

Mr Forster's files

S T A N D A R D S O F P R O D U C T I O N ⁴
I N A G R I C L T U R E

(BY)
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Sir Henry New stated that 'roughly approximate as these figures are, they appear generally to indicate that the expenditure per acre on manual and horse-labour together on the cultivated area is less in this country than in any of those with which comparison is made.' This was the first occasion on which any importance was attached to the idea of the net production per acre; or, in other words, to indicate the importance of the cost in relation to the product.

But of still greater importance was the attempt made to measure the productivity per person engaged in agriculture in the various countries. The tabular statement was as follows:

PRODUCTION PER PERSON

Country or Division	Corn and Pulse : Crops -Bushels:	Cattle : No.	Sheep : No.	Pigs : No.
United Kingdom	129	5	13	2
England - -	157	5	13	2
" Div. I.	239	3	9	2
Austria	52	1	0.3	1
Belgium	101	3	0.3	2
Denmark	204	5	1	3
Hungary	96	1	1	1
Italy	34	1	1	0.3
Netherlands	69	3	1	2
Prussia	144	2	1	3
U.S.	154	6.66	3.5	5.9

The discussion remained at this stage until Sir Thomas Middleton's 'Development of German Agriculture'* was published in 1916. Again the comparison of the results of different systems of organizing production in agriculture was based on the unit of land, and this time in a very striking way.

This comparison of the standard of production of British and German agriculture has had wide and frequent publicity, yet the one critical analysis of it is scarcely known.** Each 100 acres of land in Germany is stated to feed 70 to 74 persons, and each 100 acres in Great Britain only 45 to 50 persons. Taking the mean in each case ($72\frac{1}{2}$ and $47\frac{1}{2}$) the standard in Germany is represented by 100 and that in Great Britain by 64; or in other words 152.6 acres are required in Great Britain to produce as much food as 100 acres produce in Germany. That is the result of one standard. But Sir Thomas Middleton goes on to show that much more labour is employed in Germany than in Great Britain.

* Cd. 8305. 1916.

** R. G. Hawtrey, 'Economic Journal.' 1917 (vol. 27).pp. 143-5.

PERSONS EMPLOYED PER 100 ACRES OF CULTIVATED LAND.

<u>Germany -</u>	<u>Males</u>	<u>Females</u>
Permanently employed	6.2	6.0
Temporarily employed	2.1	4.0
T o t a l	8.3	10.0
<u>Great Britain -</u>		
	18.3	
Permanently employed	3.6	1.0
Temporarily employed	1.0	0.2
T o t a l	4.6	1.2
	5.8	

If the crude totals are taken, the same comparison as Sir Thomas Middleton made with regard to land may be made with regard to labour. The statement then is that each ten persons engaged in agriculture in Great Britain feed 81.9 persons, while each ten persons engaged in agriculture in Germany feed 39.6 persons, which may be represented as 100 in Great Britain to 48 in Germany. There is, however, a high proportion of casual and also of female labour employed in Germany, so this comparison is unfair. If we attempt to correct the basis, and use figures for 'men regularly engaged' we reach an estimate of $4\frac{1}{2}$ persons per 100 acres in Great Britain and $12\frac{1}{2}$ in Germany. On this basis each man regularly engaged in Great Britain feeds nearly 11.2 persons and in Germany 5.8 persons. The comparison is therefore 100 to 52.

A more useful way of stating the comparison is that of showing the amount of land and labour required to feed 100 persons: -

<u>LAND AND LABOUR</u>	<u>GERMANY</u>	<u>GREAT BRITAIN</u>
Land (acres) - - - - -	138	210
Persons - - - - -	25.2	12.2
Or 'Men' - - - - -	17.2	9.0

The ratio of land required in the two countries is 1: 1.52 in Germany and Great Britain respectively. Taking for labour 'men' only, the ratio of the amounts required is 1: 1.91 in Great Britain and Germany respectively. The ratio of the combined factors in Great Britain and Germany is 1 : 1.15.

Unfortunately, we have no reliable estimates of the amount of capital used per 100 acres in German or British agriculture,* but if capitalisation is heavier in Germany than in this country the results of the systems, judged by the combined standard of the three factors, could not fail to be in favour of this country.**

Recent discussion has again turned attention to the standard of production per man. An American comparison of the productivity per person engaged in, and per person dependent upon agriculture, in the United States of America and in certain European countries was made during the war. This has received some publicity in this country

* British estimates relate to the United Kingdom and not to Great Britain.

** In Justice to Sir Thomas Middleton it should be stated that his study of the productivity of German agriculture may have been used for propaganda purposes, for which it was not intended.

through publication in the Yearbook of the U. S. Department of Agriculture, 1918,* and Dr. K. L. Butterfield's book, "The Farmer and the New Day"; but much more through publication of an extract in the Rothamsted Report for 1918-20. Dr. Russell's quotation from Butterfield's book states that the following is a comparative measurement of the efficiency of agricultural workers: -

United States	100
United Kingdom	43
Germany	41
France	31
Italy	15

It is very unfortunate that the estimate is not what it purports to be, or what Dr. Russell has been led to believe that it is. The figures quoted in the Rothamsted Report relate only to the arable land and its productivity. This works with a very adverse effect in the case of a country like our own which has a low proportion of arable land and a large extent of rich and heavily stocked pasture. The acreage of land - 'approximate area in cultivation' - in the United Kingdom used for this comparison is 16 million acres, while the total cultivated area (including arable and pasture) is about 47 million acres.

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If we turn from comparisons of the productivity of the agricultural systems of various countries and the methods by which they are made to the comparison of the productivity of agriculture and other industries in our own country we are still on uncertain ground. But here the only standard which has been used is that of the production per person engaged. In the case of industries in general this has been reduced to the comparison of net output per man. Net output 'expresses . . . the total 'amount by which the value (at works) of the product of the 'industry of the groups, taken as a whole, exceeded the cost (at works) of the materials purchased from outside, i. e., it represents the value added to the materials in the course of manufacture. This sum constitutes for any industry the fund 'from which wages, salaries, rent, royalties, rates, taxes, depreciation, advertisement and sales expenses, and all the other similar 'charges have to be defrayed, as well as profits.'*

The value of net output per head of persons engaged (wage and salary earners) as summarized in the Report of the Census of Production (pp. 13, 15) varies between £506 per annum in sugar refining and £ 55 in the silk industry. In the case of sugar refining

* Cd. 6320. 1912. p. 8.

a considerable amount of duty is included in the 'net output', but taking an industry like grain milling the value of net output per head is £178 per annum. Unfortunately, we have no official estimates of the net output per head in agriculture. The Report on Agricultural Output of 1912 provided, in the case of agriculture, only a figure for gross output or 'total sales.' In Great Britain the gross output per person engaged in agriculture was : -

Including occupiers of holdings	- - -	£ 90
Excluding " " "	- - -	£129

As Sir Henry Rew stated at the time, ' a calculation of the estimated 'value of the materials used' in producing this output 'would be largely speculative.' But an estimate is required, and if we take the value of fertilizers, feeding stuffs, seeds, imported animals, and any other raw materials at a total sum of £ 36,800,000 we have a total net output for Great Britain of £ 114,000,000* or the following approximate sums per head: -

Including occupiers	- - - - -	£ 70
Excluding " " "	- - - - -	£ 97

There are reasons for the variations in the value of net output apart from the variations in the efficiency of the organization of the in-

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The total value of gross output was estimated to be £150,800,000. The value of fertilizers, feeding stuffs, etc., £ 28,400,000, and of store animals £ 7,000,000, and to these have to be added the value of the imported corn and seeds used on farms. But there is no definite information as to the proportion of these materials used for purposes other than 'agriculture' as the term was used for the purposes of the Census.

dustries. Some of the most important of these are the elements of monopoly of "proprietary values," and the existence of trade or labour organizations which enable the manufacturers or workers to enforce a high valuation of their contribution to the product. But it is worth while stating briefly some of the chief causes of the variation in the value of net output per person: -

A high net output is usually associated with -

- (1) High average wages.
- (2) Heavy capital expenditure, especially when the need for expensive equipment throws the trade mainly into the hands of large firms.
- (3) An output which consists of patented or proprietary articles.

The net output per head will also vary with -

- (1) The magnitude of establishment charges.
- (2) Speculative changes in price.
- (3) Seasonal or other changes in trade conditions relating to a particular trade.

For the purpose of comparing the efficiency of the productive organization of agriculture with that of other industries the most important influences are those arising from the possibility of organizing methods of enforcing high valuations of labour or of capital, and those

arising from the conditions under which competing supplies are produced. The British farmers and farm workers are scattered over wide areas and their facilities for organizing for protective purposes are poor. The supplies which compete with their products in the market, and which partially determine the prices of their products, come from all quarters of the globe and are produced under all sorts of varying conditions. Even if they were well organized for protective purposes the farmers and farm workers could exercise little influence on the prices of such products as are subject to the strong competition of imported supplies.

On the whole it appears that fluctuations in the prices of farm products (taken as a group) closely follow the fluctuations in general prices which are due to changes in general trade conditions, money and credit. But this does not exclude the possibility that the farmer and farm worker receive less for their capital and labour than their real productivity warrants. The general weakness of agriculturists in the valuation of their contribution to the value of net output would be as apparent at any time in the previous half century as it is at the present moment.

The only statement of the net output of English farms, with any real claim to accuracy, is that which Mr. C. S. Orwin published in 1917.* This statement relates to six farms for the year 1914-15,

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'Determination of Farming Costs.' pp. 111-115.

when the average value of net output per man was £162. If allowance is made for the increase in prices between 1909 and 1914-1915 this is equal to a little over £100 in the earlier year.

use of the Commodity

The standards and methods considered up to this point could be of value only to social economists or statesmen, and are of very little value to agriculturists, even if reliance could be placed on the limited results. A general standard which provided reliable results should, however, be of value to the farmer as well as to the social economist. For purely farming purposes several methods of measuring the productivity of farm organization have been used. It is not proposed that these should be discussed in detail, but the chief of them may be mentioned. They are: -

- (1) The managerial income of the farmer.
- (2) The return per unit of manual labour.
- (3) The return per unit of horse and manual labour.

But three factors, - land, labour, and capital - are used in all farming operations. These three terms appear simple, but they need some definition. 'Labour,' may cover the managerial work of the farmer, but is here intended to cover only such labour as actually receives wages or salary. Consequently, the managerial work of the farmer has to be included with his capital. This is not merely a

matter of convenience, for the farmer's income may be partly due to the interest for use of his capital, and partly due to him for personal services, but as these items can not be separated in his profits or income, it is necessary to deal with them as one item. 'Land' includes not only surface area, and fertility of soil with its variations, but climatic variations also. Capital in its broadest sense covers all the materials used in production which are not classified under the other terms. Any method of judging the productivity of farming systems must take due account of the contribution of these three primary factors in production, and judge productivity on the yield not only for the unit of each factor, but on the yield for the three factors combined.

It is difficult
From the records of five farms for the year 1918-19 it is possible to illustrate the methods of comparing standards of production in the industry. But it is necessary to point out that the use of the term 'land' is apt to lead to somewhat serious error. 'Land' is really the contribution of the landowner to production (in the English system of tenant-farming) and consists of land plus all its permanent equipment. This factor, when measured merely by surface area, varies enormously in quality from district to district and even from farm to farm. There are differences in quality in any units of quantity of the three factors, but there are great-

er differences in the quality of parcels of 100 acres of land than will be found in various groups of three farm workers or even in various units of £1000 of farmers' capital. For this reason it is necessary to find a method of securing greater uniformity of quality in the units of land and its equipment even when using land alone as a measure of the standard of output. However, the familiar methods of measuring production may be illustrated from the records of these five farms, before amplifications are indicated.

Farm:	Totals			Net output per unit	
	Acreage:	Men employed:	Net output:	Per 100 acres:	Per man
			£	£	£
A	965	23	6,717	696	292
B	196.5	6.4	1,366	694	215
C	98.5	3.7	746	842	201
D	371	17	5,213	1,405	307
E	323	5	1,780	551	356
	1,944	55.1	15,822	814*	287*

The organization of production, and the use of the factors, can be judged by either the standard of production per unit of land or by that of labour. For instance, if the production per land unit is used, Farm D would be judged the best farm; but when the production per man is used, Farm E would be judged the best.

* These figures have reference to those preceding them in the same horizontal line.

The production per unit of land varies with the quality of the land itself much more than the production per man varies with the quality of the man. It is therefore necessary to find some method of equalizing the units of land as regards their quality. This may be obtained by estimating the value of the landowners' capital in land and its equipment. The records of these farms do not include valuations of the land and its permanent equipment, but reasonable estimates may be obtained by capitalizing the rents at twenty years' purchase. If this is done, the following comparison of production per unit of land and per unit of landowners' capital will be obtained.

Farm	T o t a l s			N e t O u t p u t	
	Acreage	Rent	Capital Value	Per 100 acres	Per £1000 of Landowner's capital
		£	£	£	£
A	965	785 x 20	15,700	696	421 x
B	196.5	254 x 20	5,080	694	270
C	88.5	100	2,000	842	373
D	371	898	17,960	1,405 *	290
E	323	365	7,300	551	244
	1,944	2,402	48,040	814	329

In this table the variations in the rate of production per £1000 of landowner's capital are much smaller than those in the rate per 100 acres of land, and it is clear that some of the differences in

the quality of land have been reduced by the assessment of the productive capacity of the land and its permanent equipment on the basis of its capital value.

But whether land area, or a certain amount of capital value of land and equipment, be taken as a unit of measurement of production, the standard provided is quite inadequate for the purpose of estimating the productive efficiency of the organization; and this is the case even if the standard per unit of land or landed capital were combined with the standard per man, for the farmer's capital has also to be taken into account.

The following table shows the rate of net output for all the standards which have been mentioned, and also the rate per unit of farmers' capital. The total figures for the quantity of the factors used are shown only in the case of farmers' capital, as other total for land and labour have been shown previously.

: Net Output per unit :							
: Per man :		Landowner		Farmer		Farmers' Capital	
:		: Per £ 1000 :		: Per £ 1000 :		:	
:		: Per 100 :		: Landowners' :		: Total :	
:		: acres land :		: Capital :		: Capital :	
:		: £ :		: £ :		: £ :	
A	: 292	: 696	: 421	: 695	: 9,660	: 10.0	
B	: 213	: 694	: 270	: 607	: 2,250	: 11.45	
C	: 201	: 842	: 373	: 373	: 2,000	: 22.6	
D	: 307	: 1,405	: 290	: 1,438	: 3,623	: 9.76	
E	: 356	: 551	: 244	: 247	: 7,200	: 22.29	
	287	814	329	640	24,733	12.72	

ever can be entirely sacrificed, it is necessary to find some method of combining the factors and of judging by a single standard. This can be obtained by stating the quantity of each factor used in the production of a given amount of net output on any number of farms, or of farming systems. For this purpose the mere unit of land will not be used, and the land and its permanent equipment will be quoted in terms of its capital value.

Farm:	Unit of net:	Quantity of Landowners' Capital, Farmers' Capital, and Labour required to produce £ 1000 of value of net output.		
	output (Value)	Landowners' Capital	Farmers' Capital	Labour
	£ 1000	£	£	Men
A	1000	2,337	1,458	3.42
B	1000	3,718	1,647	4.69
C	1000	2,681	2,381	4.95
D	1000	3,445	695	3.26
E	1000	4,101	4,045	2.81
Avg.	1000	3,036	1,563	3.48

Total
300 100
400 131
400 135
400 137
400 136

If the contents of this table are put into simpler form indicating the differences in numerical quantity without reference to the character of the factors, it will be possible to show the differences in the total combination, with some of the results.

5/10/1911

Best
average
a with
units

Four Standards

From this table the efficiency of the farm organization in the use of the primary factors in production may be judged by any one of the four standards. But the fallacy of any single standard when a general view is required will be seen quite clearly if the table is studied. Thus on the standard per man Farm E gives the best result, while on that of the yield per unit of farmers' or landowners' capital, it gives the worst result. Farm D gives the best result when judged on the standard of yield per unit of land or on that of farmers' capital, but on that of yield per unit of landowners' capital it gives the worst result. Nor is it clear from this table which farm gives the best results throughout. At the same time it is true that if on any occasion, or in any place, one of the factors was exceedingly scarce and valuable, and great economy in use had to be considered, such a table would prove to be a useful guide to the effective organization of farm production in that it would indicate the results that might be expected from combinations of the factors of production in various quantities. It is realized, of course, that a much larger number of records would be required before definite conclusions could be obtained, but the present purpose is to indicate methods only.

As there may be at any time considerable difference in opinion as to which factor should be used most economically, and as no factor

Farm	Landowners' Capital	Farmers' Capital	Labour	Total Combination	Net Output
A	1	1	1	3.0	£ 1,000
B	1.58	1.14	1.36	4.08	1,000
C	1.15	1.86	1.44	4.45	1,000
D	1.47	0.48	0.95	2.90	1,000
E	1.75	2.81	0.82	5.38	1,000

On the whole Farm A gives the best result, for although D requires less of the total factors to produce the amount of net output, it is almost certain that better results would be obtainable on this farm if the farmers' capital were slightly increased, for the capital equipment furnished by the farmer is low in proportion to the quality of the land and the amount of labour used. On the other hand, in the case of E the amount of labour might be increased with advantageous results. B could probably be better organized if a little more labour and capital were applied to the land. But in the case of C the results would be better if the labour and capital were spread over a little more land.

With more numerous records it would almost certainly be possible to estimate the best quantitative combination of the factors of production on land of known character for given systems of farming.

And it would be easy to assess the value producing capacity (as shown by the value of net output) of different combinations of land, labour and capital, as used in different systems of farming.

No attention has been paid to the quantity of food or other materials produced, for it is assumed that under normal conditions the market value of the materials expresses their real value to the whole body of consumers. From a social view-point market value may not always be a satisfactory indicator for production to follow, but while industry is organized by individuals it is the only one which a man who wishes to keep his head above the economic floods has time to study. If society as a whole requires goods which have a low valuation on the market, yet are costly to produce, it must not only show the way but provide the incentive to follow it. British farming produces few, if any, articles which have definite disutility when regarded from the point of view of the economies of consumption, unless hops and barley are included in such a category. Taking the dietary and the general requirements of life of the urban and consuming classes of this country as they exist there is full justification for treating the money value of output of British farming as the measure of the success of the organization. Any considerable change in farming, especially towards intensification of cultivation would make necessary a corresponding change in the consumption of the urban classes. Or a change in the

demand of the consumers would entail a corresponding change in farm production and the methods by which it is obtained. Indeed, modern farming methods are very largely the result of changes in the urban demand during the last half century.

Ultimately, the real economy of production from land consists in getting the requirements of life with the least possible expenditure of physical energy which is consistent with the continuance of production. In existing circumstances there is no possibility of indicating the respective amounts of energy used for the production of a given amount of goods under different systems, but it might be possible to secure records, on a small scale, of the amount of energy consumed in the production of given classes of goods under different systems. The results of a study of this character would, in all probability, provide ample repayment for the trouble and cost involved. It appears, however, that the study would have to be made under conditions somewhat analogous to experiments in a laboratory. In the meantime, a rough measurement of the energy used under ordinary farming conditions could be obtained from records of work on a few farms if the records were designed for this purpose.

It will be many years before economists, to say nothing of politicians or agriculturists, begin to think of economy in this sense.

There is more to be gained for immediate and practical purposes, both for social and business policies in farming, by making studies of the economy of production in terms of the use of labour, capital and land. Such studies would have to take account of the general economic and political circumstances of the country or the period in which they were made. A densely populated country, with little or no mineral resources, must inevitably attach great importance to the yield per unit of land; a country with a plentiful supply of land and small supplies of labour or capital must attach great weight to the yield per unit of these two factors. This is in fact universally recognized, as may be seen in one case in Denmark or Belgium, or, more strikingly, in Japan; and in the other case, in any of the new countries settled by peoples having their origin in Western Europe. In no country, and in no period, can any one of the factors be entirely sacrificed to the other. A dense population, intensive cultivation, a high yield per acre and a low yield per man means a low standard of living and possibly eventually the Malthusian checks. A sparse population, extensive cultivation, a low yield per acre and a high yield per man may lead to evils at another extreme which will be equally disastrous to society. Such a system invites immigration on the part of peoples used to lower standards of living; it may even invite an attempt at wholesale immigration by means of war, as has happened before in the world's history. It is between such a Scylla and Charybdis that agriculturists and statesmen have to steer a national agricultural policy.

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