

# SYSTEMATIC PLANNING AND SCIENTIFIC CONTROL OF FIELD OPERATIONS

By G. C. SHEPPARD

There is evidence that in many cane growing countries field practices have not kept pace with scientific progress, and in fact may be lagging far behind. One of the reasons for this is that there are no yardsticks for measuring productivity in the fields comparable with extraction and other efficiencies that are continuously and accurately calculated in sugar mills in relation to the measured weight of cane processed. The weighbridge at the mill is therefore the dividing line between scientifically controlled processes in the mill and rule of thumb operations in the fields.

There are so many variables in agricultural conditions that efforts to make comparisons between zones, estates and even adjacent fields are complicated to such a degree that they often become meaningless. In such circumstances there is a natural tendency to lower budgetted field efficiency targets to a point only slightly above current performances, whereas it has been proved in practice that improvements in efficiencies of 50 to 100 per cent can be obtained simply by making fuller use of existing facilities.

The purpose of this paper therefore is to describe planning and control methods that can be used profitably to increase the utilization of labour, machinery, materials and fields in cane growing and in other branches of agriculture. Needless to say any direct improvement in the physical features of agricultural work will in the long run reinforce the development of scientific practices and thereby improve yield.

It is desirable at the start of the programme to be described, to form a small and suitably trained planning staff to work under the direction of management. The planning and control procedures to be introduced, while similar to those employed in highly organized engineering and manufacturing organisations, are adapted to the peculiar conditions found in agriculture. They can be applied effectively to any reasonably well run agricultural undertaking and do not rely for their success on the presence of ideal conditions. Their function is rather to measure the effectiveness of existing conditions and systematically to find ways for improving them.

Good timing is more critical in importance in agriculture than in any other industry because of the effect of the seasons on plant growth. Failure to carry out any one operation in the life cycle of a plant at the right time and in the proper sequence will either result in permanent damage to the plant

or destroy the effects of previous work which will have to be done over again.

The first step in developing control through planning is for management to make formal estimates in complete detail of every phase of agricultural work to be carried out during each month of the year ahead. This involves laying down a programme for every field in respect of land preparation, planting, weeding, fertilizing, cultivation, reaping, cane transport, irrigation and every other conceivable activity. Priorities must be set and quantities measured or estimated in terms of tons, acres or miles.

Labour and equipment requirements are estimated for every project on the programme, for each month of the year. These requirements are then plotted graphically, in the manner shown in Graph A, to ascertain whether or not the programme can be carried out by the anticipated amount of labour and equipment available. It invariably occurs that the first attempt at programming fails to make the most economic use of the available resources or to balance them in each month of the year. Any lack of balance imposes too great a load on the available resources at some times and too small a load at other times, so that the cost of production is increased either way.

The final objective is of course a programme that flattens out the peaks and fills in the valleys to achieve the fullest utilization of the available resources.

Experience has proved that capable agriculturists can programme and estimate with a highly satisfactory degree of accuracy. While some flexibility must be allowed for the uncertainty of weather conditions, the targets of a well conceived programme can be achieved. Contingencies are dealt with as they arise.

To plan and to progress is to set targets and to establish controls which measure actual performances against the targets. Most agriculturists plan informally or have a mental picture of work they intend to do in its sequence. Unfortunately planning in this form cannot be displayed for those whose job it is to follow the progress of work. Further, the longer the period of operations becomes, the more difficult and less accurate are the mental calculations involved, and the harder they are to remember.

While the compilation of a yearly programme in the complete detail necessary is an arduous task on

the first occasion, it develops into routine in subsequent years, with ever increasing results. It provides the only reliable basis for determining policy with regard to labour recruiting and tends to reduce overall labour requirements. It is a positive brake on the costly tendency to engage excess labour when it is in plentiful supply as insurance against the possible shortage of labour later in the season.

Opportunities are presented to minimize equipment requirements by centralising control. For example; where it is customary to allocate one crawler tractor to each section for land preparation, regardless of the task in hand, it is invariably possible to reduce the number of crawlers in use by pooling them and allocating machines to sections according to programmed requirements. The management at a local sugar estate successfully used this approach to reduce the number of crawlers in service for land preparation from nine to three and halved the crawler cost per acre planted.

The next step in planning is to break down the approved annual or long term programme into short term monthly or fortnightly periods which are issued to section managers and overseers as they fall due. The short term programmes constitute a directive from management specifying how and when each phase of planned work should be carried out. These programmes are plotted graphically so as to illustrate visually the necessary phasing of operations and the results achieved in relation to time.

A specimen field work programme is shown in Table B. It lays down the work to be done in a four week period together with labour standards and budget costs.

TABLE B  
FIELD WORK PROGRAMME

Section: Example		Period: May (4 weeks)				
Field	Operation	Standards	Acre or Tons	Unit Days	Cost Unit	Total Labour Cost £
(a)	(b)	(c)	(d)	(e)	(f)	(g)
5	Weeding	6	25	150	2/11	21.88
2	Cultivating	1	90	90	2/11	13.12
24	Weeding	7	30	210	2/11	30.62
15	Weeding	5	90	450	2/11	65.62
10	Weeding	8	45	360	2/11	52.50
18	Reaping	4	1000	250	5/6	68.75
18	Second loading	7	1000	143	3/5	24.43
—	Fire Breaks	—	—	300	2/11	43.75
Totals				1953		320.67

Management is directly responsible for planning the supply of labour, equipment and materials outside the control of the man on the spot.

Follow-up is provided by normal supervision who account for work completed in relation to programme. Supervision also imposes quality controls by systematically rating the cleanliness of fields in respect of weed growth, cane left behind after cutting, bad stumping and trash spreading. Management meetings are held weekly in order to measure progress, to revise programmes where work is not up to date and to discuss future projects.

The "Job Request" system is employed for modifying programmes. Job requests are numbered orders contained in triplicate books issued to every official. They are used to provide written notification from one level of management to another when a change from the original programme must be made or to issue a new instruction. The original order is given to the official concerned and a copy is routed to the field manager to keep him always in the picture. The second copy remains in the book.

Job requests are followed to completion systematically. The issued copies are placed on special wall boards in the offices of the receiving official and the field manager in order of priority and under the headings "In Hand", "Hold Over" and "Completed". When a request has been completed it is suitably endorsed and returned to the originator via the field manager. Adherence to this routine provides: better understanding by all concerned of the work in hand; improvement in the standard of instructions because they are given officially and in writing; better follow-up and a reduction of the misunderstandings and recriminations that so often occur where verbal orders are given.

The basic programmes with all modifications are plotted graphically on a calendar basis against achievements plotted in a contrasting colour. These graphs provide the agriculturists concerned with a simple, up to date and visual means of control over every aspect of their work.

Once the broad principles of planning and control have been established there is wide scope for systematically improving productivity by introducing various scientific management techniques. Among these are:

1. Labour Control for fixing labour complements, keeping them up to date with changing policies and ensuring that actual labour employed does not exceed the complement.
2. Time study to measure work, to reveal the causes of lost time and to set more accurate production targets for labourers and machines.
3. Methods study to improve on existing work methods and to ascertain accurately and conclusively which is the best and most economic of two or more alternative methods to be used under given conditions.

4. Job descriptions that outline and formally record the selected methods of carrying out every aspect of agricultural work.
5. Aptitude testing and labour training based on job descriptions.
6. Incentive pay to encourage higher productivity on those jobs where it is possible to measure accurately the quantity and quality of work output in relation to pre-determined standards.
7. Budgetary control based on measured standards of work output and of expenditure.

A selection of results achieved by a sugar estate which has applied these principles of scientific management in their fields is tabulated below. It is noteworthy that the labour budget figures for the current year are based on an improvement of 42 per cent in utilization for direct labour.

#### 1. Motor Transport

	Year 1	Year 2
Tons cane handled ... ..	154,000	213,587
Running and maintenance costs ...	£29,674	£31,389
Cost per ton of cane ... ..	3/10	3/-

#### 2. Crawlers and wheel tractors used on land preparation and planting

	Year 1	Year 2
Acres planted ... ..	881	1,852
Running and Maintenance costs ...	£13,502	£14,255
Cost per acre... ..	£15 6 10	£7 13 3

#### 3. Labour used on Land preparation and planting

(Plowing, land preparation, clearing, stumping, planting mailla application, mix fertilizer, roll cane and re-plant).

	Year 1	Year 2	Year 3
			(Budget)
Acres planted ... ..	741	1,852	1,144
Unit days worked ... ..	28,857	61,018	24,400
Unit days per acre ... ..	39	33	21

#### 4. Labour used for reaping and sundry jobs

(Reaping, spread trash, second load, long carry, lay tramlines, pre-trash and cultivate).

	Year 1	Year 2	Year 3
			(Budget)
Tons cane reaped ... ..	146,000	187,000	140,000
Unit days worked ... ..	113,278	128,506	78,843
Unit days per 100 ton... ..	77	68	56

#### 5. Labour used on weeding and weedicide

	Year 1	Year 2	Year 3
			(Budget)
Acres weeded ... ..	10,300	19,781	31,289
Unit days worked ... ..	85,094	136,498	184,049
Unit days per acre ... ..	8.3	6.9	5.9

#### 6. Total direct labour

	Year 1	Year 2	Year 3
			(Budget)
Unit days worked... ..	238,375	351,170	299,120
Measured productivity index ...	100	117	142

#### 7. Indirect field labour

	Year 1	Year 2	Year 3
			(Budget)
Unit days worked ... ..	169,628	143,147	61,685
Productivity Index ... ..	100	118	275

#### 8. Expenditure on controllable field stores

(That is all stores used in the fields excluding "policy" commodities such as fertilizer and weedicide).

	Year 1	Year 2
Expenditure ... ..	£6,200	£3,930
Reduction ... ..		£2,270

Most cane planters rely for the results they achieve on personal experience, knowledge gained from their predecessors, advice received from working colleagues or agronomists and instinct. New methods giving spectacular and therefore easily identifiable results, are invariably passed on for the good of an estate or the industry as a whole, but there can be no doubt that many relatively good practices developed by individuals are neither identified nor adopted by others.

It is not difficult economically to justify the introduction of formal effective planning in any sugarcane estate. It systematically harnesses the skills of many individuals to a common cause, provides a plan and a follow-up that clearly illustrates performance trends, which, although they may be insignificant in the first instance, can be fostered and improved to gain great results. It will most assuredly improve timing and good timing saves money in a big way. It will achieve optimum labour complements and improved utilization of equipment together with increased growth of cane.

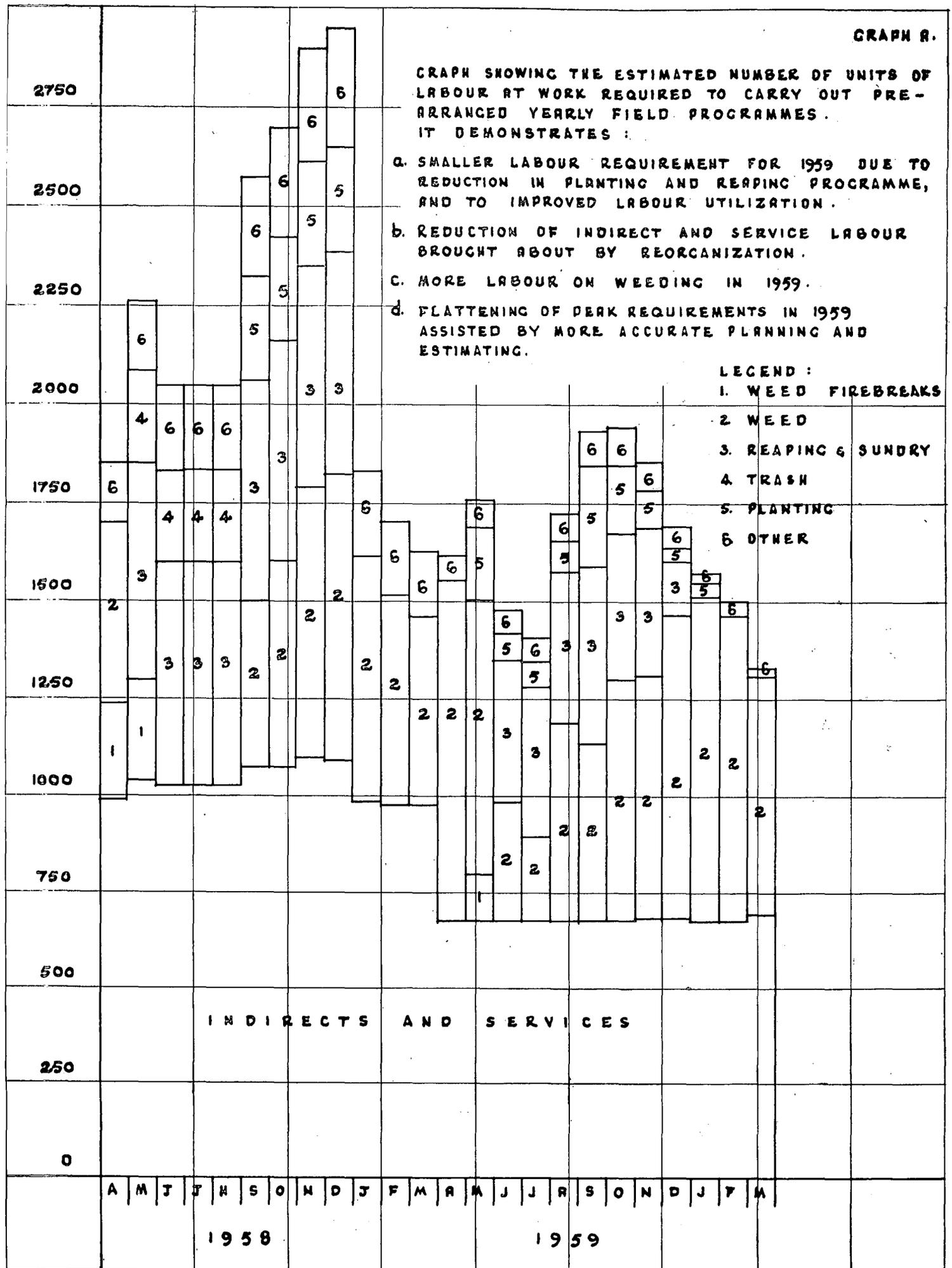
GRAPH R.

GRAPH SHOWING THE ESTIMATED NUMBER OF UNITS OF LABOUR AT WORK REQUIRED TO CARRY OUT PRE-ARRANGED YEARLY FIELD PROGRAMMES. IT DEMONSTRATES :

- a. SMALLER LABOUR REQUIREMENT FOR 1959 DUE TO REDUCTION IN PLANTING AND REAPING PROGRAMME, AND TO IMPROVED LABOUR UTILIZATION.
- b. REDUCTION OF INDIRECT AND SERVICE LABOUR BROUGHT ABOUT BY REORGANIZATION.
- c. MORE LABOUR ON WEEDING IN 1959.
- d. FLATTENING OF PEAK REQUIREMENTS IN 1959 ASSISTED BY MORE ACCURATE PLANNING AND ESTIMATING.

LEGEND :

- 1. WEED FIREBREAKS
- 2. WEED
- 3. REAPING & SUNDRY
- 4. TRASH
- 5. PLANTING
- 6. OTHER



**Mr. Sheppard** said, before commencing the discussion on his paper, that Mr. C. J. Saunders when opening our Congress stressed that it was more essential now than at any stage in the past 15 years, that sugar technologists should turn their attention to reducing production costs and obtaining the highest possible return from a limited market.

**The Chairman, Dr. McMartin**, said this was the first paper of this nature presented to our Association. He felt that the results achieved would no doubt be of interest particularly to those in the administrative side of field operations.

**Dr. Dick** said that obviously the scheme described was designed for a big estate and he wanted to know if this system could also be adapted to the needs of small individual growers.

**Mr. Sheppard** said that discussions had taken place with a view to putting the system across to smaller growers. This is being done in the Federation in the case of tobacco growers. After an exploratory period of six months, which proved satisfactory, these tobacco growers are now carrying out a comprehensive study of the use of labour and machinery throughout the industry. A strong team of consultants is working in conjunction with employees of the Tobacco Producers' Association. A manual of the most efficient methods employed in the various operations in all tobacco areas will be made available to the 4,000 odd big and small growers. He was confident that this would result in greatly improved productivity. There is no doubt that farmers generally would have to keep more comprehensive records in order to measure the effect of introducing new working methods and systems. In general the method outlined in the paper could be applied to the smaller cane growers.

**Mr. Boule** asked for a short description of aptitude testing and labour training.

**Mr. Sheppard** said facilities for carrying out such tests were provided by a Government sponsored body, "The National Institute of Personnel Research". The aptitude testing was based on requirements from each type of labour and was directed to engaging the best type of labour for any particular occupation. One estate in this Industry had established such a testing system.

**Mr. Pearson** said that in the graph at the end of the paper it was apparent that reaping was not the only great requirement from labour. Weeding also was most important and greater economies could be effected in this field than by mechanical harvesting. Another important point was the great reduction in units of labour required. He wondered if this was due to the policy of weeding more or less before one saw the weeds, or was it due to

greater efficiency in the management of weeding gangs?

**Mr. Sheppard** replied that it was a combination of both. This depended upon better timing and better utilisation of labour later on. On the estate mentioned in the paper, weeding constituted the biggest portion of the labour force. In more Northern climates, however, the reaping force might outnumber the weeding force.

**Mr. Pearson** said that we had possibly greater chances of improving our weeding by mechanisation than we had in reaping.

**Mr. Sheppard** thought that in general there was more prospect of using machines for weeding than for harvesting.

**Dr. Cleasby** said that the author had stated that the crop of 1958 could compare less favourably with the 1959 figures. He wanted to know what the crop figures were for the season, 1959.

**Mr. Sheppard** gave these figures: Tons cane handled by Estate transport: 1957—154,000; 1958—213,000; 1959—151,000. He said that the final productivity results for the year 1959, beat the budget figures shown in the paper.

**Mr. Thompson** said that the figures given included estate and planters' fields dealt with.

**Mr. Bentley** said that by systematic control the efficiency of labour had been improved. He asked if this had been brought about by incentive payment or by better supervision? If by incentive payment had the total cost been reduced? His experience had not always shown this to be the case.

**Mr. Sheppard** replied that the improvements in this particular example were not due to incentive bonuses to any extent. He quoted figures showing that the biggest reduction was in indirect labour—there was no increase in cost involved there. Generally there had been very little increase in bonus payment. Apart from some small incentive payment for boys weeding, there had been virtually no change in incentive payments to the natives, so that most of this reduction in labour affected direct saving in labour costs. Increased bonuses were paid to overseers and supervisors who were largely responsible for achieving the results shown. Their bonuses had been more than paid for by the result in saving of stores expenditure alone. Bonuses could always be useful provided the quality of work was adequately controlled.

**Mr. Brook** asked if the saving in harvesting costs was not due to the introduction of self-loading transport—thus saving loading costs.

**Mr. Sheppard** replied that there was some saving due to extra mechanisation but this amounted to only a small part of the total saving.

**Mr. Thompson** said that the merit of pre-planning in weeding for instance, lay in the fairly accurate estimation of labour requirements before the operation was commenced. Field management thus

played a direct part in the control of individual operations.

**The Chairman** said that Mr. Saunders in his opening address to Congress, had stressed the necessity of reducing unit costs and Mr. Sheppard had pointed out one way in which this improvement could be brought about.