E.D.R.P. No. 153.

UGANDA'S CONSTRUCTION SECTOR

A RESEARCH REPORT OF WORK UNDERTAKEN BETWEEN 1965 AND 1967.

by

C. VINCENT

MAKERERE INSTITUTE OF SOCIAL RESEARCH.

These papers are prepared as basis for Seminar discussions.
They are not publications and are subject to revision.

PART I

DEVELOPMENT PLANNING AND CONSTRUCTION ACTIVITY

In each of the three East African countries, Development Plans are currently being implemented having been drawn up with the aim of programming the likely future course of the economies, as these countries sought to obtain the economic target each has set itself. Unlike earlier Development Plans a considerable amount of detail is provided of the envisaged expansion of individual industrial sectors, and the assumptions upon which these calculations have been based. In addition to these plans Clark has published forecasts based on his own models of the three economies.

Though this paper is primarily concerned with developments in the construction industry in Uganda, it is necessary to consider this industry in an East African context. Many firms engaged in the industry move their capacity freely among the three countries in response to the state of the local market. Consequently in attempts to assess the ability of the industry in Uganda to respond to the demands of the development plan attention must be given to the overall situation as regards the demands being placed upon the capacity of the industry throughout East Africa.

The main calculations that have been produced are given in TABLE I. In the case of Uganda the figures relate to Clark's model estimates of the level and rate of growth in the production sectors, required to achieve a doubling of per capita income over the period 1966-81, and the official plan projections made on the same basis - as contained in "Work for Progress". In the case of Kenya and Tanzania the model has again been based on objectives stated in the official development plans. In Kenya, it should be noted, there have been two plans, an "original" and "revised".

From a perusal of this table two points stand out. The first is the important part that is assigned in every case to the construction industry in the achievement of the Plan Targets. The second is that though a substantial measure of agreement between the Plans and Models might be expected, important differences do in fact exist.

The importance of the industry is easily explained by reference to Appendix Table I. There, it is shown that in the case of Uganda over the period 1954 to 1965 that of total investment in the economy, the construction element was generally equal to between 50-60%. There are few reasons to expect that this could be changed though it is interesting to note that Clark does appear to claim that a choice exists between an investment strategy based on investment in construction works and one based on investment in machinery and equipment. This proposition appears questionable, to the extent that it refers to the flexibility in investment decision making that might exist in urban building work. Even this, however, has its limitations as an argument and it is far more reasonable to regard investment in construction and equipment as complementary rather than substitute for one another.

Even were it to be accepted that a choice exists in investment strategy, construction investment would clearly rate high due to linkage effects, a high labour content, and the important part played by local firms. Over the course of the current planning period it is likely that the linkage effects associated with construction activity can be increasingly exploited.(1) Thus in the construction industry, many of the materials imported are amenable to home manufacture, but the same cannot be said for the manufacture of machinery and equipment. These points are reflected in the assumption for import substitution used by Clark in his model - 75% for building materials and zero substitution for machinery and equipment.

(1) Background to the Budget 1966-67 para 3, 10.

Concerning the discrepancies evident in Table I, in the case of Uganda the difference between plan and model is a gross product estimate of £9.4m for 1971 from the former and of £13.2 from the latter. However, the Plan figures are on the basis of revised GDP estimates, this revision having inflated the figure by about 10%(1). To make the Plan and model comparable 10% should be added to the model estimate of £13.2m so making it £14.5m. It is proposed to ignore the fact that the two sets of figures represent different base year prices on the grounds that the period 1962-64 was a slack period in the industry when it is unlikely that any major change in prices occurred. A number of reasons for the difference between the two estimates can be found.

(1) Work for Progress p.10 Table 6.

TABLE I

UGANDA	MODEL PROJECTION @ 1962 PRICES			RATE OF GROWTH	PLAN PRODUCTION ** @ 1964 PRICES		
GROSS PROD.	£m 1962	£m 1971	£m 1981	% 1962-81	1966	1971	RATIO OF GROWTH
Agri. Prod.	49.9		170.5	6.7	86.2	111.1	
Urban Prod.	52.6		263.2	8.9	106.0	159.3	
Manuf. Prod.	8.6		57.7	10.6	20.9	34.9	
Servs. Prod.	22.8		114.7	8.9	65.0	94.4	
Gov. Prod.	13.4		58.9	8.1	9.5	13.8	
Transp. Prod.	7.8		31.9	7.7	10.6	16.2	
Consm. Prod.	3.9	13.2	51.0	14.5*	5.5	9.4	11.3
Total Mong.	106.4	216.59	484.7		197.7	273.7	

N.B. Services/Government product are not comparable sectors as between Model and Plan.

* Clark states 1/4 = 15.7% which would give £62.3m at the end of 19 years instead of £51.0m.

** Plan figures are all on basis of revised G.D.P. figures, which are 10% greater than previous estimates (as used in Model). See Table 6 page 10 "Work for Progress".

KENYA	MODEL PROJECTION @ 1962 PRICES			ORIGINAL PLAN @ 1962 PRICES		REVISED PLAN @ 1964 PRICES		
GROSS PROD.	1962	1970	%	1970	%	1964	1970	%
Agric. Prod.	39.9	64.2	6.1	66.8	6.8	48.01	70.85	
Urban Prod.	134.2	221.1	6.5	204.0	5.5	160.40	238.90	
Manuf. Prod.	23.9	44.4	8.1	35.9	5.2	30.13	47.80	
Services Prod.	56.7	90.1	6.0	85.2	5.2	66.39	95.30	
Gov. Prod.	28.1	43.6	5.6	39.8	4.5	34.11	51.20	
Trans. Prod.	25.6	42.9	6.6	43.1	6.9	29.77	44.60	
Consm. Prod.	6.8	15.7	11.0	10.0	5.0	4.38	12.00	15.5

TANZANIA	MODEL PROJECTION @ 1962 PRICES			PLAN PROJECTION @ 1962 PRICES	
GROSS PROD.	1962	1970	%	1970	%
Agric. Prod.	48.5	94.6	7.7	86.5	7.3
Urban Prod.	68.2	155.2	9.6	154.8	8.8
Manuf. Prod.	15.4	46.6	13.1		11.1
Services Prod.	18.4	42.0	9.6		8.4
Gov. Prod.	17.3	32.6	7.3		8.0
Trans. Prod.	15.7	31.0	7.9		8.5
Constr. Prod.	8.0	32.3	16.7	21.0(i)	12.7

See Note (c) p.117 of P. Clark for details re base year figures

(i) See text in connection with Constr. Prod. Plan figure.

SOURCE: Development Planning in East Africa. Clark Development Plans as published.

The most important difference between Plan and model concerns the overall rate of growth assumed. Though the model is based on 1962 and the Plan on 1964 prices, the overall objective is the same - that is, to double per capita income that was estimated to have been obtained in 1966. This being so, there should be little or no difference in the rate of growth postulated for GDP. The figures are, however, as follows:-

TABLE II

	MODEL	PLAN
Monetary GDP 1966-81 per annum	8.4%	7.4%
Non-Monetary GDP 1966-81 per annum	4.7%	3.2%

Part, but only part, of this difference can be accounted for in that the model assumes a population growth of 2.6% p.a., and the Plan 2.5% per annum.

A significant difference arises in the capital - output ratio employed. The model uses a ratio of 3:1 calculated from past observations though projected at a lower level. The Plan, however, uses the ratio of 2.8:1 and though it is explicitly recognised that this is rather low with the obvious implication that capital must be more efficiently used than was so in the past, it may prove too optimistic.(1) The first Five Year Plan, it would seem, achieved a

(1) Clark P. page 82. Work for Progress page 11.

ratio of the order of 3:1 though a much lower ratio appears to have been planned for (1).

(1) Background to the Budget 1966-67 page 48 paras. 9.12 - 9.13. GDP increased by £37.6m with an associated investment of £115m, giving a capital to output ratio of slightly less than 3:1 if price adjustments in the investment figure are considered. If the original targets as set out in these paragraphs had been out, an incredibly low capital to output ratio would have been reported to be achieved.

These two points lead to the tentative conclusion that investment projected in the Plan may be too low to achieve the targets set, and that as a result the gross product figure for the construction industry is understated. But reason can be found for thinking that Clark's estimates may be too high. First, on the basis of past trends as given in Appendix Table I, construction investment has

perhaps been more realistically geared in the Plan at 52% of total investment than Clark's figure of 60%. Second, concerning value added as a proportion of total output (as gross product as a proportion of construction investment which is the same thing) while the Plan used a figure of 30% Clark employs the very high figure of 54.6%. The survey of industrial production for 1966 found the figure in its sample to be 35%. Clark in fact assumes that this proportion progresses on an upward line trend - that is, wages, profits and salaries are assumed to progress relative to that proportion of total output accounted for by materials. Whilst there may be some truth in this contention the logic of projecting a line trend for this variable is questionable.

Whilst it can be suggested that Clark's estimates are too high and the Plan's too low, it is very much more difficult to state precisely where the true figure lies. In order to provide a basis for judging the overall growth rate required of the construction industry in East Africa a compromise for Uganda is suggested using a growth rate of 12.0% p.a. to give a construction gross product estimate of £10.7m by 1970.

In the case of Kenya there is a wide divergence between Clark's model and the original version of the Plan as far as the construction sector is concerned. Clark in fact questioned whether or not the planners had made a serious underestimate of the construction industry's role. In the revised form of the Plan, most sector

(1) Clark, P. Development Planning in East Africa p. 132.

gross product figures are slightly higher than Clark's estimates, and possibly all the difference could be accounted for by price changes over the period 1962 (the model's base) to 1964 (the Plan's base). But the construction target suggested in the revised Plan is still lower than the model estimate despite the fact that the new estimate is 20% higher than the previous one. Both, model and Plan, however, put the construction sector to the fore in terms of growth rate, in the model with a figure of 11.0% per annum and in the revised Plan 18.3% per annum - a very high figure due to the depressed state of the industry in 1964.

In the revised Plan construction investment is some 57% of gross investment and in fact marginally higher than the figure used by Clark of about 53%. Furthermore, the capital output ratio assumed in the Plan is higher than that postulated in the model; 3.3:1

in the former and 2.8 in the latter. It is the assumption used regarding the proportion of value added in gross output that appears to account for the divergence between the Plan and model estimates as to the level of building activity. In fact the figures used in the Plan look most peculiar. The annual average of construction investment is £37.05 million, which over the five year period equals £185.25m (it is assumed that these figures are to a 1964 price base). The gross product associated with this investment must be calculated from the following data:-

	1964 G.D.P. @ 1964 Prices	1970 G.D.P. @ 1964 prices	Compound p.a. r/g
Construction	£4.38m	£12.0m	18.3%

Calculating the gross product figures for each year and summing over the period 1966-70 gives a total of £44.12m associated with an investment of £182.25m. This means that the Plan assumes value added to equal 24% of the total output as compared with the 1963 Census figure of 38.7% and Clark's assumption of 38.5%. Even if the Plan figures are calculated on the basis of 1970 - that is a gross product of £12m and gross output of £37.05m a figure of 32% is obtained.

Again using the simplifying device of ignoring price changes over the period 1962-64 - and this was a very slack period of building activity in Kenya - it is suggested that the Clark's estimate of the level of construction activity required to fulfil the Kenya Plan targets is more realistic than that pur forward in the Plan itself.

To comment on the divergence in TABLE I between Plan and model estimates for Tanzania is very difficult owing to the use of different base years and base year figures (that is revised and unrevised). In fact Clark - the source of the Plan projection data given in Table I - does not give figures for the product of sectors outside the agricultural and urban, due to differences in base year estimates and definitions.

In order to gain some idea of the order of magnitude of the divergence between the plan and model estimates in TABLE I the Plan figure has been derived by using the same base figure as Clark but projecting it at the Plan growth rate of 12.7% p.a. This provides widely divergent estimates of the gross product of the construction industry in Tanzania in 1970, but as in the case of Uganda it would seem that Clark has overestimated the growth of gross product (value

added) relative to total output. According to Clark's figures a gross product of £32.3m in 1970 arises from an investment in construction works in that year of £49.7m - a value added figure of 65%. Were the Plan figure of £21.0m to be used the high, but nevertheless more realistic figure of 42% is obtained. On these grounds it is suggested that the Plan projection figure given in TABLE I might provide a more reliable guide to the growth of the construction industry in Tanzania.

In TABLE III these very tentative conclusions relating to the required rate of growth is the construction industry if current development aspirations are to be met, are brought together. The implication is that the construction industry in East Africa will by 1970 have to attain a level of output two and a half times that recorded in 1962.

TABLE III

	1962 £m	1970 £m	Annual Growth Rate %	Ratio
UGANDA	4.3	10.7	12.0	2.5
KENYA	6.8	15.7	11.0	2.3
TANZANIA	8.0	21.0	12.7	2.6
	19.1	47.4	12.2	2.5

This estimate, it will be apparent from the above comments is conservative to that prepared by Clark. Clark's calculations for the three countries in fact imply a trebling in output over the period 1962-70.

Such demands, compare with a duration of activity in Kenya as from 1957 through to 1964-65, a stagnation of output in Uganda over the period 1956-64 and a moderate rise in the activity of the Tanzanian industry. Clearly such rate of growth as conveyed on the Plans and models are outside the immediate past experience of the industry.

The Governments of the three countries have shown themselves to be very well aware of this situation. In the Uganda Plan the industry is identified as a critical sector the failure of which could delay the implementation of the other parts of the plan.

> "thus a major and rapid expansion of the construction industry will be necessary in order to achieve the overall investment and output targets of the Plan".

(1) Work for Progress p.109, See also paras. 3.39 and 3.41

"The projected sharp increase in investment activity raises questions concerning the capacity of domestic industry to cope with the higher level of investment demand. There is no problem with transport equipment and other capital goods which have to be imported; rather it concerns primarily the construction industry ..... careful forward planning will be required to avoid bottlenecks in the industry, noteably by ensuring that technical experts and machinery are available as needed".

(1) Kenya Development Plan p.112

Clearly this has equal implications for the building materials industry. Not only is it required that this industry should expand in line with the expansion in demand - that is with the rate of growth of the construction industry - but achieve in some of its sectors a substantially higher rate of expansion by substituting home production for imports. The balance of payments constraint which it is considered will inevitably arise as a result of the projected growth in the economy, requires efforts both to produce those goods not previously produced in East Africa or to expand the output of those already in production.

The sheer magnitude of this problem can perhaps be better appreciated if compared with that confronting the British building industry. In Britain, projections for the future, especially in connection with the ill-fated National Development Plan, caused a flurry of activity amounting perhaps to anxiety as to the expansion the industry was to be called upon to provide. A number of reports and surveys of the industry, official and unofficial, concerning its general state of preparedness for this task were undertaken and yet, the problem in Britain was to achieve an expansion of output of some 60% over a twenty year period. This is clearly very small indeed alongside the growth rates that are confronting the industry in East Africa.

PART II

THE DETERMINANTS OF CAPACITY

Having identified the extent of the problem it is necessary to consider the determinants of capacity in the construction industry, the factors most likely to restrict expansion, and the means by which enterprise might be encouraged.

Surplus Capacity

In Uganda the First Five Year Plan had a chequered history, and many of its achievements were recorded in the final two years. The first two years of the plan period were set against a background of a poor crop and export performance, but the revival in exports in the third and fourth years provided the basis for the expansion in investment witnessed in 1964 and 1965. Almost three fifths of central government development expenditure took place during the last two years of the plan, and this was half of the total gross investment in the economy.(1)

(1) Background to the Budget 1966-67 para 9.18 p.49

This spurt in activity was reflected in the construction sector where the gross product figure for 1965 was some 32% greater than that for 1964. But it is of significance that as a result of this expansion the industry displayed signs of being over extended by the end of 1965. This indeed is put forward among the reasons why the targets of the first Plan were not achieved.

That this constraint should have arisen during the first Plan is particularly noteable since Clark has estimated that the industry in 1962 had a degree of surplus capacity of the order of 10-20% (1).

(1) P. Clark, Development Planning in East Africa p.23

To the extent that this was true then the industry's performance over the period 1962-66 should give rise to concern if only because it proves how unresponsive capacity in the industry is to the prospect of a high level of future demand. But on the other hand, it must at least be questioned whether the means of production that achieved the boom in construction activity in Uganda in 1956 (and Kenya in 1957) were still available during the course of the plan period for harnessing to the efforts required by the Plan. At the very least the physical deterioration of plan and wastage of the labour force would

need to be taken into account in making an objective assessment of the degree of surplus capacity available.

But whilst evidence of a construction constraint has been found [1] other evidence can be presented indicating considerable

(1) Background to the Budget 1966-67 p.47

surplus capacity in the industry in 1965. In 1966 an enquiry was held among the members of Uganda Association of Builders and Civil Engineering Contractors (UABCEC) which indicated that most of those felt that they would, with their existing resources, be able to achieve a significant expansion in output. This conclusion is based on the return of 25 questionnaires out of 75 dispatched, the sample received representing about 10% of the industry's turnover. Of the 27, 15 indicated that they were operating with surplus capacity and that in most cases the degree of this was considerable.

Similarly the survey of Industrial Production for 1965 found that of 51 firms classified to the industry, 22 stated that with their existing machinery they could have expanded production; of 21 firms in the sub-trades, that is the electrical, painting and plumbing group, 8 indicated the capacity for expanding production.

This contradictory evidence can possibly be reconciled, and in a way which is of interest and importance in itself. It is suggested that indeed as indicated by Background to the Budget, pressures were being felt by the end of 1965, but that these pressures were probably confined to the civil engineering, as opposed to the building side of the industry. This explanation could account for both the surplus capacity found in the two surveys and for the fact that Uganda Cement Industry was at this time able to report that for the first time in many years it was working at full capacity - civil engineering, being a heavy user of cement. It seems not unreasonable to suppose that a large proportion of the expenditure on construction in the period 1962-66 was on civil engineering project such as roads and the defence programme.

But other means of reconciling the conflicting data is to recognise that in both the surveys of capacity mentioned above the concept was defined as to include factors internal to the firm and to exclude in particular skilled labour. Were it true that this was its short supply at this time then no conflict would exist in the evidence. However, in the light of conditions in the labour market

in 1966-67, as far as these could be ascertained, it would appear unlikely that in 1965 the supply of labour was a major constraining factor.

Thus capacity constraints in certain sections of the industry were beginning to arise before the close of the first Plan with the target set by that Plan unfulfilled and with Clark's projected output growth from 1962, and the revised growth suggested in Part I, high above the level in fact attained. Against this background, and the scale of the expansion envisaged in Part I, it would seem that the capacity of this industry could become during the current planning period, a major constraining force to the success of the Plan.

But the question of the ability of the industry to expand its capacity depends in large part on the nature of the capacity to be expanded, in particular whether this is building or civil engineering capacity. This is a distinction between the building sector based on jobs of small scale, requiring small scale organisation and based on the techniques of building and its crafts and skills, and on the other hand civil engineering with its contracts and firms of a large scale and employing an engineering technology which makes very heavy technical demands on the firm. It is notable that civil engineering is principally but not wholly, the preserve of the European firm; it is also to be noted that while a civil engineering firm can move into the building sector of the market in slack times the same movement into the civil engineer's market is not possible for the building firm.

It has already been suggested that capacity in the civil engineering field was under strain in Uganda towards the end of the first Plan. To the extent that the present Plan involved an expansion in building work, from the viewpoint of organisation and technical know-how it is doubtful if much of a problem would be posed in expanding capacity. To the extent that expansion is envisaged in civil engineering work the task seems to be that much greater, since the scope for new firms entering the field is more restricted - in building local builders, can, given certain conditions, expand their activities and enter the monetary economy. Further, in view of a world wide shortage of engineers those firms already engaged in civil engineering might find it difficult to recruit the necessary skills to sustain an expansion in output.

In the case of Uganda no attempt is made to provide a breakdown in official statistics between building and civil engineering but it

is clear that much development expenditure will be made in the civil engineering field (roads, hotels, office buildings etc.). In the case of Kenya this information is provided and as will be seen from Figure II over the period since 1954 the civil engineering section of the industry has been the most important. Moreover, a considerable increase is envisaged in activity within this sector of the industry over the next plan period, as seen from the projection, though the actual rate of growth as compared with the other sectors is not great. Thus, not only are these countries confronted with the problem of achieving a large increase in the capacity of the industry as a whole, but of that part of the industry that it is going to be the most difficult to increase.

Determinants of Capacity

The capacity of a building firm depends primarily on the 'capacity of its management and head office staff, the number and quality of its site supervisors and its stock of equipment. The first item is clearly highly individualistic and not susceptible to comment here. In the case of site supervisors they seem to be among the few members of the firm below the management level who are in any sense permanent employees; in most firms the employment of site workers is predominately on a temporary basis. Should a firm wish to expand, and requires extra site supervisory staff, this apparently is a critical problem unless the firm in question is European based and can import 'expatriates'. The traditional 'mistry', the Indian, seems to be effectively barred from entry into East Africa today - despite certain government guarantees that this would not be so. In fact, the flow appears to be outwards.

Regarding capital equipment the question arises as to the nature of the association between an expansion in output and the level of investment required to achieve it. Little appears to be known about the capital - output ratio in the construction industry, though it can reasonably be seggusted that it will be low but that the figure will vary according to the sector of the industry considered. This difference is most clearly seen when comparing the small builder of houses using a cement mixture, lorry and a minimum of hand tools, with the operations of a civil engineering firm employed on the construction of a road.

An attempt was made to get some insight into the capital-output ratio from the UABCEC survey, based on the assumption that the difficulties that are usually said to exist to the empirical estimation

of this concept have been overstated and that any businessman should be able to answer the question - how much capital equipment will it be necessary to install to achieve a given rise in output? (Of course it becomes rather more difficult in going about it in this way to take account of the influence of surplus capacity working. In fact, of the 19 respondents that had reason to answer this question, 17 did in fact do so. Of the 17, 11 were thought to be directly engaged in building as opposed to the sub trades. During the course of the questionnaire all firms had reported their 1965 turnover and the extent of surplus capacity working expressed as a percentage of this turnover. They were then asked if they were expanding their businesses, if so by how much, and furthermore how much capital investment would be required. Making the assumption that value added was 38% of total output a capital output ratio was calculated - capital being defined as investment in machinery, except replacement expenditure unless the replacement was a machine of higher capacity than the one being scrapped, and output as the additional to value added that we envisaged to flow from that investment.

(1) While more than just investment in machinery is likely to be involved it is likely to be in this industry, of such a small magnitude as to be not worth the additional complications of estimation.

The results of this exercise, however, did not prove very enlightening ranging as they did from the comment that "in the building trade no capital investment is necessary" and through virtually all the ratios between 1:1 upto 5:1.

In the Uganda Plan a ratio of 2:1 is in fact used - thus it estimated that to raise the annual net output (value added) from £5.1m in 1966 to £9.4m in 1971 will require an investment of £8m in machinery and equipment. No separate calculations relating to the purchase of equipment for the construction industry have been made in the Kenya Plan nor in Clark's models. Over and above the level of the firm there are what might be described as industry constraints on the level of capacity. Under this heading the following are suggested - the supply of building materials, the capacity of the professions, such as architects, engineers, surveyors, etc. and the supply of labour.

The question of materials will be discussed more fully later. The supply position is that of the materials used as least 34% are imported(1). In these imports metal products of one sort and another predominate, but large proportion of the total requirements of other

(1) See appendix Table of Survey of Industrial Production

products are imported - for instance sanitary-ware, paint and glass. It is clearly most unlikely that Uganda's increased demands for building materials are going to affect the world market significantly, and thus it would be unduly pessimistic to envisage trouble for the Ugandan building industry from this source. But such difficulties as will arise are connected with the fact that the Plan depends to a large degree for its success on import substitution in building materials. But while the government will clearly do all it can to discourage imports and promote home production it would obviously be inconsistent for it to adopt policies that positively obstruct an expansion of construction activity.

From home production Uganda is able to supply many of the basic materials that it would be both difficult and extensive to import. But some anxiety with regard to the supply situation may exist here. Already in 1966 the Uganda Cement Industry was working at full capacity, and though plans are well in hand for another plant to be built one wonders if this will be in time to prevent shortages of this material, or its costly importation, from arising. The latter clearly affects the balance of payments and would contribute to rising building costs, both of which are effects to be minimised if at all possible.

The question of the supply of professional talents is indeed interesting. From the time of being conceived in a client's mind to the time of the involvement of a contractor, an act of investment in the product of the construction industry engages the attention of a number of professional men - architects, quantity surveyors, engineers and so on. The capacity of the construction sector depends just as much on these professions as it does on the work of the construction firms. This problem has in fact already been met in connection with the first Capital Development Plan where a shortage of engineers for preparatory road survey work was reported. From casual observation and conversations it appears that architects are not under particular strain, but that quantity surveying firms are up against the limit of their capacity. The shortage of engineers referred to in connection with the first Plan is sufficiently recent as to be likely to still persist.

A 'clogging up' of the professional services would have wide-spread effects throughout the industry, not only in delaying the putting-out of jobs. For instance, to the extent that quantity surveyors fall behind in the settlement of final accounts, this can have serious effects on the financial position of builders impairing

their ability to tender for the next job or causing delays on the job they are engaged upon for lack of working capital.

The question of a bottleneck in professional and administrative personnel was specifically recognised by Clark in the context of government employees both in terms of present manning and demand for their services, and of the future when an additional variable is the desire to Africanise higher level appointments. As can be seen from Table II the proportion of development expenditure falling on government and para-statal bodies is large as compared to the private sector and to previously attained levels. Thus much of the success of the Plan depends on the capacity of all grades of personnel within government - and the available capacity in the private sector to which it is possible to farm out some of the work. Both the Ugandan and Kenyan Plans recognise this potential problem but remain optimistic that it can be overcome, though one wonders just how objective their assessment of the capacity of government departments has been.

TABLE II

	ESTIMATED SPENDING FIRST PLAN		TARGET SPENDING SECOND PLAN	
	£m	%	£m	%
Central Government	42	(34)	90	(38)
Para-statal & EACSO	28	(23)	60	(25)
Private	54	(44)	90	(38)
	124	(100)	240	(100)

Finally the question of the supply of labour must be considered. It is without doubt the generally held belief that a major restraint likely to arise in connection with the expansion of the industry is the supply of craftsmen and other skilled manpower. It was this factor which was stressed time and again in the replies received to the UABCEC enquiry into the possibility of an expansion of output. This question is discussed in greater detail in Part IV. Indeed it is clear that this brief review of the determinants of capacity, internal and external to the firm that the most critical problems are likely to arise on the labour front - that is with the supply of site supervisors and skilled craftsmen.

Implications of the Failure of Capacity to Expand

Having found reasons to suspect that the industry was, at least in some area of its activity reaching the limits of capacity by 1966,

and further that certain parameters of capacity are likely to present supply problems in the immediate future, it is necessary to consider the implications of the failure of the industry to expand to meet the development targets.

This question might seem to be rather academic and that a realistic view would take into account the fact that if demand was to rise as much as has been indicated it would give rise to an increase in building costs to the point that the necessary capacity was created in response to the profit motive. While it is undoubtedly necessary that building costs should rise during the course of the Plan period to stimulate an expansion of capacity it is also a rather unhappy fact of life that any large scale movement in costs could have the effect of seriously disrupting the implementation of the Plan. This is basically because along with the other development restraints that have been mentioned above - balance of payments, supply of supervisory and skilled manpower, and the strain on government staff - there exists a government budgetary restraint, which must be considered alongside the very important part that the government sector has to play in the Plan. ".....Since in the recent past the critical constraint appears to have been government finance the task of initiating accelerated development made the new plans depend very much on raising additional finance for the Development Budgets". Clark p.27.

"The leading role for public agencies has both advantages and disadvantages. The major disadvantage is the tremendous responsibility it places on the shoulders of the public authorities to organise large investment projects, to raise tax revenues rapidly and to increase the budgetary contribution to development investment....." Clark p.83.

Thus any rise in building costs is going to add to an already large bill for capital investment, and put a corresponding strain on the revenue raising capacity of the budget. It is of course possible to argue that a rise in building costs is simply a transfer from one sector of the economy to another and that as quickly as profits appear in the construction sector they can be taxed away by the government. But it is already envisaged that very large increases in the rate of taxation will have to be levied to carry through the Development Plan. Consequently any further increases are to be avoided on grounds of incentive and administrative capacity. Furthermore, it is rather difficult to envisage a special taxation policy to deal with the removal of profits from one sector of the

economy alone.

Tanzanian experience with the implementation of its Development Plan clearly has relevance to possible developments in Uganda and Kenya unless a more vigorous response to their own Plans is forthcoming. The investment of building costs in the first two years of Tanzania's Plan has been described in a paper by the Hon. A.Z.N. Swai then Minister for Development and Planning.

---

(1) Implementation of the Five Year Plan Rising Building Costs. A.Z.N. SWAI.

In this paper it is made clear that increases in building costs of the magnitude being experienced were preventing the achievement of the Plan targets. It was estimated that over an 18-month period building costs had risen some 15-29%.

> "The Plan aims to achieve a total gross capital formation of £246m, about 60% of which will be in building and construction activity. These estimates are based on 1960/62 prices which means that already another £30m have to be found if original Plan targets are to be achieved. Expressed in real terms this would mean that only 80-83% of planned gross capital formation in building and construction can be achieved provided that no further rise in building costs occur. As investment in machinery and equipment is dependent on construction activity it is likely that rising building costs may also hamper other investments. The importance of tackling this problem, therefore, cannot be overemphasized."

The paper proceeds to analyse all aspects of cost - materials, labour, machinery, overheads and profits - and finds that all of these contributed to the increase with the exception of machinery costs. Very considerable increases seem to have been registered in wages, and the paper appears to imply that this is due in part to labour scarcity and in particular to the scarcity of skilled labour. At the same time the increase in construction activity brought about by the Plan has resulted in increased profits - which the government claims to have been substantial. Thus,

> "....it would seem that price increases on imported materials, increased labour costs and increased profits are the main factors contributing to the rise in total building costs. Insufficient data,however, does not permit us to quantify these findings."

This is a situation that is likely to be repeated in the other two countries as their Development Plans are implemented. If for various reasons capacity proves to be inelastic building costs will rise, though it must be emphasized that it would be too much to expect no increase under these conditions. Already in 1967, in

Nairobi, government agencies were claiming that the publication of the Plan so stimulated the industry as to its prospects over the Plan period that building costs registered an immediate increase. Perhaps this reaction, however, is rather promising showing that builders have taken note of future trends and, in addition to cashing in on the rise, intend to expand capacity as well. In Uganda there seems to have been very little reaction to the Plan, the prevalent attitude in the industry being one of "wait and see." The UABCEC enquiry revealed that of the 27 respondents 7 had not read the Plan (and this was very widely defined to include press reports). Of the other 20, 12 claimed to have been sufficiently awakened by the contents of the Plan to proceed to activate an increase in the size of their business.

Means of Promoting an Expansion of Capacity

Against this background it is necessary to consider the means of promoting an expansion of the construction industry. It is suggested first, however, that the Ugandan Development Plan contributes little to the need to promote a spontaneous effort on the part of the industry to expand. Basically all the Plan says is that the gross product to the industry is expected to rise by 11.3 p.a. over the period 1966-71, thus making the industry one of the fastest growing sectors of the economy. But this information service can hardly be thought to be adequate - for instance how many builders understand the concept GDP - and this being so the Plan cannot hope to meet one of its main requirements (para 3.39), that of creating confidence with industry as to the future for industrial expansion. This can be summed up as the basis of experience elsewhere.

> " If the exchange of information between various bits of the public sector is inadequate for the planning of optimum resource allocation in the governments of the less developed countries, the flow of ideas and information between the public and private sector tends to be even less so. Not that business men and civil servants are wholly out of contact with one another..... But this is not the sort of communication relevant for planning. It neither widens the horizons of the cloistered planner nor sharpens the expectations and projections of the private operators."

(1) R. Vernon E.J. March 1966.

> " If the total programme of public building can be drawn up for the next 5-8 years to avoid uneven loading, or overloading of the industry, contractors with a reasonable assurance of continuity would be encouraged both to capitalise on new plant and to retain established building teams....."

(1) Report on Building Costs, Robert Mathew, Johnson Marshall and Partners for the Government of Northern Nigeria p.7 M.O.D.

The attitude taken by the planners seems to be summed up on p. 109 of Work for Progress, where they say that the growth of the construction industry cannot be planned like that of other industries since its market derives from the projects of other sectors. This seems to be rather a surprising argument though the statement is,of course, inherently true. What appears to have been lost sight of is that probably some 70% of the projects in question will emanate from the government and that these will surely form the basis of the Plan. It must be a necessary part of the planning process to have projects programmed for implementation over the period. It is suggested that it is precisely this sort of information that is needed to sharpen the expectations of the private sector of the industry and to provide the necessary basis for achieving confidence in future market conditions. Given these projects - and it is stated in the Plan that a future portfolio does exist - it would be but a short step to prepare and publish a construction programme covering types and number of buildings, the scheduled dates for commencement of work, the approximate size and cost, technical features, location and so on. All that the present Plan gives is expenditure by agency and not by type of expenditure. Thus it is impossible to get any idea of the expenditure likely to be incurred on the building of schools, to say if builders or civil engineers or both are to encounter a boom in activity, or if a builder in Mbale can be reasonably assured of a market for the next five years. Without this sort of information it is difficult to see how the Plan can provide the industry with an assurance of its future, and without this assurance opportunities for capacity expansion are likely to be sacrificed.

To digress somewhat, this situation can probably be traced to the fact that no one institution exercises control over the government construction work. Each Ministry apparently maintains responsibility for and control over their capital development programmes. The Ministry of Works has its own defined area of concern - engineering projects, roads, and housing - and in addition accommodates the government's Architectural and Quantity Surveying sections. But this Ministry does not have all the government architects and furthermore nor does it have responsibility for all housing as the projects involving housing are contained within the expenditures of individual ministries. This leads to the incredible position that no one in government appears to know how many houses, where and when are scheduled to be built by the government over the course of the current Plan. To the extent that this is true of all construction projects it is clear that no one is in a position to

lay down a specific policy covering the government's Works Programme, to make an assessment of capacity available to schedule demand in order to keep it geared to the available capacity.

Any control over a Ministry's actions in respect of development expenditure is exercised through the Central Planning Bureau. Prior to the Bureau's investment, however, a Ministry can engage the time and energy of the government's architects to produce designs for buildings that the Ministry wished to see incorporated in the Plan. It is not until the project screening stage of the planning process that the political pressure for high cost, status type buildings can be dealt with at a political level, by which time the resource of professional men have been utilised in the design and costing of these buildings.

Against this background it is suggested that the whole question of administrative policy for the handling of construction works requires urgent consideration.

In addition to providing the appropriate environment for the expansion of existing firms the government also has open the possibility of attempting to stimulate new enterprise. This of course raises the economic question of economies of scale - is it advantageous in terms of cost per unit of output to have large plants (or rather firms) or is there no real disadvantage to look for expansion of activity from a number of new, and inevitably at the outset, small firms? As said before, it seems doubtful if there would exist any real difficulty in raising the capacity of the building sector of the industry. This is because, in addition to those firms whose activities are already recorded in official statistics there exists a large number whose activities escape the attention of the Census. These firms practice the techniques of the industry though at a variety of levels of competence, though some undoubtedly have the potential for making an important contribution given the opportunity.

In fact it is rather surprising that so much attention is devoted to the Africans who wish to take over some part of "trade and commercial" activity that has been developed by the Asian community. The building industry represents roughly the same picture of Asian dominance but Africanisation of this industry is a rarely heard demand.

The position differs in Kenya where a National Construction Company has been established with the aim of fostering the entry of African to the building industry.(1) The Kenya Plan recognises

(1) Kenya Plan p.278 para 121

practical help is required in the form of tendering and contract procedures, site organisation, building techniques, accounts and costing. In fact something of this nature has in the past been undertaken in Uganda with specific reference to training for African builders in the preparation of tenders. Though deemed to have been successful this course has not been repeated.

Apparently the Ugandan Ministry of Education has for some time been attempting to pursue a policy of encouragement to the African builders in the work they have contracted out. But they make the point that it is not enough simply to give the African builder preferential treatment - one must also be prepared to be rather more tolerant of standards of work. What is therefore required is more institutional attention to be given to achieving higher technical standards.

As with the African in trade so the African in industry may find financial difficulties acting as a severe restraint on his activities. Ineed the provision of credit to those in industry is far more restricted than it is to those in trade. As with any businessman a builder has a need not only for working capital but in addition for meeting current purchases. The builder has also to meet what is known as retention money. On the award of a contract the builder is required to deposit 10% of the contract value with the client. Work then proceeds, with the builder purchasing the necessary materials. At intervals, during the course of the contract, payments are made to the builder and when the job is finished his last interim payment is made. But then for a further period of 6 months the 10% retention money must remain deposited with the client - with no interest payment made on it - as a bond to ensure that necessary 'making good' of the building work is carried out. This practice is understandable, but it does, however, place a considerable strain on the finances of the small firm,especially where there may be delays in final settlement, and further where it is apparently impossible to get bank credit to cover this money. It appears that there is in fact very little difference between the need for and type of credit that the African trader and the African schemes are confined to trader. For example the trader can obtain credit to purchase goods from a wholesaler repaying the loan as the goods are sold. There

seems to be very little difference between this arrangement and that required by the builder for credit to cover the retention period - on the one hand the risk is that the trader will abscond with the proceeds of the sale of the goods; on the other that the builder will fail to carry out the necessary repairs. But what would be of equal value as far as the African builder is concerned would be for credit to be advanced for him to purchase materials since it is his working capital that the retention money is utilising, thus depriving him of his effectiveness in business. Thus it would seem that the government could achieve two very welcome effects by encouraging the participation of Africans in the building industry - the first is the expansion of capacity in the economy that it seems likely will be in short supply; the second the promotion of the African businessman in something other than trade and commerce. As to the expansion of capacity of civil engineering the scope for action is more restricted - and it has been suggested that the need might perhaps be greater. One thing that the government does seem intent on doing, as announced in the Plan, is to set up a National Construction Company which from its description sounds as though it is to operate as a civil engineering concern. Regarding the expansion of existing business only one suggestion has been put forward, and that is to provide them with greater information as to the scope for the industry over the next few years. Basic moves to eliminate the effects of the retention money system might increase the scope of individual firms, for the financial constraint does appear to affect severely the small firms.

Against the background of a considerable requirement in terms of expansion in order to meet the Development Plan targers, it has been seen that already by 1966 the industry appeared to be under strain to meet its work load. A distinction was made between building and civil engineering and it was suggested that it was the order where conditions were more acute and yet where expansion in the future is likely to be no less pronounced. Furthermore the problems of achieving expansion of civil engineering capacity are much greater from a technical standpoint, and also on the basis of the scale of operations of the determinants of capacity those likely to be of strategic importance in the future concern manpower - professional, supervisory and skilled. Though the skill component (i.e. craftsmen) of civil engineering work is less than that for building work, already by 1966 the major civil engineers were encountering difficulties in recruitment along with other sections of the industry. How the capacity of the civil engineering section can be expanded other than by encouraging the efficiency of existing

firms is difficult to say. However, with the building section of the industry a number of worthwhile opportunities do seem to exist, given the willingness of government to take the necessary action.

PART III

THE SUPPLY AND PRODUCTIVITY OF LABOUR

In Part II of this paper attention was drawn to the importance of the supply of skilled labour as a potential constraint to the expansion of the industry. This being so, attention is now given in this section to the supply, productivity, and training of labour.

Employment and Productivity

In Table A of Part III the labour intensity of the production process in construction was to be seen from the ratio of wage payments as a proportion of value added – 69.7% for construction as compared with 34.3% for manufacturing. In the case below, the number of African employees required to produce £1m of net output is given, which further emphasizes this point.

TABLE A

	1960	1961	1962	1963	1964	1965
Construction	7490	8043	7327	7413	6919	6873
Agriculture	997	920	1087	818	790	823
Manuf. Food Prods.	6170	6003	5949	5911	5432	4252
Misc. Manuf.	3525	3602	3469	3152	2660	2157
Trans. & Comms.	1633	1636	1545	1558	1458	1519

In Table B the African labour force in construction is expressed as a proportion of total African employees. The figure for 1966 and 1971 relate to the total labour force, but the difference between the two sets of data is not significant.

TABLE B

1960	1963	1965	1966	1971	%
12.8	12.4	13.8	10.5	11.0	

The projection to 1971 is derived from the official Uganda Plan. The significance of this figure is that it relates to one of the most labour intensive sectors of activity, exhibiting almost the fastest sectoral growth targets and yet failing to increase its share of the labour force.

The reason for this is to be seen in the anticipated relationship in 1971 between net output and labour input. The planners estimate that by 1971 48,000 men will be engaged in the industry producing a net output of £9.4m. Adjusting this data to

make it comparable with that given in Table A (i.e. eliminating the 10% revision in the output figures) some 4965 workers are anticipated to be required to produce £1m of construction net output. This is clearly a big reduction on past figures and reflects an expected increase in labour productivity and possibly the substitution of capital for labour. In the Plan, productivity is forecast to advance at the rate of 5% p.a.

To bring about an advance in productivity is a thoroughly desirable aim, except when it is achieved by the injection of capital. Thus capital is the scarce factor of production in a developing economy, and should this be questioned it might be suggested that skilled labour is the more important constraint. It must be emphasized in answer to this that capital normally substitutes more substantially for unskilled and not skilled labour.

With construction employment having declined over a period of many years it has been asked if this was due to falling output, increased productivity through managerial effort or increased labour productivity and substitution due to the injection of capital. From the data available it appears possible to reject the first of these possibilities, but it is not possible to make an objective choice between the other two.

In figure I labour required per £m of output as recorded over the eleven years 1954-65 is plotted. Two points emerge from this data: first, the relationship between the two variables is very unstable; second, a downward trend is clearly in evidence though it should be appreciated that rising prices will inevitably contribute somewhat to this. This figure leaves little doubt that factors other than falling output have accounted for the decline in the labour force employed in the construction industry.

Whether this trend can be accounted for by increased productivity through better managerial organisation, or through substitution of capital for labour, is impossible to say for certain. In this respect a comment in the Uganda Development Plan may be pertinent:

> ".....any tendency to employ machines rather than men simply because machines require less managerial effort must be resisted as economically wasteful" (para 12.8, p.146)

Indeed, such information as has been collected in connection with this research project suggests that very little managerial effort at improving labour productivity is likely to have been made.

Furthermore, this accords with current views on the question of African labour productivity; that it is that management is frequently at fault, and not labour.

Thus is has been seen that construction is, relative to other sectors of the economy, highly labour intensive but that this has declined over the course of the 1950's and 1960's. Along with hopes for rapid economic growth go the wish for greater employment opportunities in the monetary sectors, and because of the labour intensity of construction output this policy rests to a large extent on the industry. But as it has been suggested here, and will be discussed again later, the parallel quest for greater efficiency may for reasons of poor management and other external forces contribute to a decline in the employment generative powers of construction investment. Yet it should be remembered that a successful management achievement in raising labour productivity will bring the same result, however, more justifiable and economic it may appear in these circumstances.

It has been emphasized throughout this paper that the most significant likely constraint on the growth of the industry is the supply of labour. Attention has been drawn to the situation with regard to professional men, and to the necessary supervisory and craft trained men on-site. It is with the latter that we are primarily concerned here. The supply situation of craftsmen appears in fact to be a long term problem. The Worthington report, reflecting upon itself had the following to say,

> "It appears that in constructional work of all kinds there will be a serious bottleneck caused by insufficient numbers of artisans because the present system of training.....is not likely to produce the requisite number of skilled men."

(1) Worthington Report. Postcript. p. 109

Since 1960 there have been a number of developments to change this situation. The most obvious is that output in the industry has expanded, particularly over the last few years in association with the first Five Year Plan. But in addition to and as mentioned before, political factors have from time to time encouraged the departure of many Asians who at one time filled very important positions in the industry either as 'misteries' (that is supervisors) or highly skilled craftsmen. This position is reflected in the figures given in the following table.

MALE NON-AFRICAN EMPLOYEES (PRIVATE & PUBLIC)

	1958	1959	1960	1961	1962	1963	1964	1965
European	504	473	434	378	330	217	155	188
Asian	1292	1267	1037	843	804	628	596	722
	1796	1740	1471	1221	1134	845	751	910

The position in the labour market in mid 1967 appeared to be tight as far as the supply of skilled labour was concerned, but this is by no means confined to the construction industry. Throughout industry in general there appears to be a basic shortage of craftsmen as opposed to theoretically trained men who wish to occupy administrative posts. In fact the Federation of Ugandan Employers, which encompasses all branches of industry, has taken positive steps to study and deal with the problem.

(1) Uganda Argus p. 6 10th February 1967.

The way in which many contractors describe the labour market at the time of writing is that it is almost impossible to get the better type of skilled man though generally labour is still available. The prospect as output rises in accordance with the Development Plan is that skilled labour will present a very serious problem in terms of the expansion of the industry and the quality of its product.

In the UABCEC enquiry referred to earlier, the question was put to the members of the industry - what did they consider to be the greatest constraining force to the expansion of their business within the industry. Of those that answered this question only one cited a factor other than the supply of supervisory or skilled manpower. In fact this problem of labour supply was the basis of a speech by the Chairman of the UABCEC.

(1) Uganda Argus p.6 10th February 1967

The position is, of course, well understood by the government and the development planners. Thus the Minister of Labour has recently reconvened the Advisory Council on Technical Training and the Apprenticeship Committee.

> "Shortages of skills in certain categories for which it is inherently difficult to make temporary use of overseas personnel may create special problems. Such shortages are specially likely to occur in the middle range foremen, craftsmen etc.. Because of the considerable requirements of specialised skills, construction is, in particular, an industry in which such bottlenecks are likely to appear."

(1) Work for Progress para. 9

Such a situation immediately raises the question, what can be done to alleviate the position? The situation is of course not very much different from that encountered in the area of 'high level manpower' - which broadly means university and professionally qualified people.

(1) Work for Progress p.131 for a definition.

Here,however, it has proved possible to spell out the problem in far greater detail than is possible in the lower end of the labour market. In the preparation of the Plan a considerable amount of effort was put into acquiring the necessary factual information to assess the extent of the shortage of high level manpower and to evaluate its implications. Thus,

"Systematic manpower planning in Uganda needs information about:

(a) the existing stock of high level manpower

(b) the relationship between the increase of high level manpower and the growth of the economy

(c) the normal wastage due to death and retirement

(d) the amount of Ugandanisation that can be achieved"

(1) Work for Progress p. 132 para 11.7

In fact the techniques of manpower planning were used in the Plan to study the likely demands for high level manpower, the basic data outlined above being obtained. The method employed was to obtain ratios between the numbers of different types of higher level manpower employed at the time of the survey and the recorded output that they achieved. Thus given estimates of output derived from the Plan it was possible on the basis of these ratios to project the need for the various types of manpower required. The results of such an exercise are undoubtedly very suspect, but nonetheless, they are better than no information at all. Thus in the Plan the estimated requirements over the Plan period for architects, surveyors, accountants and so on will be found.

p. 134

The situation in that area of skills with which we are concerned here is very much different - the information necessary to make even crude estimates does not exist and furthermore there are reasons which prevent its collection or subsequent use. Though the problem of scarcity is as compelling at this level as at the higher level, and is so recognised in the Plan, all that the Planners can achieve is as follows.

Ratios were established between total labour employed and output achieved in some base year - presumably 1966. On the basis of these ratios and projections of the likely growth of output over the Plan period (and in addition making some allowance for changes in productivity), total employment by sector was estimated.

---

(1) In the case of this 'low level manpower' the difficult task of estimating productivity changes really appears to be a necessity. In the professional level it is at one and the same time much more difficult to define and probably of less importance.

	1962	1966		1971
Construction Employment	29,800	30,000	(i)42,000	(ii) 51,267
Construction G.D.P.		£5,500,000		£9,400,000
Employees per £m output		5454		

Estimate (i) = plan estimate of labour force in 1971 allowing for productivity change.

Estimate (ii) = estimate based on projection of same ratio of 1966 no allowance made for productivity.

The rate of growth of employment making an allowance for changes in productivity is about 7% p.a. while that of the estimate making no such allowance is of the order of 12% p.a. thus leaving productivity assumed to grow at a rate of just less than 5% p.a.

This is the sum total of the information available on the labour situation over the Plan period in the construction sector - and in fact in all sectors at this level of manpower skill. It clearly has little or no value in helping to deal with the problem of the shortage of skilled labour. There are a number of points to be raised, however, in connection with any manpower planning that might be attempted for this sector.

First, such a method of projection is very crude if only because of the instability of the ratio between labour input and output generated on which it is based.

Second, even assuming that we were able to estimate ratios that we believed to be reasonably constant the nature of the construction industry is such as to make these ratios - whether they be ratios of total employment or ratios of particular skills - highly susceptible to the composition of total output. Concerning the second of these two periods during the course of my research project an attempt to study further the skilled labour ratios of different types of building was attempted. On all sites a muster roll is kept that records a man's name,

status, and presence or absence, among other information. Clearly from these documents, given a big enough sample of projects carried out by different builders under different conditions - and of different sizes - some measure of the projection ratio could be calculated as for each major type of building. From this a much more detailed estimate of labour requirements divided by skill than is possible now could be made - assuming, as has been done elsewhere in this report that a reasonably detailed breakdown of the construction programme can be put out by government; which is after all responsible for such a large proportion of total construction demand. It is of interest to record, that although a number of contractors were willing to give access to their muster rolls, on investigation it was found that very few of these would be of any use for the purpose in mind. Many contractors are of mixed nature and no attempt is made by the contractor to keep separate records for the different parts of the contract. Thus any accurate determination of these ratios seems remote.

Third, the question what is a skilled man when referred to the building site, is most difficult to answer and it appears that it cannot be easily related to the educational system.

Fourth, some objective study of labour productivity requires to be undertaken in order that this may be treated as a variable. At present no information on the rate of improvement exists.

A skilled man is usually thought of as one who has attended some sort of the theoretical-cum-practical course in an approved Institution or who has served some recognised system of apprenticeship. In Uganda the first of these - and it is understood that generally there is little in the way of bonded apprenticeship in existence - as far as the construction industry is concerned, implies attendance at one of five Technical Schools at Mbale, Fort Portal, Kisubi, Lira and Masaka. The enrolment figures for these schools are given in the table, though it

TECHNICAL SCHOOLS - ENROLMENT

1961	1964	1966	1966 index 1961=100
620	802	900	145

should be made clear that these schools are not purely building trade schools but carry out the training of other skills in addition. Nonetheless, the output of these schools in terms of construction workers must run into some hundreds per annum. The training in these schools is full time for the award of the City and Guilds Craft Certificate - with some prospects for entry onto advanced craft certificates. (The Uganda Technical College, like Makerere University College before it, is moving

away from craft training and into fields of professional and university standard education.) It will, of course, be expected that the five trade schools should provide at least the nucleus of the skilled work force on-site, but of the small sample of construction firms questioned on this matter only one - the largest - had trade school men on its payroll at the craftsmen level, and the others implied that they had no more than a fleeting acquaintance with men so qualified. Unless a thoroughly biased picture has been presented by this cross section of the actual state of affairs, one wonders where the output of the trade schools finds employment. With the numbers involved, and in any case the level of training that they are getting it is clearly not in supervisory grades. Indeed the low rate of expansion of these trade schools has been explained by the low demand for their students.

(1) para 11.65 Work for Progress

This raises two questions - why are they not employed on-site, and just who does fill the ranks of skilled man. According to those contractors interviewed the main reason for their lack of interest in this type of labour is that they find it very difficult to handle since it is obviously so much better educated than the average worker on the site and aspires to supervisory posts. Another possible reason that must be mentioned is that to employ a man with a certificate costs more than to employ a man without one, both in terms of wage costs and total costs. This is likely to be a very pertinent factor in the whole question and will explain the 'lack of demand' referred to above. Thus, most firms do not define a skilled man in terms of a man with a certificate. Rather their recruitment policy is based on personal recommendations, that is either testimonials or on the basis of advice from the mistry, or the Labour Exchange, followed in both cases by a trial period. It appears that the industry has been faced with an elastic supply of labour which it has found convenient to define as skilled, but which in fact is composed of men who, much to their credit, have over the years, on the site, picked up the essential points of a trade and are able to get through the trial periods over which employers "examine" them. Two general points tend to bear this out.

First, the contractors were asked if in general their skilled men were competent in their whole craft or a part thereof - for example a mason is supposed to be skilled in block and bricklaying and in plastering. From their answers it would seem that very few are in fact masters of a trade. Thus it was suggested, on more than one occasion, that less than 10% of all masons were able to do anything apart from block laying.

Second, asked about employment policy particularly with regard to the 'end of contract' period nearly all of them indicated that they generally laid off all their men apart from about 10% - somewhat more in a few cases - and that this small band of men constituted the best of the craftsmen that one imagined were within the group of trained craftsmen. From what the contractors have said themselves it appears that their rather happy state of being able to freely recruit labour with a necessary minimum ofskill but no qualifications is coming to an end. In the future as demand rises it is possible that contractors will be forced into employing the trade school man and consequently paying him a satisfactory wage. In addition, training undertaken by the contractors themselves may take on more appeal Of those contractors interviewed only one had a properly bonded apprenticeship arrangement on offer. All the rest of the contractors indicated a vague sort of training arrangement for their men. At this point manpower planning will have relevance since it can be reflected back on to educational requirements. But there are clearly many questions unanswered here, and the assertions are based on a minimum of evidence. There is an obvious need for some full scale research into the whole question of skilled labour in the building industry. Apart from the points raised concerning the relation of skill to educational establishments, the other difficulties will remain and all the information as set out in connection with high level manpower on p.71 and in addition productivity measurement will be required before a picture begins to emerge of the skilled labour situation in the industry. At the present it is impossible to be any more specific than to clain that a shortage of skilled men is likely to arise over the course of the Plan period. What the magnitude of this problem is, in what particular trades it will arise, and how best it can be tackled, from the supply side, is impossible to say until more information is available.

It is worth recording here elements of the situation in Kenya. The problem is clearly recognised:

> " In many developing countries otherwise sound Plans have foundered because of the shortage of skilled manpower and a failure to take the vigorous steps necessary to alleviate the shortage." (Source: Kenya Plan pp.44)

This argument is accepted and acted upon despite the realisation, as the estimation, that though the demand for "skilled craftsmen" and "semi skilled manual" workers will rise, it will do so at less than that for what is described as high level "manpower." Nevertheless, the rate of growth in the number of"skilled craftsmen" and "semi skilled manual" workers is thought to be 4.5 and 5.3% p.a. respectively.

Given this background, Kenya appears to be prepared to meet the evolving situation.

> "...the upgrading of trade schools to secondary level, the introduction of new streams and the coordination of the programmes with apprenticeship training schemes and the Kenya Polytechnic Institute to meet the expected demand for skilled and senior skilled craftsmen."
>
> "....the expansion and also coordination of apprenticeship training programmes in private industry and the provision of more extension training schemes by the government."

But some effort had apparently been made in the past to introduce incentive schemes of one type or another by a number of the builders interviewed. The most common scheme is that of task work where at the start of the day a man is set a task which when completed means he may leave the site for the remainder of the day. This may be labelled as an "other productive activities" incentive scheme (and perhaps even leisure incentive). Whether these schemes raise productivity is open to doubt if only because they are operated on a casual day-to-day basis with no labour records to back them up.

Two other contractors indicated that they had made attempts to establish bonus schemes, based on the continual assessment of the productivity of individual worker by the mistry. The contractors expressed the view, however, that these schemes achieved very little in terms of productivity advance; that they were difficult and expensive to administer and that invariably the quality of the work suffered. Thus of those contractors interviewed, none had any form of labour incentive scheme other than the traditional work which has really little significance being the common basis for organising work. A few incentive schemes operated of the type known to European constructors, i.e. they serve to raise wages in return for higher output, while at the same time lowering unit costs. The management of such schemes is known to be very difficult and for this reason their general absence in Uganda is not surprising.

It is suggested that in any discussion of labour productivity in the building site, attention should be concentrated on the management of the labour force. Nevertheless, a great deal of work remains to be done in this field and in particular that of labour response to incentive and attitude to paid employment.

Productivity of Labour

The problem of the shortage of skilled labour can be approached not only by means to increase the supply of that labour but also to improve

the productivity of the existing stock.

The existence of the significant difference in labour performance between the industry in Uganda and Kenya, and between the construction industry in Uganda and other sectors of activity was commented upon in Section III. The relevant data is summarised in the following table.

VALUE ADDED PER EMPLOYEE

Construction Sector	Kenya	1963	£310.2 (2)
	Uganda	1964	£173.8(1) (3)
Processing Sector	Uganda	1964	£209.4 (3)
Manufacturing Sector	Uganda	1964	£631.5 (3)

(1) Value Added defined to include rent
(2) Kenya Survey of Industrial Production
(3) Uganda Survey of Industrial Production

The most valid comparison to adopt from the same table is that between the construction sectors in Kenya and Uganda, if only because differences in capital intensity of production will be minimised in this comparison. But when comparison is made with other industrial sectors conclusions are difficult to substantiate since capital per employee - but also, probably managerial performance - is undoubtedly widely different.

Employees in the construction sector are of course, very willing to confirm the apparent poor labour performance, though no reason for this, of any substance, can be given. It is interesting that most contractors distinguish between the good work performance of Kenyans and the Bakiga from South West Uganda compared to the rest of their Ugandan labour force. This is interesting since the two groups have the common characteristic that they are likely to have been displaced from the land, and thus have to rely on wage employment for a living. But for the majority of the Ugandan labour force this may not be true; wage employment might be considered by them as a source of 'pocket money' simply additional to a subsistence earned from the land. The validity of this argument tends to be borne out by the apparent difficulties associated with getting men to work overtime and the nature of the system of most incentive that predominates in the industry, which is discussed more fully in the following section.

A major obstacle to productivity improvement concerns the nature of the skilled men employed on site. Should the assertions contained in the previous section as to the definition of skill be correct then low productivity, poor quality workmanship and restricted opportunities for raising these skills are natural concomitants.

But quality of management is at least as important as the quality of the labour force in the determination of productivity, and as a reversal from an earlier position that inevitably stressed the 'uselessness' of African labour for monetary employment, the management of that labour has of late come in for extensive criticism.(1) In the case of Uganda

(1) R. Green: Wage Levels, Employment, Productivity and Consumption EDRP 109

P. Kilby: African Labour Productivity reconsidered Economic Journal June 1961

(and East Africa) the situation is somewhat understandable since supervisory skills are known to be in short supply, and furthermore, the supervisions are mainly of an alien group - i.e. Asian whose effectiveness post-independence, has possibly been reduced.

In the group of contractors questioned about the labour situation the problem of productivity dominated the discussion. But it was evident that action undertaken by management to correct the situation has been negligible. Of those interviewed only one contractor kept labour records additional to the muster roll. This means that only one contractor had more than a vague notion of the productivity of his labour force at any given time and under different circumstances. Without this basic data little or no positive action can be embarked upon to increase productivity with any likelihood of success.

One of the methods of achieving the objective of raising labour productivity is through the exploitation of the 'learning effect' derived from the repetition of an operation. The implementation of this innovation, however, is likely to have considerable multiplier effects such as to raise effeciency over and above that attributable to repetition, since the conditions to be met include strict control over the labour input, the preplanning and scheduling of work and the introduction to the wage structure of a system of incentive payments.

It was hoped to present results of research into the existence of a 'learning effect' on a building site in Uganda. In April 1966, an agreement was reached with the National Housing corporation and the then Ministry of Housing and Labour, to conduct an experiment in repetitive building on a National Housing Corporation site at Entebbe. The contract at Entebbe was for five houses and from what will be said below it is clear that a run of five is almost a contradiction in terms of repetition. Nevertheless, the purpose of this project was to demonstrate the existence of a 'learning effect' and to tackle some of the problems which would arise when, as it was hoped, a larger site could be dealt with. As it was, the

multiplier effects quickly showed themselves in that the National Housing Corporation had to design a form to record man hours per operation - something which apperently was not standard practice hitherto.

Unfortunately, the experiment was a failure, and after three months full time on the site, the project had to be abandoned with nothing achieved. Nevertheless, the project did succeed in arousing a considerable amount of interest in the application of repetitive building techniques. In working papers being prepared in the Ministry of Works, Communications and Housing, the importance of the potential of the 'repetitive effect' is being cited as a reason for the need to create a coherent and programmed housing policy. Furthermore, the National Housing Corporation claims to have attempted to apply the method on an army barracks contract at Mbarara with 'most encouraging results'. Unfortunately, they have not kept records of operation man hours on this site!

In these circumstances it is perhaps opportune to outline the basis of repetition its implementation, and the problems likely to be encountered in its application. It is of interest that the implementation of repetitive building is being widely investigated in Europe, where similar problems of expanding output with shortages of skilled manpower exist. Its application in Developing countries is an example of a 'modern' innovation that does not require the input of capital to raise productivity. (i)

Two categories of repetitive building may be distinguished: repetition within the building materials factory and repetition on-site. Both these aspects of repetition have been documented by the U.N. Economic Commission for Europe.(ii) Here, however, attention is devoted to 'on-site' repetition, or to quote the terms of reference of the Economic Commission for Europe study, to assess

> " the influence on labour productivity and building costs of the scale of production and the degree of repetition of operations carried out on-site" (iii)

The best documented aspect of the learning process is that already referred to between labour and the volume of output. By repeating an operation time and again, an operative gains in what may be termed

---

(i) See Green, R. Wage Levels, Employment, Productivity and Consumption. EORP 109

(ii) Cost, Repetition, Maintenance - Related Aspects of Building Prices. E.C.E. ST/ECE/HOU/7; Effect of Repetition on Building Operation and Processes On-Site. E.C.E. ST/ECE/HOU/14.

(iii) Ibid. p.2

'technical knowledge' and reduces the time taken to complete an operation. Thus repetitive building means a longer run in the production of a homogeneous product and specialisation by the labour force. As the labour force becomes more knowledgeable and skilled, it has been found that wastage of materials decreases, and so gives rise to another aspect of the volume-cost relationship.

The third source of this relationship is concerned with complexities in the production process; the complexities of work organisation, work methods, tool and gang co-ordination, organisation of the work place and solution of engineering problems, within a given technique of production. These problems arise and can only be solved after management has acquired technical knowledge of the production process as a result of experience of operation.

Finally, as volume increases and jobs are repeated, tools used by workers undergo adaptation and improvement, increasing their efficiency.

Only the first and third of these are explicitly treated here: the two clearly associated in that the contribution of indirect labour manifests itself in the labour input per unit of output. (i) The second aspect of the volume cost relationship is omitted since it is in any case a direct function of the rate of learning, and because it is felt that any saving will be a small proportion of the total materials cost of a building. (ii) The final factor is ignored since it would seem from empirical work to make only a small contribution to the overall learning effect, and furthermore, it is perhaps inappropriate to talk of the introduction of sophisticated hand tools into the Ugandan building industry.

The conditions of work organisation necessary to achieve a 'learning effect' are quite obvious, but nevertheless rarely met in building. As indicated they are, specialisation by operatives on particular operations and longer runs in the production of a homogenous product.

A peculiar feature of the building industry is that specialisation is craft based, and far from meeting the requirements of the 'learning effect' it often detracts from it. This can be seen at two levels.

(i) This statement is true only in terms of labour intensive technology, and should not be taken to mean that an independent management learning process does not exist in a capital intensive technology. The latter is referred to as 'debugging', which is dealt with at length in Baloff, N. The Learning Curve. J.I.E. July 1966.

(ii) Bulk purchase discounts could be considered here.

First, within any [illegible] distinct operations that its members may be required to carry out. For example, in East Africa, a mason is considered trained to erect brick and block work and to execute the plastering of walls. Second, even if specialisation is operation based, some operations on a building site are so complex as to warrant sub-division if a maximum 'learning effect' is to be achieved. A good example of this is bricklaying in Europe, which is carried out by operatives trained in little else. But so complex is the [illegible] structure of most buildings that considerable savings from the 'learning effect' have been recorded following the breakdown of this operation into parts.

Basic to the 'learning effect' is specialisation on a single job repeated over and over again, with no interruption. However, a haphazard allocation of labour was the norm on the Entebbe site, and it was a failure to break this practice that ruined the experiment. Specialisation beyond that enforced by a man's training appears to be completely alien. The problems of planning work such that continuity could be maintained by each work gang were [illegible].

In addition, operational discontinuities must also be avoided. The effect of the lack of sufficient managerial control over the production process has received similar study in the E.D.I. report. Where discontinuities arise, they are followed by an increase in labour input, which represents wasted labour. The conditions to be met include an adequate and continuous supply of materials on site, maintenance of operation form, maintenance of gang composition, avoidance of breaks in a supply of services to the site, and so on. None of these conditions was met on the Entebbe site.

Length of run is generally not determined by the building firm, and in fact the market displays features which militate against long runs. The most relevant of these in Uganda seems to be the failure of the public sector to co-ordinate and programme its building work. The experience of the National Housing Corporation is that housing is often treated as a residual item, undertaken in haste and without co-ordination, if surplus funds exist at the end of the financial year. This is further reflected in the lack of a housing programme, or policy, associated with the current Development Plan. Given these conditions, it is hardly surprising that building is haphazard, contracts generally small and therefore length of run small. The cost of this lack of programming is only in part the opportunities forgone of cost reduction through repetition.

Clearly, there is considerable scope for the modification of the 'traditional' building process, both with regard to the conditions for repetition and efficiency in general. With regard to the former, it is as well to remember that the building industry differes from industry in general in several important effects: The required continuity and co-ordination of work gangs is more difficult to achieve in the building industry; sites are mobile and display peculiar characteristics of their own; it is the operatives and not the work who must be made to 'flow'; and sites display primitive conditions for work being subject to restricted movement and external influences.

So far attention has been devoted to labour hour reduction, but the important variable is, of course, labour cost. First something must be said about the likely scale of saving in labour input. In industry generally, an 80% relation can perhaps be taken as the norm, which means in the literature on repetition on doubling the number of units produced the average labour input declines by 20%. This would mean a reduction of the average labour input to 50% after nine repetitions. The E.C.E. has suggested that as a result of the factors discussed at the end of the previous section, the norm in the building industry is likely to be somewhat lower. They have in fact found the relation, in a limited range of studies, to lie between 87% and 92%. In considering the situation in Uganda, there are a number of reasons for thinking that the likely improvement will be greater than this.

Plainly levels of productivity in the industry in Uganda are generally recognised to be very low, and the degree of management is probably a contributory factor to this in that little or no control is exercised over the labour input. (i) The introduction of a repetitive system will in itself, and through the multiplier effects, probably lead to quite significant advances in labour productivity. Furthermore, recent analysis of African labour productivity has switched attention away from the quality of the individual to the quality of management. What is more significant is that two sources have cited the aptitude of African workers for repetitive work.(ii)

Cost savings can be grouped under two headings: decreases in operational costs due to the more efficient execution of the work manifest in increased productivity and; indirect cost saving resulting from a reduction in construction time. The influence of improved productivity on building costs depends primarily on the system of remuneration employed. If the hourly or daily system is used then any gain in productivity would be reflected in building costs. But under this system of payment there is no incentive for the operatives to take advantage of their increased

---

(i) This is a general impression, though quite accurate with regard to the N.H.C.

(ii) Kilby,P.African Labour Productivity Reconsidered.E.J.June,1961. Conclusions and Recommendations of the Uganda International Seminar on the levels of Productivity.

facility at the job and raise output. If a piece rate system is employed, then direct saving in labour costs will be small, while indirect savings are likely to be substantial.

With regard to the piece rate system, it may be argued that the indirect cost saving in Uganda is likely to be small since these costs will assume a smaller proportion of total costs than in Europe. To judge on this matter a cost breakdown would be required, and it would be very interesting to know what proportion of indirect costs to total costs is for an organisation such as the National Housing Corporation.

Between the hourly and piece rate system there are incentive schemes where the effect on labour costs depend on the ratio between the incentive that has to be offered and a given increase in the level of productivity. In a European 'high wage' economy, it is likely that the incentive offered - via the target rate set, and the proportion of time saved paid to the operative will be higher than required in a 'low wage' economy. This is based on the assumption that operatives judge the fruits of their extra efforts in terms of the proportional addition to the basic wage. (i) Assuming that a monetary system of incentives will operate on a full working day, then this system of incentives involves the replacement of that at present generally operated - a leisure incentive system. The greater the returns that can be earned from productive leisure time activities, the more incentive is likely to be required under this system.

But if leisure productive activities are so remunerative, then it should be possible to operate a leisure incentive system, with a progressive raising of the daily target set, in accordance with the slope of the progress curve. Under this system, the benefits of repetition will be reflected in wage costs.

Thus there are grounds for thinking that the savings in labour costs arising from the introduction of a repetitive system of building will be greater than those recorded in Europe. But very little information exists as to the effect on building costs. In Czechoslavakia, an 18% reduction in average costs per unit was recorded as a result of lengthening the production run from 125 to 2250. In the Netherlands, a saving per unit of 20% resulted over the range 74 to 432, with another 3% if extended to 1,152. It would be more useful however if this information were given over the whole range of output, from unit one. (ii).

(i) Steps in the marginal tax rate will also affect this, again operating in Uganda's favour.

(ii) E.C.E. op. cit. p.86

Conclusions:

This section has attempted to introduce the basic ideas of the learning curve, its potential for a Ugandan situation, and some of the problems that its application would raise. As such it reads more like a research outline than the conclusion to a piece of research. Nevertheless some very impressive reductions in cost have been recorded as a result of the application of this idea. For this reason, and because of the situation confronting the industry in Uganda as outlined earlier in the paper, it would seem to be a worthwhile exercise to attempt to apply the idea here. Moreover while it is what might be described as a modern innovation, it fits into the restrictions placed upon innovations by this type of economy. The repetitive process brings about increases in labour productivity without the injection of capital though it is likely that the capital labour ratio per unit of output will rise, but as a consequence of a more efficient use of labour. In addition, to the extent that capital is better utilised under a repetitive system, a fall in the capital-output ratio may be experienced.

Clearly the introduction of repetitive building requires changes on-site and in the organisation of demand. With regard to the latter, many changes are long overdue. Responsibility for housing requires to be centralised, and the total of this housing commitment fitted into a programmed housing policy over the plan period. At present housing sites are generally small, as that at Entebbe. The implication of this for cost saving from repetition are obvious, but what is perhaps as important is that this form of building inflates the cost of providing basic services to the units. (i) Finally, the repetitive effect in the materials section of the industry should not be ignored. The manager of a small Joinery works in Kampala has complained of the practice of designing buildings with a whole range of door sizes. This practice only serves to raise the cost of building with apparently little or no advantage to the eventual occupier.

(i) Baloff. op. cit. p.282

(ii) See Danielson, L. Survey of Public Housing Development for Low Income Groups in the Region, for a discussion of these problems.

PART IV

BUILDING MATERIALS AND FORECASTING

In this section attention is turned to the question of bottlenecks that might arise from shortages of building materials and thus impede the fulfillment of the Development Plan targets. While there are no particular reasons for believing that such shortages will arise it is clear that the materials industry will be under at least the same requirement for growth as the construction sector itself.

For a fuller understanding of the likely future course of events it would be necessary to have a great deal of information, at present not available, on the relation between total construction demand and the demand for individual items of building materials. Part of this research project has sought to investigate one line of construction planning that might help to achieve this. The aim of the research was to provide a means for forecasting the effects of any planned expansion in construction activity on the materials industry. A number of applications for any such forecasting methods can be suggested:

- to facilitate future development planning by making possible an analysis of the required expansion in building materials production consequent on a planned expansion in construction activity,
- to make available market information to facilitate investment decisions in this field of activity,
- and to facilitate the work of those whose responsibility it is to order supplies of materials to carry out a programme of building work and in so doing prevent costly delays on-site.

From what has been said the implication is that a proportionate increase in the demand for all building materials cannot be forecast on the basis of an anticipated expansion in construction demand. There are two reasons for asserting this. First, in the context of the Development Plan where considerable import substitution is assumed the incidence of this substitution will inevitably vary, making greater demands on the productive facilities of the home industry in respect of certain materials than for others. Second, it is suggested that the relation between input and output will depend, to a large degree, on the product composition (schools, house etc.) of that output. For example, an expansion of the construction of office blocks will make much greater demands on the cement industry than an equal increase in the construction of houses.

It is with the second of these two factors that insight was sought in research project. In putting forward this hypothesis of the variability of input coefficients, criticism is made of conventional

input - output analysis which tends to treat the output of the construction industry as homogeneous. In so doing it is suggested that input - output analysis will lead to erroneous results, due to the instability of the input coefficients arising from changes in the pattern of demand. It may well be, however, that such differences, as among various type of building, are not great in that these differences tend to cancel one another out when considered in the aggregate. But this view has not apparently been subjected to analysis, and thus the conventional means of approach - the basis of which is to be seen in the Survey of Industrial Production where material input are analysed in relation to the total output of the industry - must remain suspect.

Furthermore, the Survey of Industrial Production in providing a cost breakdown of construction output determined the value of 7 fuel and 14 material inputs. In so far as there is no large residual item the information concerning fuels appears to be quite satisfactory, but the same cannot be said of materials analysis. In 1964 total materials purchases amounted to £1.5m., but the value of those unspecified in the Survey equalled £0.7m. as 47% of the total.

Thus two factors, plus the overall needed for some forecasting framework for building material requirements, determined the nature of the research undertaken:

- first, that stability of the input coefficients could be achieved only by analysing material demands on the basis of different types of building,
- second, that by adopting an alternative approach to the problem, a wider coverage of total material requirements might be secured as compared to the results of the Survey of Industrial Production.

It is worth noting here the experience of research workers in Zambia, where, quite independently of this project, work on very similar lines has been pursued by the Office of National Development and Planning. A detailed and very comprehensive analysis was made of the materials and labour requirements of the Development Plan and in particular the building programme. The materials requirements of the building programme was provided in total, and for private and public demand separately, and analysed by the demand arising in the various provinces of the country.

The data was provided from the analysis of 100 bills of quantity which served to establish average input coefficients for the various classes of building. Thus these 100 bills were considered to relate to what must be described as "typical buildings" within their subgroups.

This analysis provided input coefficients for 106 materials, specified in value and volume terms.

Within the 'Building Programme' details of the number of various type of buildings it was envisaged would be built, were available; this information was available in detailed project form for the public sector, and estimates were made of private sector demand. Translating this demand into reliable input coefficients was relatively straight forward, since it is understood that designs are standardised upon in Zambia to a degree unknown in Uganda. Thus the input coefficient derived from the sample of 100 "typical buildings" could be employed directly. As a result the Zambian authorities published a very detailed forecast of the demand for building materials over the years 1966-67. Whilst the time period was short - a forecast of at the most eighteen months - and thus the conditions of the 'model' unusually good from the standpoint of the determination of the details of product demand, what is particularly interesting is the methodology, based as it was on an analysis of the bill of quantity.

In Uganda the situation is rather more complicated than that described in Zambia. First, and as already stressed in the chapter on labour, no building programme as such has been published in Uganda in conjunction with the Development Plan so that it is impossible to detail the various types of building, the construction of which might be contemplated in the future. There is no way around this particular difficulty, and if one is to argue that as the basis for forecasting the demand for building materials should be a product division of total building work then some attempt, however, rough must be found for forecasting the demand for various building types.

The second difference from the situation in Zambia is rather fundamental and this has an important bearing on the forecasting model finally evolved. Whereas it is understood that in Zambia a comprehensive scheme of standardised designs for building types is actively implemented the same cannot be said to hold true in Uganda. Though standardised designs do exist, they have not found wide acceptance and thus are only rarely employed. Apart from the relevance that this has to the research project being discussed in this section it has for wider implications in terms of the building costs and the minimisation of the scarce input, architectural services. Moreover, the absence of standardised design usage puts a severe barrier in the way of adopting the same type of forecasting model as was employed in Zambia.

It was against this background that a method of forecasting the demand for building materials had to be derived. The starting point, as

in Zambia, was the Bill of Quantity. This document, one of which exists for virtually all but the smallest buildings, provides a complete inventory of all the materials required for the particular building to which it relates. But so comprehensive is this doecument that the data extraction problem, at least for the purpose being considered here, is considerable. To start with the Bill of Quantity specifies all material requirements stopping just short of individual nails and screws. But in addition to this, the way in which the bill is laid out is geared to actual building operations, rather than materials content. This means that hundred of items of the following type,

"Lay a 4" screed 80 feet by 13 feet,
using a 1:3:4 cement, sand, stone mixture",

have to be translated into their content. This represents a considerable clerical task, as well as demanding some familiarity with the concepts of building and the Quantity Surveyors' jargon. However, having undertaken this work, an accurate description of the materials inputs required has been obtained. In Zambia these 'administrative' problems were overcome by employing a Quantity Surveyor to translate the 100 bills of quantity that were used there.

The inventory obtained is of course, in physical units - tons of cement, gallons of paint and so on. No disadvantages of this were considered to arise; indeed it was felt that this had at least two advantages. First the essential forecast would be in units which related to the units in which the productive capacity of the various sections of the building Materials Industry is measured. This is of importance in itself and also as a direct result of the fact that forecasts and money terms would be difficult to handle in the absence of an index of building material costs.

In the absence of standardised designs a forecasting model had to be derived taking account of what,at the outset at least,appeared to be the key determining variable of materials demand - size of building and design. That materials input depend on size of building was clear enough, but the extent to which this relationship is disturbed by difference in design as among buildings - as well as evolutions in design over time - was not so clear cut.

The need to consider these two variables suggested the general method of forecasting to be investigated. By exploring the relationship between materials input and size of building through a regression analysis the influence of design would, if of significance, be highlighted in the initial plotting of scatter diagrams. Variations in design over time were in fact considered due simply to the necessity of including a

number of 'old' (in terms of years) bills to raise the sample size.

In choosing to use the regression method it must be admitted that the extent of a difficulty already discussed would in any future application of the method be compounded. The use of this method to forecast demand for building materials depends not only on the provision of data as demand by product type but in addition this must be broken down into the unit of the independent variable - size of building. This is a major criticism of the method discussed here, but to offset this the method does have important advantages over that employed in Zambia. It is more sensitive to the variety that must inevitably exist in demand, however, standardised, and thus more accurate. Moreover the likely accuracy of forecasts can be given some statistical basis, and non-linearities in the relation of input to size explicitly handled.

The result of the analysis that becomes immediately apparent were first that in general it can be said that design has no influence on materials input either over time or at a point in time. This conclusion is derived in relation to generalised design differences and not major design features such as the use of a wooden in place of a concrete floor. These major differences can be quite easily handled by making an explicit specification of these alterations and calculating the necessary relationships to be applied when these instances arise. It is interesting to note, however, that two bills in the sample did prove troublesome to a minor degree, and that these were the only examples of the work of one architect.*

---

* However, some evidence of heterogeneity was found, for the larger the building the greater the scope available for design variations. The extent of this, however, was not considered sufficient to disturb the nature of the relationships quantified for forecasting purposes.

These general conclusions as to the validity of the method employed are drawn in relation to an investigation of a smaple of Bills of Quantity, numbering 33, relating to houses. No particular reason exists for having chosen houses as the basis of the investigation - indeed it had been anticipated at the outset, and before the data interpretation problems had been encountered, that a variety of buildings would be dealt with. However, Bills of Quantity relating to houses were readily available from a variety of sources (both Kenya and Uganda) and over a long time period - up to 12 years and it was hoped that this work would have important links with that done on labour input into housing.

In the case of housing the size variable, that is the independent variable, was specified in terms of square footage of area. For other buildings more appropriate measure of size might exist - as for example number of beds in a hospital, or the number of children for a school.

Given the size of each house through the forecasting model it was intended to derive a basis for estimating the required materials inputs. The nature of the model was implicitly determined since with only one independent varaible - the size of the house - and a minimum of dependent variables the model had to take the form of the devise of a simple regression equation, one for input considered.

As a result of the data collection phase some 15 variables were isolated, virtually the number as in the Survey of Industrial Production. Furthermore, the list of variables from the two sources are very similar, though while the survey includes the important electrical items which do not lend themselves to the type of analysis employed here, it omits other potentially important materials fron an 'economic' viewpoint, such as glass and metal tubes. Furthermore, the omission for the list of variables includes many sanitary fittings - along with such items as galvanised tanks etc. This is not important since most houses simply have one unit of each item irrespective of their size. It will also be noted that the Surveys' list includes such relatively unimportant items as bricks and burnt clay tiles. While it cannot be precisely quantified it is suggested that this list of 15 materials input given below, plus the ability to specify "one-off" materials, will cover quite a large proportion of total material input.

TABLE I

VARIABLES ISOLATED

X1	Size (Square feet)	X13	Glass (square feet)
X2	Structural Concrete (c.f.)	X14	Bituminous Felt (square feet)
X3	Cement (tons	X15	Paint (gallons)
X4	Sand (tons)	X16	Roof Sheets (square feet)
X5	Stone (tons)	X17	Timber (based feet)
X6	Wall Mortar (cubic feet)	X18	Reinforcing Fabric (sq.feet)
X7	Cement (tons)	X19	Reinforcing Rods (pounds)
X8	Sand (tons)	X20	Ceiling Board (square feet)
X9	Cement Blocks (number)	X21	Roof Timbers (board feet)
X10	Mortar Plaster (cubic yards)	X22	Block Board (square feet)
X11	Cement (tons)	X23	Metal Tubes (linear feet)
X12	Sand (tons)		

These 15 variable, as 22 varaible forms as listed above, were related to the size of the 33 houses considered. The sample covered a wide range of house types, from servant quarters to very large residential buildings over a square footage range of 435 square feet to 2178 square feet.

From the list of variables it will be noted that difficulties are likely to be encountered with major design alternatives. In none of the

Bills considered were wooden floors encountered, but should they become more common as an alternative to the concrete floor, then separate provision for the materials input of this item would have to be made. In the case of roof covering, tiles are likely to be as frequently encountered as roof sheets - the way this was handled was to take roof area as the dependent variable, from which it is but a short step to convert into numbers of tiles required as an area of roof sheets. In the list variable roof timbers are specified as a separate variable since quite frequently metal supports are employed in place of wooden trusses. To deal with this alternative the variable for roof timbers would need to be omitted and a relationship between pounds weight of steel trusses and size of house substituted for it.

Thus given this background the 22 variable forms, to give 15 distinct materials inputs, were regressed on the size of house. As a basis for estimating materials inputs the results, as seen from table II, were good, in every case the 'b' coefficient being significant at the 1% level of significance, and the coefficient of correlation high. The only exception to this concerns the value for fabric and rod reinforcement. The inputs of these variables are only to a very limited extent related to the size of house, and in addition they are related to each other to only a small degree. An explanation for this apparently random use of reinforcement was sought. It was suggested that while architectural practice did indeed vary widely the important determining variable - if it may be so termed - is the nature of the site, and in particular the stability of the soil. This clearly has nothing to do with size of house. In addition it apparently has no association with any other of the 20 variable forms that were studied since a 'step-wise' regression procedure was investigated but with no improvement in the relationship originally recorded. The basis of this method is to select another dependent variable which is highly related to both the independent variable and the 'problem dependent variable', and by establishing the relationship between the dependents variable to determine indirectly, or stepwise, a basis for estimating the 'problem dependent variable'.

It should be mentioned that the number of observations varies since some inputs were absent from certain of the buildings in the sample, and where the reason for this was obviously not related to size, it was felt to be more meaningful to exclude this zero observation than to have it influence the relationship.

TABLE II

Xa	Xs	Regression Equation	N	rab	(£ @ 0.005) calculated	
					1%	£
X1	X2	X2 = -20.07 + 0.741	33	.94	2.75	15.24
X1	X3	X3 = - 0.27 + 0.005	33	.93	2.75	14.55
X1	X4	X4 = - 0.45 + 0.016	33	.94	2.75	14.87
X1	X5	X5 = - 1.20 + 0.027	33	.94	2.75	14.69
X1	X6	X6 = - 3.87 + 0.137	33	.94	2.75	15.27
X1	X7	X7 = - 0.01 + 0.001	33	.92	2.75	13.21
X1	X8	X8 = - 0.18 + 0.006	33	.93	2.75	14.55
X1	X9	X9 = +241.87+ 1.999	33	.95	2.75	17.46
X1	X10	X10= + 0.32 + 0.011	33	.88	2.75	10.37
X1	X11	X11= + 0.10 + 0.003	33	.88	2.75	10.17
X1	X12	X12= + 0.14 + 0.014	33	.88	2.75	10.34
X1	X13	X13= -42.08 + 0.171	33	.90	2.75	11.81
X1	X14	X14= - 7.68 + 0.170	33	.91	2.75	11.90
X1	X15	X15= - 3.66 + 0.032	33	.92	2.75	13.43
X1	X16	X16= +62.69 + 1.458	33	.94	2.75	15.95
X1	X17	X17= -120.28+ 1.071	33	.88	2.75	10.55
X1	X18	X18= -168.37+ 0.295	33	.64	2.75	4.63
X1	X19	X19= - 3.12 + 0.397	33	.49	2.75	3.09
X1	X20	X20= +21.77 + 0.855	28	.97	2.78	19.30
X1	X21	X21= -429.53+ 1.947	25	.89	2.81	9.41
X1	X22	X22= -49.06 + 0.491	26	.86	2.80	8.13
X1	X23	X23= - 9.41 + 0.205	23	.83	2.83	6.85

Having described the method of forecasting that was studied in detail and indicated its potential as an estimating tool, it must be frankly admitted that in the context of 'development planning' this model is altogether too academic, though the method has been found in the case of housing to be straight forward in its application. To be used in practice it would require data that is plainly not at present available today in Uganda. Indeed it is questionable whether it is even easily available in the most sophisticated Economies. However, it may be that in discussing housing and its square foot area from the viewpoint of the availability of forecasts of demand giving this degree of detail this criticism may be overstated. It appears more reasonable to expect a Development Plan to provide forecasts over a five year period of the number of large, medium and small sized schools to be built - and the same might be said for hospitals (number of beds).

But this leads to another difficulty which it has not been possible to investigate. This concerns the applicability of such an approach to other building type - shops, offices, factories and so on. This question

is whether these buildings lend themselves to such a generalised approach as whether basic design feature and methods of construction are likely to vary so fundamentally as to impede any form of averaging. In addition, it must be asked how many building type can be identified from the total of building demand. It was considered for example that difficulties might be found in some way grouping industrial buildings on the grounds that apparently a tremendous variety of such buildings exist. This difficulty was, however, minimised by Quantity Surveyors consulted who suggested that such industrial buildings, apart from breweries, currently being erected in Uganda conform to a fairly standard type of construction.

CONCLUSIONS

The considerable expansion required of the construction industry in East Africa has provided the theme of this monography which has dealt mainly with the problem as it affects Uganda. It was pointed out that in Uganda, following a distinct upturn in construction activity over the course of 1964 and 1965, signs of strain were already becoming apparent in the industry. This strain had two important characteristics; first, it appeared at that time to be affecting mainly the civil engineering side of the industry that part it was suggested an expansion of which would be the most difficult to achieve. Second, while the problems of the civil engineering sector derived mainly from the fact that there are so few firms in this field the overriding general problem derived from an increasing shortage of skilled manpower . The implications of the failure to increase the capacity of the Construction Industry are clearly enough putting in jeopardy the success of the whole Development Plan.

It was therefore suggested that there are a number of ways in which the government might act to increase the capacity of the industry. By drawing on that stock of management and labour which was currently involved in economic activity and by increasing the capacity of existing firms to take a more active part in development efforts. However, scope for expansion will remain limited while it is constrained by a shortage of cash and the fundamental input of skilled labour.

Efforts to deal with this problem requires a full understanding of the employment of skill within the Building and Construction Industry. It was demonstrated that no basis at present exists for forecasting the likely further demand for various types of skills. But it was suggested that a problem existed in terms of our definition of a skilled man with obvious implications for any future efforts to overcome the problem of skill shortage. Given that men at present trained to fulfil the role of skilled craftsmen on a site do not appear to be actively engaged in physical labour some fundamental rethinking of the problem of craftsmen training would appear to be essential. This could be directed at two levels, first by changing the system of formalised education in craft skills such as to provide practical training for basically uneducated men, and second, by encouraging more effort at training labour by the firms in the industry. The first of these suggestions would be such as to avoid the apparent pitfall of the present system, where in the environment of the labour market as it exists today, men are being overtrained for their designated role - and in fact apparently often never fill it.

In the meantime considerable scope undoubtedly also exists for increasing the supply of skill by making existing craftsmen more productive. Here again a positive government lead is required. Apart from more formalised and admittedly additional schemes such as that described under the heading of 'repetitive building' there is a great deal of scope for some formalised scheme of productivity improvement to be undertaken among existing builders. At the very least the government could seek to act through example since it seems quite incredible that the public sector should employ some 20,000 men, twice as many as the private sector, mainly on maintenance work. However, in the view of the author, what should be avoided in the public and private spheres, is the attraction of improving labour performance by capital. Its injection serves to save mainly on unskilled rather than skilled labour, and hence contribute little to a solution of the problem, and in terms of the many other opportunities that exist for improvement it is very expensive.

EMPLOYMENT

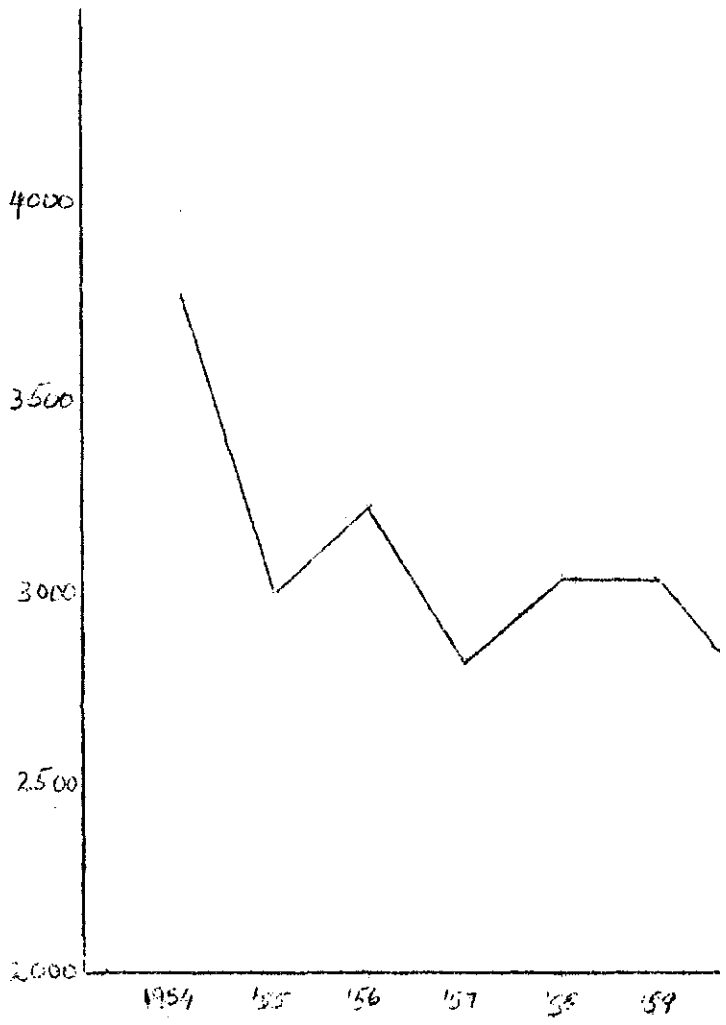


FIGURE I

NUMBER OF EMPLOYEES REQUIRED PER
MILLION £ OF TOTAL OUTPUT

NOS. EMPLOYED – ENUMERATION OF EMPLOYEES

OUTPUT – CONSTRUCTION INVESTMENT FIGURES – CURRENT PRICES – IN G.C.F.

1954 – 59 P. CLARK DATA

1959 – 65 REVISED G.F.C.F. FIGURES FROM 1966 "STATISTICAL ABSTRACT"

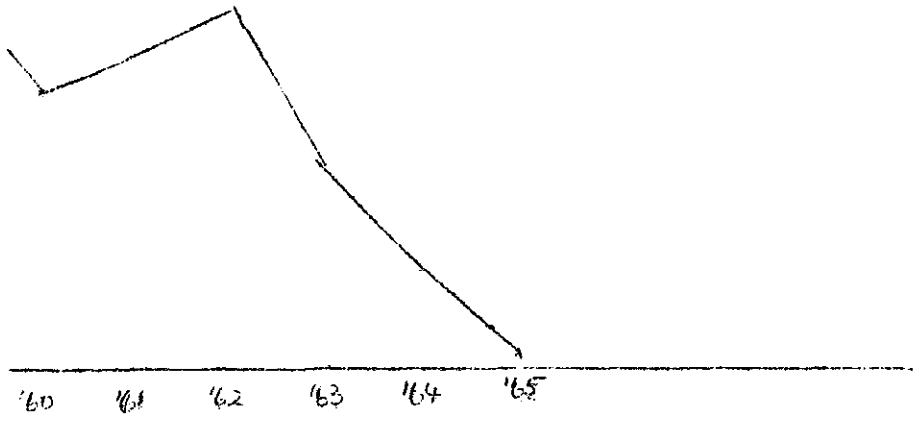
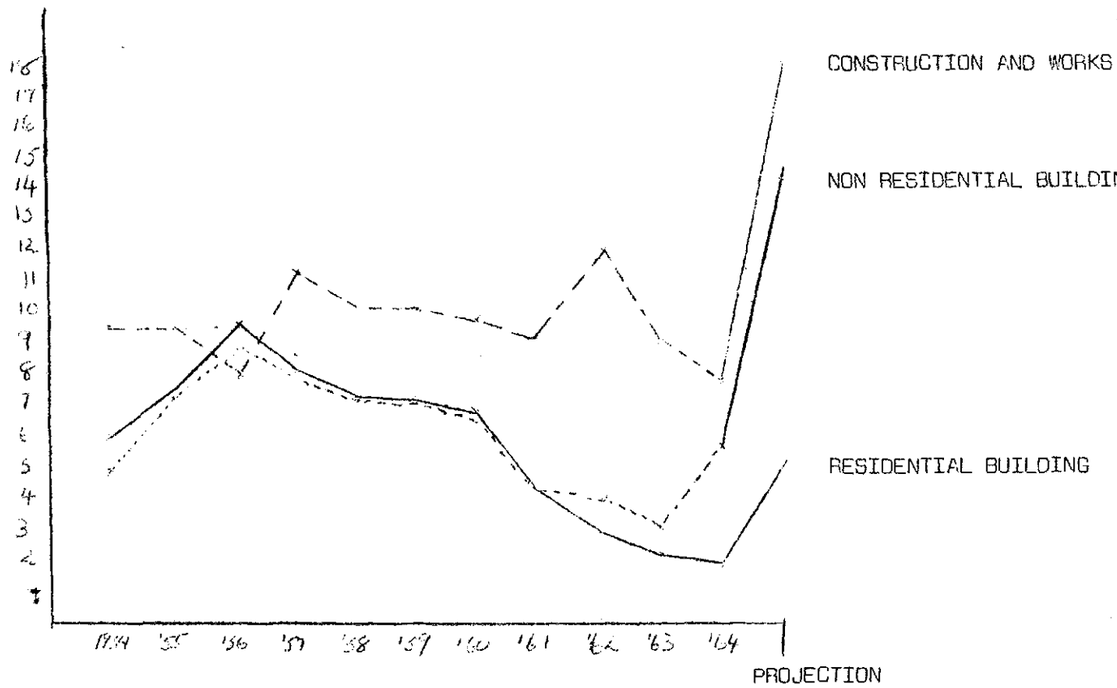


FIGURE II



KENYA: BREAKDOWN OF BUILDING ACTIVITY. CURRENT PRICES UNTIL 1964 - PROJECTION, IN 1964 PRICES, FOR PLAN PERIOD 1966-70 ANNUAL AVERAGE

APPENDIX TABLE I.

A. MAJOR ECONOMIC INDICATORS AND THE CONSTRUCTION SECTOR

		1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
1) GROSS DOMESTIC PRODUCT(FACTOR COST)													
(a) Construction	£000	3926	4343	5356	3912	4191	3833	3899	3550	3908	3483	3482	4594
(b) Monetary Economy	£000	92760	101990	102778	109375	105931	107982	110815	111170	107928	128597	140788	150820
(c) As a % of (b)	%	4.2	4.3	5.2	3.6	4.0	3.5	3.5	3.2	3.6	3.0	2.5	3.0
2) GROSS CAPITAL FORMATION													
(a) Building, & Works	£m	12.1	13.4	11.7	12.6	12.1	10.5	10.7	10.2	9.9	10.2	11.1	15.7
(b) Gross Investment	£m	18.5	23.2	21.7	20.8	20.2	17.9	18.6	18.0	17.7	20.0	24.2	32.3
(a) As a % of (b)	%	65	58	54	61	60	59	58	57	56	51	46	49
3) G.C.F. as % Monetary G.D.P.	%	19.9	22.7	21.1	19.0	19.1	17.6	16.8	16.2	16.4	15.6	17.2	21.4
4) AFRICAN EMPLOYMENT													
(a) Construction:Private	No	18122	20208	17383	18762	18565	15344	12142	9085	9395	6970	6845	9972
(b) :Public	No	27326	20274	19724	16422	18077	16434	17062	19469	19240	18849	17246	21601
(c) :Total	No	45448	40482	37107	35184	36642	31778	29204	28554	28635	25819	24091	31573
(d) Total Employment	No	224782	226284	225729	226916	228399	224260	228889	220999	216773	208350	212346	228186
(e) As a % of (d)	%	20.2	17.9	16.4	15.5	16.0	14.2	12.8	12.9	13.2	12.4	11.3	13.8
5) Exports - Coffee.Cotton	£000	34355	36520	35006	39063	38968	34116	31917	30695	28434	41511	51235	47183

COMPARISON OF THE MANUFACTURED AND CONSTRUCTION SECTORS.

	Number of Establishment	Turnover £ m	Gross Output £ m	Value Added £ m	Number of Employees	Wage Bill £ m	Trading Surplus £ m
Processing	282	38.44	38.58	3.91	18,672	1.46	2.45
Manufacturing	322	38.42	38.02	13.16	20,838	4.40	8.76
TOTAL	604	76.86	76.60	17.07	39,510	5.86	11.21
Construction	72	4.969	4.974	1.54	8941	1.07	0.47
	(4/3)	(6) % of (4)	Value added per Employee	(7) % of (4)		(7) % of (2)	
Processing	0.10	37.3	209.4	62.7		6.4	
Manufacturing	0.35	33.4	631.5	66.6		22.8	
Total	0.22	34.3	432.0	65.7		14.6	
Construction	0.3006	69.7	171.6	30.3		9.4	

SOURCES A TABLES 6 x 7 2

SURVEY IS INDUSTRIAL PRODUCTION 'BUILDING CONSTRUCTION 1964'

NOTE : VALUE ADDED HERE DEFINED TO EXCLUDE "RENT" IN LINE WITH STATISTICAL DEPARTMENT IT SHOULD BE NOTED THAT ELSEWHERE IN THIS CHAPTER RENT IS INCLUDED IN VALUE

Sources and Notes

(1) (a) (b) Source : Annual Abstract of Statistics

These figures have not been adjusted for the under-estimation which has recently been discovered.

(2) (a) (b) Source : ;1959 - 65 Annual Abstract of Statistics 1966.
Other Years - Annual Abstract of Statistics

Figures for 1959-65 had recently been revised.

(4) (a) (d) Sources : Annual Abstract of Statistics

Figures 1950 and later not strangely comparable to earlier years due to greater coverage.

(5) Sources: Annual Abstract of Statistics

Coffee is 'not roasted'

Cotton is 'raw'

Figures are for Domestic Exports, that is outside U.A.