were really two sides to the coin. Initially the onus was on those who dared to suggest that labour might compete with equipment to prove that labour was not incompetent. The datum for comparison

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was always highly efficient equipment. But during the mid 1970s research showed that this was not even tenable in industrialised countries let alone developing ones. For example in industrialised countries average productivities for a bulldozer were 25 per cent, and for a loader 65 per cent, of theoretical maxima. In developing countries highs of 17% were achieved on large-scale operations. The smaller the scale of work and the more dispersed the operation the lower the productivities observed: 5% and lower were recorded.\footnote{Muller 1970; McCutcheon 1980} It began to be realised that a complex of factors severely limited the long-term productivity of equipment in developing countries.

This was not much of a problem during construction. New roads were considered essential for development and a quick way for national politicians and donors to produce visible results. Most new roads were constructed by expatriate companies using the same design and technology as conventional equipment-intensive construction (about 10% to labour): 'parachute' operations.

While construction was by expatriate companies and donor financed, maintenance, if mentioned, was to be the responsibility of government. For a variety of reasons it proved more difficult to maintain than construct: procurement procedures, foreign exchange, fuel, spares, mechanics, workshops, trained operators, management systems, were all a problem.\footnote{Edmonds and de Veen 1982.}

The technological and system requirements of equipment were not matched by local technological and institutional capacities. While low equipment productivities have been mentioned the extent of the difficulties with equipment-based systems may be illustrated in two ways. It has been estimated that of the 45 billion US dollars invested in road construction in sub-Saharan Africa (excluding South Africa) some 15 billion of constructed road has physically disappeared and if considerable amounts are not invested within the next few years a further 40% of the network will be in jeopardy.\footnote{Anon 1985; Mason 1985; Robinson et al 1985; Robinson 1988; World Bank 1988} In its 1981

\footnote{Muller 1970; McCutcheon 1980}
\footnote{Edmonds and de Veen 1982.}
\footnote{Anon 1985; Mason 1985; Robinson et al 1985; Robinson 1988; World Bank 1988}
report on *The Road Maintenance Problem and International Assistance* the World Bank stated that in no case had it been expected that it would take 10 years to establish a capital-intensive maintenance system yet in no case had it taken less than 10 years.  

In the long-run the use of equipment in this type of work has certainly not revealed the orders of magnitude of improvement expected by analogy with manufacturing; to the contrary. But these assessments were still in the future. While the later phases of the World Bank study on the substitution of labour for equipment did take some account of the lowered equipment productivities in developing countries, it was mainly concerned with the improvements that could be achieved by advanced labour-intensive methods over the inefficient traditional methods. Placing more emphasis upon the need to improve the productivity of labour than delineating the actual productivity of equipment, one of the Phase Three conclusions was that with superior tools, high incentives and good management, labour productivity could be improved to the point that labour-intensive methods could be fully competitive with equipment-intensive methods at certain wage rates. In 1983 in its Sector Support Strategy Paper for Transportation the World Bank advised:

Wherever the basic wage actually paid ... is less than ... about US $4,00 per day in 1982 prices, and labor is available in adequate quantities, the alternative of using labor-intensive techniques should be seriously considered.  

In 2003 the International Labour Organization stated that US$ 10 had become the “break even” wage.  

From Theory to Practice

Over the past twenty years labour-intensive road construction has progressed from being

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18 IBRD 1981  
19 ILO Howe 1981  
20 IBRD 1986  
21 Majeres 2003
a hypothetical possibility to a practical reality. National programmes have been established in Kenya, Botswana, Ghana, Lesotho and Malawi; several pilot projects have been carried out in Ethiopia, The Gambia, Mozambique, Tanzania and Zambia. These projects and programmes have usually been initiated by governments as part of their policies for rural development, and have included the creation of employment opportunities, the provision of infrastructure and the fostering of agriculture. Below the author will deal in some detail with the programme in Kenya and to a lesser extent that in Botswana.

**The Kenyan Rural Access Roads Programme**

The Third Phase of the World Bank's research began with further investigation of the improved labour-intensive methods in single-site operations and then expanded into consideration of multi-site operations. This research joined forces with the ILO's recommendations to the Kenyan government on employment. In turn it gelled with a Kenyan government interest in increasing agricultural production. The farmers had said that they could produce more food but would be unable to get their produce to market because of the lack of access roads.

Despite a measure of synchronicity, engineers within the Kenyan Ministry of Works, which was responsible for the major part of the road network, were extremely sceptical of the use of labour-intensive methods for road construction. A report carried out by an internationally respected consulting firm had shown that the use of labour-intensive

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22 Coukis 1983
23 De Veen 1983
24 McCutcheon 1983 to 1992
25 Bentall 1990
26 Edmonds et al 1986
27 Hagen and Relf 1988
28 (Cahoon) 1986
29 ILO 1987
30 Boardman 1986
31 McCutcheon 1987
32 McCutcheon and Borchgrevink 1985
33 IBRD 1986
34 ILO 1972
35 Kenya MoTC 1975
36 Personal Communication Edmonds to author 1977 and 1985
methods would be far more costly than the use of equipment. Nonetheless, donor pressure was brought to bear and the Ministry of Works (later Transport and Communications) somewhat reluctantly agreed to establish a Special Projects Branch to house a pilot project.

The pilot project was carried out in 1974. New designs and specifications were developed for low volume rural roads constructed by labour-intensive methods: final camber was set at 5% instead of the conventional 1.5 to 2%, *in-situ* material was used extensively; and even more shocking, compaction was achieved by natural consolidation, weathering and the passage of vehicles. Through detailed work studies 'task' rates for different activities were ascertained as well as the organisation of construction operations so as to effectively use increased productivities ('balancing'). High productivities require good quality tools: specifications had to be developed and Tender Boards persuaded that tools had to first accord to specification and then to lowest cost. Management systems were developed for recording, reporting, monitoring, controlling, procurement and administration. The wage rate was set above the government minimum and workers were hired on monthly contracts.

In 1975 the Kenyan Government decided to implement a national Rural Access Roads Programme (RARP). Progress was by no means unproblematic (the greatest problem was with the most equipment-intensive portion) and there is an extensive literature on the programme. In a nutshell: by 1976 only 250 kilometres of road had been constructed, by 1986: 8 000 (Figure 1). At its peak over 15 000 people were employed - over 120 000 years of employment. In order to obtain the necessary skilled personnel to implement such a programme, a fully integrated training programme was established to train the necessary site road-builders, clerks, drivers, multi-site supervisors and engineers. Building upon the pilot project work all the training material had to be generated by the programme itself. The RARP became progressively more absorbed into the formal

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37 Sir Alexander Gibb and Partners 1968 in IBRD Jan 22 1986
38 ILO Nov 1976
39 De Veen 1983
40 IBRD 1986
institutional structure of the Ministry: initially somewhat tenuously located within a Special Projects Branch, it was eventually squarely within the Construction Branch. For the first six years the senior engineers were expatriates. Progressively more Kenyan engineers became involved. Whereas in 1978 there were only 2 Kenyan engineers to some 20 expatriates, by 1985 there were 23 Kenyans to 6 expatriates. Of equal importance, since 1981 the programme has been headed by a Kenyan. For most of the 1980s the Permanent Secretary of the Ministry was a person who had previously been a District Engineer in the RARP. His personal knowledge of, interest in, and commitment to the programme was invaluable: at crucial moments the Permanent Secretary acted in support of the programme.

Internal success may be judged by the fact that the Kenyan Government has continued to find the funds for the programme. In addition, the Government itself (i.e. without Donor support) began to finance maintenance (which had not initially been considered). Equally, in 1987 it formally initiated the Minor Roads Programme which was committed to the maintenance of the 8 000 kilometres of access road and the upgrading and maintenance of 4 500 kilometres of gazetted road. It has also begun to use labour-intensive maintenance on the major road network. Such formal success was mirrored by reports that at the local level politicians would not allow Government to think of stopping the programme because of its dual success: employment and usable roads.

A more formal analysis showed that the 8 000 kilometres of road had been constructed at a budget overrun of 11 per cent. In investment terms the World Bank's analysis estimated that 69 per cent had remained inside Kenya compared with a maximum of 28 per cent using equipment. The proportion of programme costs devoted to wages was 56 per cent; since 1980 this has varied from 60 to 71 per cent. This increase is a partial reflection of having had a pilot project lead into a long-term programme. Initial high overheads for development, 84% during the first three years, were reduced to 16% over

41 Kenya MoTC Jan 1985
42 IBRD 1986
the life of the programme.\textsuperscript{43}

Independent analyses of quality were favourable.\textsuperscript{44}

In 1986 the World Bank published its completion report on its section of the funding. It concluded:

Considering the institution building requirement, the staffing and related training need, administration and supervision required for the size of the programme, this has been one of the most successful donor financed programmes in Kenya and one of the best organized labor-intensive road construction programmes anywhere.\textsuperscript{45}

\textbf{Botswana}

In 1974 the Botswana Government decided to initiate a Rural Roads Programme within the Ministry of Works and Communications (MoWC). The intention was to use labour-intensive methods of construction. However, the whole process of design, specification, construction, organisation and training was not re-evaluated, neither was specialist advice obtained from either the ILO or the World Bank.\textsuperscript{46} The programme became progressively more capital-intensive.\textsuperscript{47} Despite pressure being brought to bear expatriate engineers within the MoWC refused to countenance the use of labour-intensive methods on the gazetted road network.\textsuperscript{48}

Fortunately the non-gazetted network was another matter. Under its policies of decentralisation and rural development responsibility for non-gazetted roads had been given to the District councils which were autonomous bodies falling under the overall jurisdiction of the Ministry of Local Government and Lands (MLGL). In 1980 a pilot

\begin{footnotesize}
\begin{enumerate}
\item Hagen 1985
\item Rolt 1979; ILO (Petts) 1982; Sir Alex 1984
\item IBRD 1986
\item McCutcheon 1991
\item Per com Tveter to author 1981
\item Per com Borchgrevink to author 1984
\end{enumerate}
\end{footnotesize}
project of labour-intensive "district road" construction and maintenance was initiated in the Central District. The ILO was requested to provide Technical Assistance and the author was appointed to lead the team. From the ILO's perspective the intention was to replicate the Kenyan Rural Access Roads Programme. Eventually a successful programme was established and many key aspects are similar to the RARP. However, replication was not as straightforward as might have been expected given the scale of success achieved by that time in Kenya. In the first place there was complete rejection of labour-intensive construction by the District Engineer's Office, several senior District officials and influential Members of Parliament. A design appropriate to hilly terrain in Kenya was not acceptable in Botswana: distances between villages were greater, speed had a higher priority; vehicles were newer, mostly on government business (so dissatisfaction was quickly relayed back to District Council and Government); the excellent gravel network in South Africa was the standard for comparison. While the fault lay in the design, it was interpreted as the result of the method of construction: roads had to be built by machines, the use of labour resulted in low standard, expensive roads. Fortunately the President had been the Minister of Finance and Development Planning at the time of the approval of the MLGL project. His personal support gave us the breathing space to improve the design (wider roads, shallower side drains, improved vertical alignment (less bumpy)) and then reconstruct the offending roads. Gradually the construction of acceptable roads and number of people employed overcame the anti-lobby and in 1983 the Ministry decided to expand the pilot project into a national programme.

Once the technical details had been clarified a coherent training programme was developed to produce three levels of staff: site level road builders (1 year), multi-site supervisors (2 years), district level co-ordinators (3 years). Between 1980 and 1989 145 people (55 of them women) were trained as road builders; in addition 11 people were trained as multi-site supervisors and 6 as district level co-ordinators. Whereas by the end of 1983 only some 200 kilometres of road had been improved and less than 200 people

49 McCutcheon 1983
50 McCutcheon 1992
employed at any one time, by 1990 over 2 000 kilometres had been upgraded and over 3 000 people employed (per year).\textsuperscript{51} It can be seen that as for Kenya the lead-in time is extensive, partly because of the fact that one is establishing and staffing an institution.

The standard of construction is far higher than that in Kenya, it is competitive with equipment, and since an animal drawn haulage system was developed, the overall system is more labour-intensive than that in Kenya: over 65 per cent of costs go to labour. Independent evaluations have concluded that the programme has been a success in relation to most of its objectives.\textsuperscript{52} Of greater importance the MLGL has stated that the programme is also an asset to the country.\textsuperscript{53}

Discussion

Labour-intensive programmes have also been established in Ghana, Lesotho and Malawi. Although there are significant differences\textsuperscript{54} between these programmes and those in Botswana and Kenya (in particular that in Ghana contracting companies are used for maintenance) the similarities are sufficient to conclude that within different institutional and organisational frameworks, a wide range of techniques of labour-intensive road construction and maintenance have been extensively tried and tested over the past 19 years. Local variations have resulted in experience under climatic conditions varying from arid to tropical; terrain conditions varying from flat to mountainous; traffic conditions varying from ten to several hundred a day; standards varying from spot-improvement to engineered gravel roads and haulage varying from tipper truck to donkey cart - the latter in relation to a relatively high standard of construction.\textsuperscript{55} Institutional frameworks have varied from a Department of Roads within a Ministry of Transport to a Roads Unit within a District Council that was semi-autonomous from a MLGL. Workers have been employed on individual monthly contract or by contractors. In the early

\textsuperscript{51} Solberg et al 1990  
\textsuperscript{52} Solberg et al 1990  
\textsuperscript{53} Minister of Local Government and Lands NORAD 1986  
\textsuperscript{54} McCutcheon 1988  
\textsuperscript{55} McCutcheon 1985
phases emphasis was upon the creation of employment opportunities for unskilled labour. Over time it became clear that the productivities achieved by organised labour could not be considered the result of unskilled work. Equally that to motivate labour to construct a sound product it is essential to train skilled supervisors who are technically and organisationally competent and that during training as much attention should be paid to character as competence.

**Conclusions from Theory, Experience and Analysis**

Based upon theory, experience and analysis of programmes in Kenya and Botswana and many projects in South Africa, the author has drawn the following conclusions with respect to:

- Principles of Labour-intensive Construction and Maintenance
- Reasons for long-term success on a large scale.
- Reasons for failure.

**Principles of Labour-intensive Construction**\(^{56}\)

Investigation of the World Bank research and later experience has revealed that, in relation to technical feasibility and economic efficiency, successful site implementation depended upon the following basic principles of labour-intensive construction:

- A programme approach must be adopted as opposed to ad hoc projects
- The programme and projects within the programme must be treated as proper engineering (i.e. re-analysis of product and process of production) while giving serious consideration to carefully selected socio-economic objectives: employment generation, skills and targeting.
- Operations and activities in the project must be amenable to the use of labour-intensive methods (project choice).
- Detailed technical analysis must be carried out.

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• Designs, specifications, documentation and tender procedures should be appropriate.
• The greater use of productive labour is the “design driver”.
• As far as possible the work must be based on individual and group tasks.
• During preparation work (preparation period/pilot or demonstration projects) method and work studies should be carried out, iteratively, to reveal:
  - the various operations and optimal sequencing of such operations;
  - the various activities within each operation;
  - the individual and group tasks appropriate to the different activities and operations;
  - the balancing of activities within an operation;\(^{57}\)
  - the balancing of operations within a project.
• Conditions of employment must be appropriate: the majority of the physical work will be carried out by daily or monthly employed labour; contractual arrangements require close attention. And:
  - “A fair day’s wage for a fair day’s work”; and its corollary:
  - “A fair day’s work for a fair day’s wage;”
  - As far as possible where labour is concerned: no work, no pay;
• The labourers make their own way to work: transport to site is their responsibility.
• High quality appropriate tools and equipment must be specified, procured, and maintained.
• Training must be extensive and good at what it sets out to do: particular attention must be paid to “hands-on” site supervisors and multi-site supervisors (sites’ supervisors or managers). The training process should pay as much attention to character as technical competence (those trained have to be self-motivated to work all day, every day, without direct supervision).
• The labourers must accept instructions given by trained supervisors.

\(^{57}\) This type of analytical work is not peculiar to employment-intensive work. It forms part of the standard procedure with regard to the use of equipment; for example, balancing the numbers of mechanical excavators, loaders and trucks required for cut and fill. However, it is curious how often balancing is ignored in employment-intensive work. The labourers are then blamed for standing around doing nothing.
There should be close liaison between site work and the local community: but liaison must not be the responsibility of the site supervisor who has to be on site all day every day.

- Sites must be well organised.
- Strong organisations are required with good management systems.

The last two do overlap with some of the factors influencing programme development. They are included here because of their importance for day-to-day site performance.

And the corollary: the subject must not be treated as emergency relief.

The above principles were derived from several sources: desk-top studies; single-site work and method investigations; pilot projects; and large-scale programmes. The latter have repeatedly demonstrated the effectiveness and efficiency of the technology.

**Reasons for Success and Failure**

The following reasons for success and failure provide guidelines for planning long-term, large-scale programmes.

*Long-term success on a large scale.*

Drawing in particular on direct experience and analysis of the programmes in Kenya and Botswana, it was considered that the main reasons for success included the following:

- Major policy and decision makers must understand the concepts and principles of labour-intensive work and guidelines for large-scale programmes.
- Appropriate types of projects were selected for implementation. These were then planned as long-term programmes of construction. Programmes were not *ad hoc* projects. Given the nature of remuneration for engineering and project management expertise, overheads...

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will usually be extremely high on a one-off project: the ratio of expenditure on engineering and managerial expertise to that of employment on skilled, semi-skilled and unskilled labour will be inordinately distorted. This can only be addressed if a number of projects can be designed and supervised by the same engineering/managerial component. It takes as much high-level technical expertise for one project as it does for many more. In Kenya, for example, the ratio of overheads to direct construction was 84:16 during the first three years (1974-76) but 16:84 over the period 1974-1985.59

There was a sound intellectual assessment of the technical feasibility and economic efficiency of labour-intensive methods: cognisance was taken of technological and institutional capacities. The principles of labour-intensive work were incorporated into the daily work.

Technical, institutional, organisational, managerial and socio-economic aspects received concentrated attention during preliminary work, continued through pilot projects, embryonic training programmes and subsequent large-scale training and construction programmes. Technical matters included design, standards of construction and maintenance, specifications, tools and equipment, and methods of construction. Institutional matters included the decentralisation necessary for grass roots success and the centralisation necessary to plan and co-ordinate a large programme. Organisational and managerial aspects included the type of organisation required, the management structures and systems (recording, reporting, monitoring, controlling and evaluation) and training. Socio-economic aspects included wage rates, conditions of employment, labour legislation, labour supply, role of women and evaluation. Prior agreement was reached between the different parties with regard to wage rates, conditions of employment and the role and responsibilities of the community.

Strong organisations were established with good management systems: a balance was achieved between decentralisation and centralisation.

Training was extensive and good at what it set out to do, viz. the training of engineers, “hands-on” single- and multi-site supervisors, clerks, vehicle/tractor drivers and artisans. The expansion of the construction programme was integrally linked to the rate at which

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59 Hagen (1985).
the training programme could produce competent personnel. In effect the human resources necessary to run the programmes were generated by the programmes themselves. In Kenya expenditure on training amounted to only 1.5-2 per cent of programme costs.60

There was long-term political support. In Kenya this was true throughout the programme whereas in Botswana during the early years it was touch and go whether the highest levels (President and Vice-President) and some senior officials would outweigh the negative views of senior members of Parliament and many district officials.

Long term financial commitment was provided by Government and donors.
On balance there was good co-ordination between Government, government departments, those administering the programme, local authorities, those providing technical assistance and donors. Independent evaluation assisted, as did the continuity and commitment provided by particular individuals.

And the corollary: they were not short-term emergency relief projects. While this anticipates a portion of the next section, it is considered of such over-riding importance that it has been highlighted again here. It is the author’s considered opinion that in a relief context, it is virtually impossible to generate employment and skills and construct sound, efficient public infrastructure.

**Failure**

Analysis of projects and large-scale endeavours that were discontinued revealed:

Very little sustainable employment was created.
The assets constructed were not cost-effective, of doubtful value and ill-maintained (the results have often disappeared).

These resulted from an array of factors, which included:

60 Hagen (1985).
• Too many ill-defined objectives that could not be independently, verifiably measured.
• Confusion between short-term relief objectives and long-term developmental objectives.
• Inappropriate institution responsible for implementation.
• “Add-on” funding as opposed to the formal procedures normally followed for the provision of public infrastructure.
• Ad hoc projects not linked to either a programme of construction or training.
• Inappropriate choice of project.
• Inadequate planning; in particular unrealistically short lead-in times between project conception and initiation of construction.
• Inadequate and inappropriate contract documentation.
• Lack of appropriate legislation, in particular employment legislation, to allow the principles of labour-intensive construction to be used.
• Little national, provincial and local institutional capacity-building took place. Furthermore, there was a lack of communication between the various levels and agencies of government.
• The expenditure on development failed to reach the target group (the poor) to the extent envisaged.
• Individual skills were not improved. Training, where present, was not particularly appropriate or focused and has not shown itself to be carried through into post-project employment.
• Internal planning, recording, reporting, monitoring, control and evaluation were severely lacking. Independent evaluation has been noticeable in its absence. Given the lack of systems for planning and monitoring, systematic evaluation (internal or independent) would have been extremely difficult anyway.

Implications for Large-scale Public Works Programmes
There are several implications for public works programmes of labour-intensive construction throughout sub-Saharan Africa (i.e. including South Africa).

Specifically: Rural roads may be constructed and maintained by highly labour-intensive means: 5 to 7 times more employment being created per unit of expenditure. It is also possible to create a significant increase in employment opportunities per unit of expenditure across a wide range of civil construction including most municipal or urban engineering services and using contractors. Research at the University of the Witwatersrand indicates that there is a high employment potential in high-standard, heavily trafficked roads, for example.

The national programmes of rural road construction indicate how to establish a large-scale employment creation programme for the construction of public works: the process resulting not only in greater employment but also in the generation of individual and community capacities in technical and institutional terms.

National programmes have been established through:

- the adoption of a long-term national perspective in which a programme is developed;
- attention to technical, institutional, administrative, organisational and socio-economic detail during the preparatory lead-in phase and throughout the programme;
- institution building at community, regional and national levels;
- extensive training at site, multi-site and national levels.

In order for greater success to be achieved in the long run a four phased approach should be adopted:

1. Orientation at senior policy making and programme management level
2. Preparatory Phase: Analysis and Design
3. Demonstration/Initial Training
4. Expanded Training National Programme

The above approach has to be located within an institutional framework: national, regional, local. A "lead-in" time is necessary. During this lead-in period phases 1 and 2 are carried out. Below the components of the different phases are listed.

**Phase One**

Education and agreement at national regional and local levels as to:

(i) Concepts and Objectives: asset creation plus significant additional employment opportunities per unit of expenditure;
(ii) Nature of long-term "programmes";
(iii) Conditions of employment, wages and linking of payment to production.

Brief local and national authorities as to type, standard, funding and method of construction; the importance of training, institution (local and national), long-term political and financial commitment.

Agreement that labour-intensive public works programmes are not emergency or drought relief projects.

Draft long-term programme.

**Phase Two**

Analysis: institution (local and national); organisation; levels of funding; specific technical analyses; criteria for staff recruitment; identification of initial communities and training sites.

Preparatory Work: design, specification, documentation; administrative, technical and training manuals; selection of trainees; briefing of communities; priorities.

Revise forward plans.

**Phase Three**

Orientation and training of trainers; start pilot projects and embryonic training programmes; revise training and national programmes; revise manuals and reporting systems prior to initiation of large-scale national programmes.
Phase Four

Expand initial training programmes within each sub-sector into a national programme. But the expansion should only be allowed to proceed in the following manner:

(i) at the rate at which the training programme can produce skilled site supervisors and managers (training must pay as much attention to character as technical competence);

(ii) to the degree to which local communities have the capacity to absorb the trained personnel;

(iii) to the degree to which the national institution is able to absorb the trained management personnel and maintain its overall planning, co-ordinating, monitoring and evaluation role.

Through the 'programme' approach (as opposed to 'project') the institution is established together with the human resources required to implement the work from site level through to national planning and co-ordination.

The four-phased approach, outlined above, is the result of many years of experience and analysis.

Although it has a proven track record that does not mean that it will be adopted without advocacy. The World Bank has recommended that where no previous experience exists a start-up period of at least three years should be considered. But even policy makers who are sympathetic towards labour-intensive construction are reluctant to face the reality of the need for a lead-in period. Policy makers who are only concerned with jobs and have little interest in product have even less appreciation of the need for a start-up period. It is recommended that the dilemma be resolved through (i) initiating a long-term employment creation programme and (ii) at the same time taking advantage sensible, short-term initiatives for immediate impact. And that the programme is not treated as

61 Coukis
emergency-relief. In this way the process of labour-intensive construction could indeed make a contribution to alleviating unemployment and generating individual and community skills in technical and institutional terms.

So much for specific conclusions. More generally, the author wishes to close with the following comments.

30 years of experience related to employment creation through public infrastructure and building works has revealed that too many were largely unplanned, resulting in the labour-extensive production of ill-defined products of doubtful value through processes which did not lead to individual, community or institutional capacities. This darker side is partly the result of the unplanned nature of the projects and programmes, but on reflection it seems to be based upon a fundamental lack of appreciation of the worth of manual labour and the need to develop individual and community skills. Frequent exposure to these attitudes has led me to conclude that one of the major stumbling blocks is the perception that labour-intensive work is simple work by simple people in simple places using simple tools and, therefore, there is no need for sophisticated people to take the matter seriously - consequently no need to plan. No appreciation of the need for development of skills.

Putting it another way, to consider a person who can move 5 to 7 tons of material in a day ‘unskilled’ is a measure of the lack of understanding of (i) the individual skill necessary to achieve such a task and (ii) the commitment, training and organisation required to enable a worker to become so productive.

Marx observed that the main characteristic of a system of machinery was that it replaced human labour.62 Developments in the 20th Century are a testimony to a continuous search for labour-saving devices. To such an extent that it has obscured our ability to see the contradiction between machines, manufactured elsewhere, working, while people who are desperate for work stand and watch.

In the mid 19th Century Tredgold defined civil engineering as the art of directing the great sources of power in nature for the use and convenience of man. It is doubtful whether he included muscle-power as one of the great sources. That is an irony because at that time in England, the railways were being constructed almost entirely by muscle-power augmented by non-motorised levers and winches. In the 1960's a Civil Engineer was defined as someone who could do for R1 what anyone could do for R3: reduced to a concern for cost.

The author considers it essential that the construction and maintenance of public works should take account of the process as well as the product. In addition, to concern for cost, quality and speed there must be the generation of employment opportunities, individual and community capacities and institutional development. While it goes against the grain of the 21st Century, the author considers that within engineering there is a need to consider muscle-power as one of the great forces in nature and to consider it and other social factors as variables to be taken into account in the process of construction of housing and public infrastructure. In the wider arena, at least where the expenditure of public money is concerned - and 70 per cent of the funding for civil engineering is public money - to take the opportunity provided by construction of public works for people to be part of production.

The paper has described and discussed the contribution made to job creation through the large-scale use of labour-intensive methods of construction and maintenance of rural roads. It has demonstrated the pivotal role played by the World Bank in the formulation and implementation of these endeavours. What are the prospects for the Bank’s future advocacy of such successful job creation programmes?

**References**

To Follow

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63 Quoted by Carmichael 1979.