REDUCTION OF STOCKS BY SIMPLIFICATION

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Simplification, according to the Lemon Report, is the process of reducing the number of types of products made (or called for) within a definite range.

It could be argued that simplification of stores does not mean that fewer stores need be carried, as, even if fewer varieties of an item are used, the *total* number of such items in service will remain the same, and the number of replacements required will not be reduced.

In actual fact, however, a reduction in the number of varieties used of a particular type of store item can lead to a reduction in the total stocks that need be held in store, without adversely affecting the probability of being able to meet requirements.

Suppose the expected monthly consumption (based on previous average monthly expenditure) of a certain item is given by x. Then the probability of using more, or less, than x in any one month is given by the Poisson Distribution with a mean of x :—

$$P_a = \frac{x^a \, e^{-x}}{a!}$$

Where :—P_a = Probability.
x = Expected monthly consumption.
a = Actual monthly consumption.
e = Base of natural logarithms.

Thus if the expected monthly consumption is 100 the probability of getting a consumption of 120 is given by :—

$$P_{120} = \frac{100^{120} \, e^{-100}}{120!}$$

Expressions of this nature are cumbersome, but it can be shown that provided x is not too small the range of probabilities given by the Poisson Distribution approximates to the Normal Distribution with a mean of x and standard deviation of the square root of x.

On this assumption (when x is not less than 10) the following equations will suffice to show what maximum consumption could be expected at various probability levels.

TABLE A

Odds	*Consumption* (*max.*)
1 in 1,000	$x + 3.09\sqrt{x}$
1 in 10,000	$x + 3.7\sqrt{x}$
1 in 100,000	$x + 4.3\sqrt{x}$
1 in 1,000,000	$x + 4.8\sqrt{x}$

Thus, if the expected monthly consumption is 100 there is a chance of 1 in 1,000 that it might reach a value as high as :—

$$100 + 3.09\sqrt{100} \quad \textit{i.e.},\ 131$$

Consider a specific case in which the following assumptions are made :—

(1) There are 5 varieties of a certain item.

(2) Previous history shows that the expected average monthly consumption of each variety is as follows :—

(*a*) 30 per month.
(*b*) 25 per month.
(*c*) 20 per month.
(*d*) 15 per month.
(*e*) 10 per month.

Total expenditure 100 per month.

(3) By simplification it is possible to reduce the number of varieties from 5 to 2.

(4) After simplification the expected average monthly consumption is as follows :—

(*f*) 75 per month.
(*g*) 25 per month.

Total expenditure 100 per month as before.

(5) Stocks are required to be maintained so that the odds of always being able to meet requirements are not less than :—

(1) 1,000 to 1.
(2) 100,000 to 1.

By using the equations in Table A the minimum stock requirements of each variety at the two probability levels have been calculated and are shown in Tables B and C.

TABLE B—5 *Varieties*
(Before simplification)

Stock required to meet odds :

Variety	1,000 to 1	100,000 to 1
(*a*)	47	54
(*b*)	41	47
(*c*)	34	40
(*d*)	27	32
(*e*)	20	24
Totals	169	197

TABLE C—2 *Varieties*
(After simplification)

Stock required to meet odds :

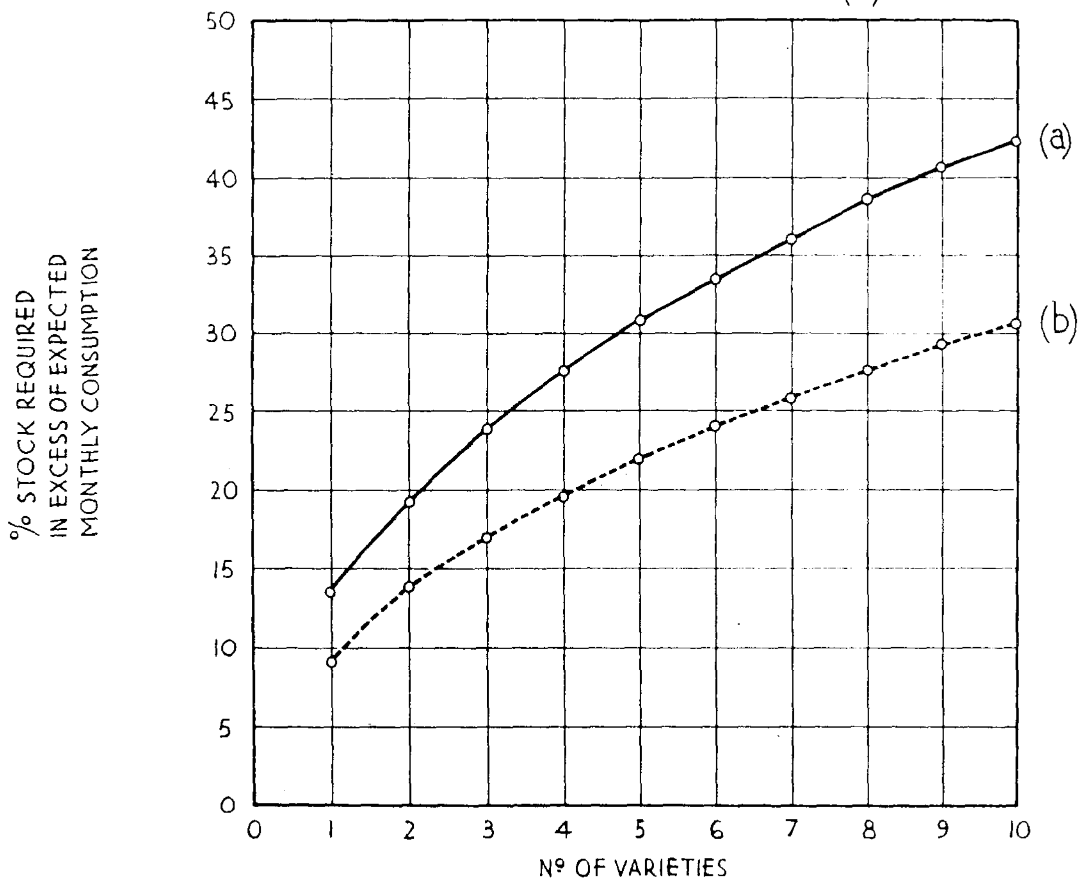
Variety	1,000 to 1	100,000 to 1
(*f*)	102	113
(*g*)	41	47
Totals	143	160

GRAPH I

THE AFFECT OF NUMBERS OF VARIETIES ON STOCK REQUIREMENTS

ASSUMPTIONS:– EXPECTED CONSUMPTION: 1,000 ITEMS PER MONTH

ODDS ON MEETING REQUIREMENTS:– (a) 100,000 TO 1
" " " " (b) 100 TO 1



It will be seen that by simplification it would be possible to reduce stocks from :—

(1) 169 to 143—about 15%
(2) 197 to 160—about 19%

This would have been done without reducing the *total* number of items in service, and without reducing the odds on being able to meet requirements.

These results have been illustrated graphically. Graph I shows how the number of varieties of an item affect the stock requirements, and Graph II shows the effects of simplification on stock requirements. In the latter case the possible percentage reduction in stocks has been plotted against the ratio of " the number of varieties before simplification to the number of varieties after simplification." Three cases have been considered :—

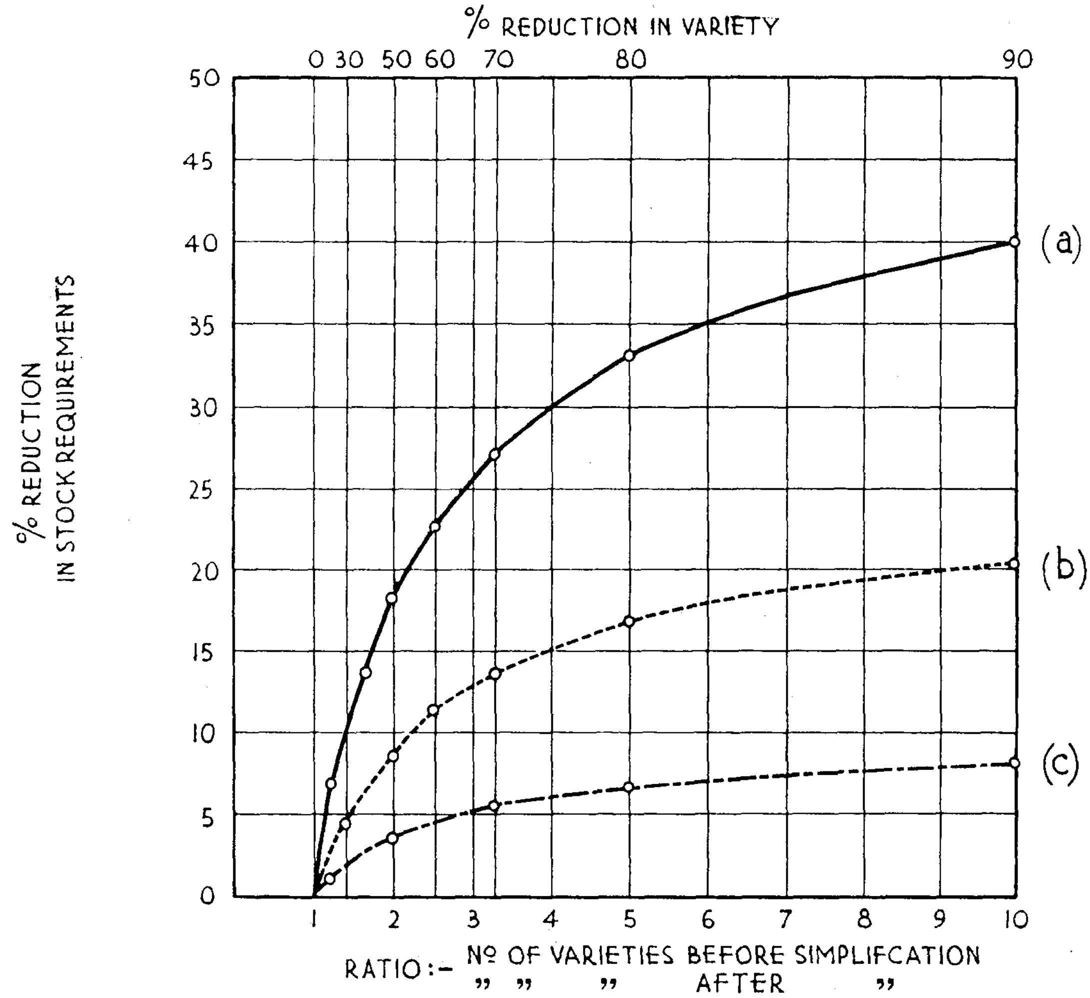
(1) When the expected monthly consumption is 100 items.
(2) When the expected monthly consumption is 1,000 items.
(3) When the expected monthly consumption is 10,000 items.

In each case the odds on being able to meet requirements from stock are 100,000 to 1, and it is assumed that the initial number of varieties is 10.

GRAPH II

THE AFFECT OF SIMPLIFICATION ON STOCKS REQUIRED TO MEET A CERTAIN PROBABILITY

ASSUMPTIONS :– VARIETIES VARY FROM 1 TO 10
ODDS ON MEETING REQUIREMENTS FROM STOCK 100,000 TO 1
EXPECTED MONTHLY CONSUMPTION (a) 100 ITEMS
(b) 1,000 "
(c) 10,000 "



It will be seen that the best relative gain (from the point of view of reduction of stocks required) occurs when the number of varieties is reduced by anything up to about 50%. For higher values the graphs flatten out and the gain becomes progressively less.

Thus even a small degree of simplification can effect a considerable saving in storage space required for stock items.