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SOME ECONOMIC ASPECTS OF
INCREASING SIZE OF DAIRY
HERDS AND MODERNISING DAIRY
SYSTEMS IN THE NORTHERN
REGION

REPORT 170 M.

January 1969. 3/6d.

UNIVERSITY OF NEWCASTLE UPON TYNE
DEPARTMENT OF AGRICULTURAL ECONOMICS

PREFACE

This report is based on a survey carried out within this Department of 74 dairy farms in the Northern region. The purpose of the survey was to obtain a picture of changes on a sample of farms where increase in herd numbers and modernisation of the dairy system were known to have occurred. The following points emerge.

The farming systems in operation at the end of the survey period were different from those initially in operation in a number of important respects. Most of the farmers reported that the changes had been accompanied by increase in profits. There were major labour savings on many of the farms which stemmed from two sources; better deployment of the labour force and more efficient housing, feeding and milk systems. Together they made possible a big reduction in the number of hours of dairy labour required per cow per year.

The increase in herd numbers, and in overall livestock units, was made possible by use of an increased acreage for dairying and/or by increased stocking intensity, with more intensive use of grassland. Heavier fertilizer applications were the general practice.

The investment per cow in dairy improvements varied widely between farms depending mainly on the degree to which the individual farmer found it possible to utilize existing buildings.

The sample farm survey technique has definite limitations as a means of studying the complex changes in the financial and economic relationships associated with these changing patterns of dairy farm management. The case study method while presenting problems of generalization might in appropriate cases, if carried out in depth, provide useful information regarding these relationships. Careful budgetting seems essential when a programme of herd expansion is contemplated.

The survey was carried out by Messrs. T. Winter, R. Evens and D. Johnson. Mr. F.O. Grogan helped prepare the report and some statistical analysis was carried out by Messrs. T. Phillips and C. Ritson.

John Ashton.

Newcastle upon Tyne,
December, 1968.

SOME ECONOMIC ASPECTS OF INCREASING SIZE OF
DAIRY HERD AND MODERNISING DAIRY SYSTEMS IN THE NORTHERN REGION

The trend towards increase in the size of dairy herds is well-known and is not confined to any particular part of the country. Earlier studies have shown that the relation of herd size to the economics of production is complex; the large herds do not always have the lower unit costs. Apart from any influence of the quality of the land this fact has commonly been attributed to variations in the level of management, including within that term the efficiency with which capital has been used in the enterprise.

A priori, it might appear that economies of scale from increasing herd size, ignoring changes in production per cow, (which would seem a separate question from any gains from increase in size of herd per se), would come from two sources:-

- (a) Spreading total fixed costs, including any capital injections necessary to increase herd size, over a greater volume of production.
- (b) Economies in labour.

Such a simplified approach does not mean denial of the fact that the changes in technology likely to be introduced in order to facilitate increase in the herd size may be associated with gains other than the two mentioned above, e.g. cheaper feed combinations; however, such additional gains may be regarded as complementary rather than as essentially part of the process of increasing the size of the herd. Also, increased herd size may be accompanied by changes in costs which may not always be strictly proportional to the change in herd size; for example, expenditure on fertilizers. Extra housing and handling facilities are likely to be required and this means additional investment.

The range of possibilities which can exist on different farms is wide and a detailed financial examination of the costs and gains possible on a range of individual farms would be correspondingly complex. However, it was considered that, without attempting such a complex exercise, there would be useful information to be had by examining a selected group of farms, where a significant increase in herd size with modernisation of the dairy system was known to have taken place over recent years. By this means it was hoped to ascertain what, in fact, had been the experience on these farms with regard to a number of the key variables involved in the expansion process and particularly with regard to investment, labour and fertilizer usage. For reasons mainly of convenience, the Northern region was chosen for study.

Aspects of the expansion process which it was considered appropriate to examine were:-

- (a) Motivation, i.e. the reasons why farmers had decided to enlarge the scale of their dairying operations.
- (b) The physical basis of expansion, i.e. the means by which farmers had been able to maintain more cows than the number previously carried, e.g. by purchase of additional land, better grassland management, increased feed purchases, etc.

- (c) The extent to which farm output, other than that directly related to the increase in cow numbers (e.g. improved milk yield per cow or increased side-line activities), changed concurrently with the increase in herd size.
- (d) The capital investment, e.g. new buildings or improvements to old ones.
- (e) Labour utilization.
- (f) Sources of capital.
- (g) Estimation from the investment incurred by farmers and from the herd increase and labour economies so achieved of the profitability of the investment.

THE SAMPLE FARMS

The initial step was to locate farms in the Northern region on which increase in herd size had taken place over the period 1960 to 1966. This was done by mailed questionnaire to 1,000 farmers in the region, with herds of over 40 cows, on the basis of a list of names supplied by the Ministry of Agriculture, Fisheries and Food. A minimum requirement of 40 cows was adopted to avoid inclusion of small family farms where study of the economics of the dairy enterprise was unlikely to give results useful for general application.

430 replies were received and, of these, 112, where the farmers had increased their herd size during the survey period, were selected for further contact. These farms were visited in order to obtain a more detailed picture of the dairy enterprise and of its role in the farm economy. Also information was sought regarding the nature and cost of the farm improvements which had accompanied the increase in dairy herd size and regarding any changes in labour usage. The final sample contained 74 farms which were widely dispersed over the four Northern Counties, with 35 in Cumberland, 19 in Westmorland, 6 in Durham and 14 in Northumberland.

The following Table, showing the break-up of farms by size-of-farm and size-of-herd, evidences the wide range in farm and herd size covered by the survey. The Table illustrates also the changes in herd size which, for the various farm-size groups, took place during the period covered by the survey.

TABLE 1.

Relationship of herd size to farm size

Farm Size Groups	1960				1966			
	No. of farms	Av. size of farm	Av. Herd size	Cows per 100 acres	No. of farms	Av. size of farm	Av. Herd size	Cows per 100 acres
Under 100 acres	5	85	35	41	3	83	56	67
100 - 149	10	127	37	29	9	131	69	53
150 - 199	16	176	38	22	14	179	67	37
200 - 249	14	218	42	19	13	215	78	36
250 - 299	11	273	58	21	13	274	84	31
300 - 399	11	349	55	16	11	346	99	29
400 - 499	3	440	47	11	4	449	88	20
500 and over	4	744	55	7	7	1031	93	9

MOTIVATION

All the farms in the sample were, by selection, farms on which increase in herd size had taken place over the years covered by the survey (1960 - 1966).

Self-ascribed motives may not be a completely reliable guide to the actions of individuals; however, the views of the farmers interviewed left no doubt as to their conviction that increase in herd size was an answer to the economic problems which, they said, they were experiencing due to rising costs. They believed that increasing the size of the herd would provide a key to greater profit by providing greater output with less than commensurate increase in costs. Such cost saving, they thought, would be principally achieved through labour economies and by spreading overheads.

THE BASIS OF HERD INCREASE

One part of the problem of increasing herd size was to provide the additional feed necessary for the extra cows. This was done in one or more of three ways;

- (a) by obtaining additional land

30 farms increased in acreage during the survey period; 33 showed no change in size and 11 showed some decrease. Overall, the average acreage per farm increased from 252 to 312, i.e. 24%.

(b) by increased production of grass

The farmers aimed at increased grass production through increased use of fertilizers and better grassland management practices. As regards fertilizer, a subsample of 64 farms where fertilizer costs were available showed an average increase from £3.17.0. in 1960 to £7.16.0. in 1966 per acre of grassland. Over the period there was little change in fertilizer prices so that it may be assumed that fertilizer usage approximately doubled.

Apart from heavier fertilizer applications some change in management practices was indicated by the fact that the number of farms practising strip grazing increased from 52 to 56 and the number of herds on paddock grazing rose from 5 to 15. Farms relying solely on extensive grazing declined from 17 to 3.

The results achieved by individual farms varied and on 8 farms the livestock carried per acre decreased. Taken over all the sample farms, the (adjusted) grassland requirement per cow unit was reduced from 1.71 to 1.46 acres.

(c) Changes in feeding management

Apart from increased grass production a bigger herd could be fed by more efficient use of the feed produced on the farm and by greater reliance on off-farm purchases of feeding stuffs. As regards the latter the survey revealed that the proportion of off-farm feeding stuffs was not increased. There was however a major increase in the production of barley. It has been mentioned above that the average farm size increased by approximately 60 acres. Of this area, 19 acres went to increase the tillage area and 41 acres to provide additional grass. Within the tillage acreage (which was 54 acres at the beginning of the survey period and 73 acres at the end of the period) all forms of tillage other than barley contracted while the barley acreage increased from 12 acres in 1960 to 57 acres in 1966.

In 1960 only two farms had obtained more than maintenance from forage crops whereas, in 1966, 52 farms obtained maintenance plus $\frac{1}{2}$ - 2 gals. of milk from forage crops. There was also a marked trend towards self-feeding systems for silage, away from the practice of hand feeding of silage with roots and/or Kale. In 1960 only 8 farms were using self-feeding systems for silage whereas at the close of the survey 70 farms used such systems. Along with the use of self-feeding systems there was elimination of roots and reduction in usage of Kale. Over the survey period the herds which were fed roots dropped from 28 to 1 and herds to which Kale was fed dropped from 36 to 12. Less concentrates were fed and a larger proportion of home grown cereals was included in the ration. As well as any bearing which these developments had on the stock-carrying capacity of the farms they contributed towards reduced labour requirements.

In the majority of cases herd increase on the sample farms was built up gradually over the survey period. The increase in numbers varied from 15 cows to 71 cows and the percentage increase from 26% to 268%. On most farms retention of home-bred heifers was used to build up numbers. Only 14 farms relied completely on purchases and in some of these cases a changeover in breeds was involved. 23 farms relied solely on home-bred heifers to build up herd numbers and on 37 farms both methods were employed.

MILK YIELD

It was expected that the increase in herd size would not give rise to any improvement in average milk yield per cow. The evidence derived from the survey on this point was rather inconclusive.

First, considerable changes in breed composition of herds have taken place over the survey period on the sample farms. This is in line with the general experience in the Northern region which originally was regarded as the home of the Shorthorn but where in the eleven years from 1955/56 to 1966/67 the proportion of Friesians in the regional dairy herd rose from 30% to 62% and Shorthorns fell from 39% to 11%. Ayrshires are now second in importance to the Friesians. Somewhat similar trends were evident on the sample farms. In 1960 there were 27 pure Friesian herds and 8 herds consisting of Friesian cross cows. The corresponding figures for 1966 were 32 and 14. The number of mixed herds which included Friesian cows increased also, from 10 to 17 during the same period.

On 18 of the sample farms there was little or no change in yield per cow. On 10 farms there was a decrease in yield which was due in some cases to disease and in others to a change to a feeding system which used less concentrates. The system aimed at reduced costs to more than offset any decline in milk yield. Also, on some farms there had been temporary decrease in yield because of introduction of a large percentage of heifers to build up herd numbers or because of delay in culling older cows. On 46 farms milk yield per cow increased.

In the following Table the association between increase in average milk yield on the one hand, and change in breed composition on the other hand, is set out.

TABLE 2.

	Herd composition changed	No change in breed composition
Yield decreased	1	9
No change in Yield	3	14
Yield increased	19	26

The above table relates change in milk yield to whether or not the herd breed composition changed. The association is statistically significant at the 97% level of confidence.

EFFECTS OF INCREASE IN HERD SIZE ON OTHER
FARM ENTERPRISES

The changes, on average, in land utilization and in live-stock* on the sample farms over the survey period are shown in Tables 3 and 4.

TABLE 3.

Changes in land use between 1960 and 1966

Crop	1960		1966	
	Total acres	Acres per farm	Total acres	Acres per farm
Wheat	782	10.6	507	6.9
Barley	916	12.4	4229	57.1
Oats	1303	17.6	213	2.9
Potatoes	266	3.6	109	1.5
Roots & Greens	672	9.1	290	3.9
Fallow	67	0.9	62	0.8
Total tillage	4006	54.2	5410	73.1
Temporary grass	6305	85.2	8459	114.3
Permanent grass	7010	94.7	7280	98.4
Rough grass	1392	18.8	1962	26.5
TOTAL ACRES	18713	252.9	23111	312.3
Total adjusted acres (rough grass adjusted to a permanent grass equivalent)	17698	239.2	21677	292.9

* Livestock numbers throughout this report were those on farms at 3rd June of years stated.

TABLE 4.

Average numbers of different classes of grazing
livestock per farm

	1960	1966
Dairy Cows	45	80
Heifers in calf	14	16
Beef cows	3	3
Other cattle		
Over 2 years	6	5
1 - 2 years	24	24
Under 1 year	29	45
Breeding Sheep	100	107

The outstanding feature of Table 3 is the major contraction of all tillage activities other than barley production. Similarly, on the livestock side, Table 4 shows no overall expansion of any importance outside the dairyherd (including followers). The dairy cows represented 41% of the total Livestock Units on the average farm in 1960 and 52% in 1966. The overall increase: dairy cows 77%; livestock units 39%.

The position differed as between individual farms. Most of the farms carried dairy replacements but on five farms rearing was abandoned to make room for more milking cows. On some farms enterprises such as cattle fattening or the rearing of store cattle were discontinued or reduced. In 1960 there were 53 farms with breeding sheep flocks. In 1966 the number was reduced to 43; however the average size of flock was slightly higher in 1966 as a result of expansion of the flock on several farms.

Except on a case by case basis it is not easy to draw hard and fast lines between the dairy and other farm enterprises especially where, as in the northern region, many of the farms have something of a mixed farming character. Even if the various enterprises are evaluated on some basis such as the number of standard man days the question still remains as to the degree to which the non-dairying enterprises represent use of labour which otherwise might not be fully employed on the dairy enterprise.

ECONOMIES THROUGH HERD INCREASE

It has been mentioned earlier that two-fold economies are likely to be achieved through increase in herd size:

- (a) the spreading of overhead or fixed costs over a greater volume of output, and,
- (b) more efficient labour usage, particularly where, as on the sample farms, herd increase has been accompanied by modernisation of the milking and feeding facilities.

(a) The increase in milk output was affected by the fact that on individual farms there had been changes (varying between farms) in breed composition and any attempt to make corrections for this fact was made difficult by inadequacies in the data available regarding milk production on the farms at the commencement of the survey period. It has been considered necessary therefore for purposes of the subsequent analysis to use the change in cow numbers as an index of output change, rather than the volume of milk.

It was realized that feed costs vary from herd to herd and that this could be accentuated by the changed in breed composition of herds. However, later in this report, in discussing financial implications of herd increase, comment will be made in terms of regional norms; it was not the purpose of the survey to collect detailed information regarding costs and returns.

The major variation in working expenses came from increased use of fertilizer. Any attempt to relate this to the increase in herd size and so to the financial gains resulting therefrom is complicated

by the fact that the improved livestock carrying capacity took different forms on different farms, i.e. the increased capacity was not always solely utilized to carry extra milking cows; in some cases it was used to carry additional followers or even other forms of livestock such as fattening cattle or sheep. Undoubtedly, however, the main emphasis was on increasing the number of milking cows as is shown by the major increase in the number of cows and by the fact that the number of cows represented a higher percentage of the total livestock units at the end than at the beginning of the survey period.

(b) Labour was employed on all the sample farms except one which was run by the farmer and his wife.

On 34 farms there was no change in the number of full-time employees during the survey period. On 17 farms the number of employees increased and on 22 farms decreased.

For all the sample farms the average number of full-time employees was 3.2 in 1960 and 3.1 in 1966. In view of the overall increase in livestock numbers and in grassland and tillage acreage some overall increase in labour productivity was obvious.

The average number of hours per cow of direct dairy labour (e.g. milking, feeding, cleaning sheds, etc.) was reduced from 90 to 42. These figures would suggest, on the basis of a standard one-man unit being 2200 hours per year, that the average number of cows handled per man-unit was 26 in 1960 and 56 in 1966. In fact, there were five herds in 1960 where all the dairy chores were carried out by one man; by 1966 the number had risen to 32 despite an increase in average herd size from 45 to 80 cows. However on several of these farms the regular herdsman was relieved for one or two days each week so that the total work for the week required more than one man's labour. Table 5 shows how general the improvement was.

TABLE 5.

Distribution of farms according to labour
requirement per cow

Hours per cow	1960	1966
Under 30 hours	-	7
30 - 49.9	3	49
50 - 69.9	14	15
70 - 89.9	25	2
90 - 109.9	16	1
110 - 129.9	4	-
130 - 149.9	6	-
150 and over	6	-

It is evident from Table 5 that even in 1960 some of the farms had managed to achieve low labour usage. In a later section of this report the improvement in labour hours per cow will be related, for the individual farms, to such factors as increase in herd size, investment

in improved facilities, and the level of labour efficiency at the beginning of the survey period.

At the commencement of the survey period all the sample farms were using cow sheds in which the cows were milked as well as housed. At the end of the period all farms used parlour milking and the cows were housed in covered yards many of which were equipped with cubicles. 60 of the farms had installed pipe lines and of these 33 ran direct to bulk tanks. The type of parlour most commonly used was the herring-bone (38) followed by the tandem (23) and the abreast (13). Similarly, labour economies were involved in the marked trend away from hand feeding of silage with roots and/or Kale towards self-feeding systems for silage.

Some of the investment was directly labour-saving, e.g. pipe lines and automatic feeding. Also there was indirect labour saving arising from increased herd size, e.g. yarding 80 cows would not normally take twice as long as yarding a herd of half that size.

The actual nature of the improvements carried out (for housing, milking and feeding) directly influenced both the costs and the labour savings which were effected. The quality of management and of labour were also, no doubt, important but are not easy to measure.

The extent and cost of improvements to the dairy enterprise varied widely as between farms. In the case of 15 farms completely new layouts were built (Category A). On 30 farms the improvements consisted of modifications to existing buildings (Category C). On the remaining 29 farms some combination of new buildings and modifications to old ones was adopted (Category B).

Investment per cow was heaviest on those farms where completely new layouts were built (Category A). In Category C where open yards and haysheds were altered and incorporated into a system based on modification of existing buildings, expenditure was relatively light. In Category B where conversions, in the main, consisted of alterations to cowsheds which were adapted for parlour milking, expenditures were of intermediate magnitude.

Cubicles were in use on 57 farms. These were installed, in most cases, two or three years after yard housing was adopted and had the advantage of reducing straw for bedding requirements and keeping cows cleaner. This had particular advantage in areas where few cereal crops were grown and provision of straw was proving difficult and expensive. The problems of dealing with slurry were solved by the use of modern manure-handling equipment and slurry tanks. Most of the farms used scrapers and stored effluent in tanks from which it was pumped into mobile tanks and thence spread on the land.

There were 23 silos erected on 19 farms. Of these 6 were butyl grain towers while the remainder (17) were of a more sophisticated type fitted with automatic feeding equipment. Of these, 9 were for storing moist barley and 8 for silage.

The highest gross cost was £24,500. The herd on this farm increased from 40 to 84 by 1966. Expansion was still proceeding as the new set-up was capable of holding up to 110 cows. At maximum capacity, therefore, the gross cost per cow amounted to £220 or £156 net of subsidy. On this farm a new set of dairy buildings was erected, complete with tower silos for grain and silage and an automatic feeding system. The silos and automatic feeding equipment were responsible for about $\frac{1}{3}$ of the total cost.

The lowest gross cost was on a farm where existing cow sheds and hay barns were altered and adapted for parlour milking, loose housing and self-feed silage and amounted to £1,950 or £35 per cow. The net cost was £26 per cow. The herd in this case increased from 32 to 55.

All but two of the investment schemes were grant-aided and, taking the farms as a whole, the grant represented 25% of the total cost.

TABLE 6

Gross Cost of Improvements

<u>Groups</u>	No. of farms	Ave. total cost per farm	Cost per cow		Range in cost per cow	
			£	£. s.	£. s.	£. s.
A. New lay-outs	15	13,060	148.12.	61. 6.	to	292. 0.
B. Combination of new & modified old buildings	29	8,235	105.10.	46.10.	to	256.12.
C. Modified old buildings	30	4,776	61. 4.	21.18.	to	136. 2.

TABLE 7

Net Cost of Improvements

<u>Groups</u>					
A.	15	9,320	106.0.	44.16.	to 212.10.
B.	29	6,265	80. 6.	36.10.	to 200. 6.
C.	30	3,708	47.10.	21.18.	to 104.14.
Average all farms	74	5,850	73. 2.	21.18.	to 212.10.

ECONOMIC RELATIONSHIPS OF FACTORS INVOLVED
IN INCREASE IN HERD SIZE

It was thought that multiple regression analysis of the survey data might reveal relationships between various aspects of the herd expansion process. In particular, it was decided to test the following hypotheses:

- (a) that the additional feed needed for the increased herd would be a function of changes in: forage acreage, barley acreage, fertilizer cost, and livestock other than cows.

- (b) that labour saving would be a function of: the initial level of labour efficiency, the initial size of herd, the increase in herd size, and the level of investment.
- (c) that investment would be a function of: increase in herd size, final herd size (because improvements were provided for all cows in the herd and not merely for the additional ones), and the level of labour saving effected.

Although in many cases the analysis produced significant coefficients for the individual variables in the equations, not enough of the total variation was "explained" to provide meaningful deductions concerning production functions. This inconclusive result of the analysis was probably at least partly due to the following factors:

- (a) The smallness of the sample coupled with the large variations in investment and in other variables.
- (b) Probable inaccuracies in the (estimated) allocation by farmers of resources to the dairy enterprise.
- (c) The fact that some farms were still in a transitional stage at the end of the survey period and the herd had not been increased to the planned level.
- (d) The varying degree to which existing buildings were adapted for changed use.

PROFITABILITY OF INCREASE IN HERD SIZE

As a check on the statements by many of the farmers that the increase in herd size had proved profitable a budget was prepared (Table 8) using average data available from the survey and from the milk costs investigation for 1965/66.

TABLE 8

Budget

<u>Before</u> 45 cows av. yield 800 gallons		<u>After</u> 80 cows av. yield 800 gallons	
	£		£
Total galls. 36,000 @ 3/3d.	5,850	Total galls. 64,000 @ 3/3d.	10,400
Value of calves @ £9 p.cow.	405	Value of calves	720
Total	6,255	Total	11,120
<u>Feeds</u>			
Concentrates @ £26 p.c.	1,170	Concentrates	2,080
Bulk Foods @ £18 " "	810	Bulk foods	1,440
Grazing @ £10 " "	450	Grazing	800
<u>Labour</u> 90 hrs. p.cow.		42 hrs. p.cow.	
= 4,050 hrs. @ 6/3d.	1,266	= 3,760 hrs. @ 6/3d.	1,175
<u>Miscellaneous Exs.</u> £20 p.c.	900	<u>Mis. Exs.</u>	1,600
<u>Herd Depn.</u> @ £3.10. p.c.	157	<u>Herd Depn.</u>	280
Total Costs	4,753	Total Costs	7,375
<u>Net Margin</u>	1,502	<u>Net Margin</u>	3,745
" " per cow	33	" " per cow	47
		<u>Extra Costs</u>	
		New Investment ^o	
		(Annual charge of 12½% on original net cost of £73 per cow)	
			730
		Extra Fertiliser (80 x 1.46 acres x £3.19.0d.)	
			461
		Total Costs	8,566
		Net Margin	2,554
		Net Margin per cow	32

Based on Survey date and Milk Costs Investigation 1965/66.

Rent included in feed costs and in miscellaneous costs.

Prices & Costs based on 1966 data.

^oCost of additional cows not included; these if purchased would represent say, £2,800 (35 @ £80) which at, say, 7% would raise costs by £196.

The following comments may be made on the above Budget.

- (a) Before allowing for the annual charge against the expenditure on improvements (£730 p.a.) and the cost of additional fertiliser (£461), the farmer was £2,213 better off as a result of increase in herd size.
- (b) After allowing for these charges he was £1,052 better off.
- (c) This figure would be reduced to £856 if a charge of £196 be included to cover the cost of additional cows.
- (d) The labour saving revealed by the budget was £1,200. (i.e. 48 hours per cow @ 6/3d. per hour).
- (e) If feed systems installed as part of the herd increase programme result in cheaper feed combinations this would imply lower feed costs per cow. In the budget no change is shown.

Regarding the investment in farm improvements, the average figure revealed by the survey (£73 per cow, net of subsidy) was influenced by the fact that the improvements were highly variable in cost depending on the extent to which the farmer was able to utilize existing buildings.

For 15 farms where complete new lay-outs were installed, the average cost was £106 (net of subsidy).

It would appear from the foregoing that, in assessing the probable profitability of herd increase, the following would be relevant:

- (a) The net margin from each additional cow would be, on average performance, £30-£40.
- (b) Labour saving would largely depend on the initial level (i.e. if labour hours per cow were already low, further improvement would be correspondingly more difficult).
- (c) For any additional land required, rent as revealed by the survey, would be up to £8 per acre or, say, £12 per cow. The budget shows rent as a variable item of cost; it is subsumed under feed costs and miscellaneous costs. If the increase in herd size were achieved without proportional increase in the acreage required to sustain the dairy herd then the costs shown in the budget after herd increase would, to some extent, be inflated.
- (d) On the cost of additional cows, interest, if charged, would be approximately £5-£6 per cow.
- (e) New dairy buildings and equipment could cost, say, £106 per cow i.e. at 12½%, £13 per cow per annum.
- (f) Insofar as any "overhead" items might be included in "miscellaneous costs" these could be subject to some reduction per cow after increase in herd size.

PROVISION OF CAPITAL FOR HERD INCREASE

In the following discussion any capital requirements for purchase of additional dairy stock has been ignored. On the survey farms the situation varied in that some farms brought in new cows while others bred replacements. In the budget presented earlier in this report a charge to cover cost of additional cows has been shown as an addendum to the budget.

The provision of capital for the expansion programmes was complicated by the fact that some sample farms were owner-occupied (47) and the remainder (27) were tenanted farms. A rise in rents for tenanted farms which followed the expansion programmes, and which took place on 18 of the 22 farms for which information was available, was complicated by the fact that in a number of cases part of the rise in rent was due to an increase on general grounds and part only was related to the improvements carried out by the landlord during the survey period. In seven cases there was a change in the size of the farm. On six of the tenanted farms the tenant provided the whole of the capital for modernising the dairy with an understanding in most cases regarding tenant's rights in the improvements effected. On the four farms where rents were not raised this was because the improvements were wholly financed by the tenant or because the rent had been reviewed about 1960 and took into account improvements to be effected subsequently by the landlord.

The rent increase (per acre) on the tenanted farms showed a wide range. This was partly due to variations in the value of improvements financed by the landlord and partly to the fact, mentioned above, that in some cases part of the rise in rent was not directly related to the dairy improvements. It appeared that the rent rise specifically related to the improvements carried out by the landlord was in most cases based on an interest charge of 6-10% on the cost of the improvements.

The average rent per acre over the 22 farms rose from £3.1.0. in 1960 to £4.14.0. in 1966. The range between individual farms is shown in the table below. The rents per acre varied considerably between farms both at the beginning of the survey period and at the end of it and the increases also varied. The range in 1960 was from 15/- per acre to 108/- per acre and in 1966 from 44/- to 157/- per acre. The capital provided by the landlord for the improvements on these tenanted farms was nil in four cases and for the remainder varied from £933 to £9,300.

TABLE 9

Changes in rents between 1960 and 1966

Farm Code No.	Size of Farm	Total Rent		Rent per acre	Size of Farm	Total Rent		Rent per acre	Net Capital invested by landlord in dairy buildings
		1960				1966			
	acres	£	s. d.	acres	£	s. d.	£		
C.521	160	247	30.10.	140	705	101. 0.	1700		
W.103	204	900	88. 3.	204	1600	157. 0.	7000		
W. 59	350	500	28. 6.	350	1500	85. 9.	2000		
D. 53	134	320	47. 9.	134	700	104. 3.	6000		
C.360	378	782	41. 4.	419	1983	94. 8.	7635		
C. 2	254	600	47. 3.	254	1228	96. 9.	Nil		
D. 54	193	470	48. 8.	373	1786	95. 9.	6500		
W. 32	210	945	90. 0.	210	1425	135. 6.	6000		
C.102	320	700	43. 9.	320	1400	87. 6.	Nil		
N. 74	197	700	71. 4.	194	1100	113. 4.	3960		
W. 64	100	300	60. 0.	100	500	100. 0.	Nil		
W.157	208	936	90. 0.	290	1885	130. 0.	8000		
C.351	363	1850	102. 0.	268	1850	138. 3.	Nil		
C.527	312	240	15. 4.	312	800	51. 4.	1758		
N. 70	220	660	60. 0.	220	990	90. 0.	2380		
C.248	100	265	53. 0.	123	490	79. 8.	1574		
W. 76	274	850	62. 0.	281	1200	85. 4.	2126		
N. 68	209	540	51. 8.	209	700	67. 0.	933		
D. 86	460	2100	92. 0.	500	2300	92. 0.	9300		
N. 64	153	765	100. 0.	153	765	100. 0.	3000		
C. 6	259	578	44. 7.	259	578	44. 7.	Nil		
C.274	65	350	108. 0.	65	350	108. 0.	Nil		

There were 47 owner-occupied farms. Here, again, the level of investment varied widely. Although on most farms substantial sums were invested in the expansion programme, there were some where expansion was accomplished comparatively cheaply. The expansion programmes

was financed from the farmer's own resources on eleven farms, from the bank loans on eleven farms and from these two sources combined on 23 farms. On two farms funds were borrowed from the Agricultural Mortgage Corporation.

SUMMARY AND CONCLUSIONS

1. The Survey covered 74 farms in the Northern Region on which, over the period 1960-1966, herd size had increased and where improvements had been effected to the dairying facilities. Overall, the average herd size increased from 45 to 80 milking cows, (i.e. 77%).
2. On all the sample farms, increase in herd size was motivated by a clear realisation of the possibility of economies of scale and, by consequence, of increased profits.
3. Of the sample farmers, 20 stated that their profits had increased substantially following increase in the size of the dairy herd, 35 stated that there had been some increase in profits and 19 said there had been no change or some decrease or, in a few cases, gave no firm indication.
4. In 30 cases there had been some increase in the size of the farm and over the whole sample this increase averaged 24% (60 acres); however, a considerable portion of the additional acreage was, in fact, concentrated on relatively few of the farms.
5. There was some evidence that the increase in herd size represented a concentration of effort on the dairy enterprise; cows represented a higher proportion of the total livestock units at the end of the survey period and there was a contraction of tillage crops other than barley.
6. There was a marked trend towards labour-saving methods of handling, feeding and milking the cows by such means as better milking facilities, and self-feeding systems.
7. A considerable economy in labour was achieved on many farms. On average, dairy labours per hour per year were reduced from 90 to 42. The greatest saving of labour generally occurred on those farms which had the highest initial level of dairy labour per cow. Also, the higher labour savings were usually on farms which claimed substantial increase in profits.
8. There was a wide range in the level of expenditure (both in total and on a per-cow basis) which was made on farm improvements related to the dairy herd. This was affected both by the nature of the improvements (e.g. some farms installed self-feed silos) and by whether it was necessary to erect new buildings or merely to adapt existing ones. On average the expenditure on such farm improvements was about £98 per cow (based on final herd numbers) and of this expenditure one quarter, on average, was recouped through government grants, i.e. the net cost was £73.

9. On practically all farms fertilizer usage was stepped up concurrently with increase in herd size. Expenditure on fertilizers approximately doubled.
10. Overall, the number of livestock units increased by 39%.
11. There was an increase in stocking density; an average of 1.49 forage acres per livestock unit at the end of the survey period compared with 1.79 acres per livestock unit at the commencement, i.e. an increase of 17%.
12. There was no increase in proportion of off-farm purchases of feedstuffs but there was apparently more effective grass-land utilization and also greater usage of home-grown barley.
13. For many herds there was some increase in milk yield per cow; this was associated with changes in breed composition and was also in some cases related to such factors as more effective culling and feeding practices.
14. In the case of tenanted farms the cost of improvements was in most cases partly or wholly borne by the landlord and it appeared in most of these cases that an annual charge of from 6% to 10% on the cost of the landlord's share of the improvements was included in the rent charged for the farm. On the owner-operated farms finance was provided either from the farmer's own resources or from bank loans or both; in two cases money was borrowed from the Agricultural Mortgage Corporation.
15. On average figures revealed by the survey there seems no reason to doubt the claim by most of the farmers that profits had been increased. Whenever herd size can be increased, without deterioration in the unit labour cost (which might occur because of indivisibilities), the net margin of £39 per cow revealed by the Milk Costs Investigation 1965/66 for this region suggests that considerable additional investment could be profitably employed in order to increase herd size.

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