

THE INSTITUTE OF ACTUARIES

ALFRED WATSON MEMORIAL LECTURE

THE USE OF STATISTICS AS AN AID TO
MANAGEMENT CONTROL

THE following is the full text of the fifth Alfred Watson Memorial Lecture which was delivered on 24 March 1952 by **Mr John Ryan, C.B.E., M.C.**, Vice-Chairman, The Metal Box Company Limited.

I. INTRODUCTORY

I AM conscious that in addressing you this evening I am privileged to have a very special audience. Your Institute and its members represent a skilled type of statistician who practises an art which is recognized as such, one which calls for a degree of competence which the outside world does not question. But I come to you this evening to talk on a subject which covers a somewhat wider area than the field at present covered by yourselves, although it may well be that your own activities might extend more widely over it, if the possibilities were more fully realized. It may be, too, that efforts should be made to explore whether in fact the industrial penetration, either directly or indirectly, by those practitioners of a competence approved by you is in fact deep enough.

I remember that Mr Menzler in his presidential address to you in 1950 did give statistical details of the extent to which actuaries are employed outside what are commonly regarded as their conventional spheres, and he did show that there had been a definite infiltration into the industrial and commercial sectors during the last twenty-five years. He directed your thoughts to consideration whether or not your Institute should further this movement.

I shall not have an opportunity this evening to go into this aspect of the matter in any great detail, but it is possible to suggest that in asking me to talk on this particular subject there is a reflexion of the natural development of an interest of that nature. In the course of what I have to say I will develop further some thoughts upon it. I shall advance the suggestion that the value of statistics as a tool of management is accepted today as of greater significance than ever before. I shall suggest that for the provision of statistics in the most useful form there is a vacuum to be filled by an atmosphere of some expert knowledge, but that our thoughts have not yet been crystallized as to the source from which this expert knowledge can best come. It will be appropriate, I think, in approaching our subject, to have clear definitions of what in fact I mean both by management and by statistics.

II. DEFINITIONS

(1) *Management*

Whatever 'management' was thought to be in the past, I do not think that today it is very different from 'leadership'. The Urwick Committee on Education for Management defined it as 'all those activities involving responsibility for the work of others'. I thought that this definition was worth quoting because it describes the particular aspect of management with which we are concerned today. If management has the responsibility for the work of others, its first requirements must be for adequate information regarding that work. Before,

however, I leave the definition of management perhaps it is worth while looking at it a little more deeply, and the need for this will, I think, become more apparent as I develop my lecture.

The late Prof. Bowie, many years ago, gave me a list of attributes for the ideal business leader. I think they are so good that I am going to give them to you:

(a) Physical and nervous energy—sometimes possessed by those not particularly fit physically.

(b) Enthusiasm. A man may be a 'head man' without enthusiasm, but never a leader.

(c) Adequate command of trade knowledge about his industry.

(d) Mental alertness. Only by continuous study can a man maintain a high degree of interest in his work.

(e) Imagination, or the ability to use the data of past experience in new situations. A lively curiosity and a sense of excitement in new ideas contribute to the finest flowering of imagination.

(f) Character. He is truthful, temperate, magnanimous, sympathetic and honest.

(g) Sound judgment. He knows whether ideas are workable and when he plans for the future he uses common sense as well as imagination.

(h) Courage. He must be brave enough to transform his ideas into deeds. Many a man has failed because he was timid and tried to please everybody.

(i) A sense of humour. The ability to see the comic side of people and of things is a valuable asset.

(j) The ability to listen well. Obviously no man can be just who is not a good listener.

(k) Knowledge of human nature. The ability to forecast the probable reactions of people and to judge individual differences is an indispensable quality. He must be capable of seeing things through other people's eyes.

(l) Purposiveness. He must believe in his job firmly enough to work unremittingly at it.

These attributes make up the ideal type of human being whom we set out to equip with appropriate tools with which to do his job.

(2) *Statistics*

The information which the manager seeks will, for the greater part, be in the form of statistics, which brings me to the second definition, namely, that of 'Statistics'. In its broadest sense this is in fact a special language—a language of size—which is quite distinct from the day-to-day words which we use in our ordinary life. It is a language in which the majority of people can neither write nor read freely, and yet it is too lightly assumed that, in fact, everybody can. This, I suggest, is leading us into great difficulties not only in business but in everyday life, in the press and in economic arguments. We have seen quite recently how obscurity can lead into extraordinary political difficulties when, for instance, one particular aspect of it, the presentation of a graph by television, led to an amazing difference of opinion on the part of people who quite clearly did not really know what they were talking about. It is no criticism therefore of the business-man that he is not, as a rule, a statistician. He will admit that he is not particularly familiar with statistical terms or theory; but he does think that he understands figures. In my view he thinks this much too lightly, and in so far

as statisticians assume—equally lightly—that he understands their language, they themselves are amazed to find that what they have produced is misrepresented or mistranslated.

Taking the mind back through history one can find instances of similar difficulties and misrepresentations which, although they have taken different forms, have had similar unfortunate repercussions on national economy. Broadly speaking, many ancient civilizations had no language of size; this language has developed in different ages in different ways and had different repercussions. It was used sometimes as a weapon in priest-craft, in others for an economic tyranny, but the result was nearly always an unfavourable reaction against it, either because of its misuse or because of the inferiority complex which it created in those sections of the population which did not understand it or feared it. On the other hand, there were civilizations which thought so little about its significance as to handicap themselves in its development. For instance, the Romans could never hope to develop as mathematicians or statisticians so long as they used the system of the Roman figures.

We, however, live in what can be a happier statistical age and one in which I think an enlightened approach is possible. We inherited arithmetic from the Arabs, and it is with the special but limited background of arithmetic that our population lives and moves. You will, of course, readily say that statistics is much more than arithmetic, and with that I should agree, but I would suggest that a statistician in presenting his findings must be more conscious than he often is that it is only to the extent of arithmetical knowledge that his normal reader understands the language which he is using. There are limits here, too, and I doubt whether in these days of millions and billions many using these words of size really understand them.

III. STATISTICS AS AN AID TO FORWARD PLANNING

Let us now consider the contribution of statistics to industrial planning.

(1) *Importance of forecasts and budgets*

The present age has grown impatient with any form of speculation that is not of immediate use. It expects an inquiry to be dynamic, to take account of the economic flux, to show a routine in change; otherwise it is static and without significance in the affairs of daily life. Forecasting is the essential aim both of the economist and of the man of affairs. If, therefore, our ultimate aim is prediction, the most ample and trustworthy data must be statistical, and the only adequate means of exploiting raw statistics are mathematical methods. The application of them to the loose data which are so often supplied by official figures is full of danger. But if it is true that the aim of statistical organization must be towards certainty as regards supply and demand, then talent in the management of industry must be measured by the capacity to foresee and to exploit economic changes; and the efficiency will be proportionate to the accuracy with which those forecasts are made.

It is interesting in this connexion to remember what Jevons wrote:

I know not when we shall have a perfect system of statistics but the want of it is the only insuperable obstacle in the way of making Economics an exact science. In the absence of complete statistics the science will not be less mathematical although it will be immensely less useful than if it were, comparatively speaking, exact.

Prof. Marshall, writing on the need of economic science, said that in his opinion the most important thing was the quantitative determination of the relevant strength of different economic forces.

The great development of statistical theory, together with an improvement in the collection of statistical data, does place us in a much more advantageous position to meet these needs. It is all the more important, therefore, that we should direct our minds to the application of the material which is now so much more amply made available.

(2) *The sales forecast*

(a) *Importance of the sales budget.* It is not necessary for me to go into the details of forecasting techniques because you know all about them and are practising them in circumstances which we have grown up to think, in five years of peace following five years of war, are normal and fundamental. I am afraid I shall, however, have to take you through some of the motions in the practice of forecasting as I develop my argument. In all types of forecasting the sales forecast is the vital factor, but it recedes in importance as the working measure in an expanding economy except in the long-term picture—recedes because it would normally ask for greater maxima than can be achieved—your market would absorb more than can be produced. In a contracting economy it is of overwhelming importance.

(b) *Forecasting in a contracting market.* We know that for many consumer goods the pipeline of distribution has been filled and that we cannot expect to pump in the same quantities as we have been doing recently. We have just received from the Chancellor of the Exchequer notice of measures designed to be deflationary for the National economy as a whole, and there are signs that the spending power of the people will be lower than it has been. But be that as it may, the bulk of responsible financial and economic opinion holds the view that inflation must be stopped sooner or later, and when that is done the problems which the turn round will bring will have to be faced.

It is twenty years since a really deep depression was experienced in the United Kingdom and thirty years since the slump of 1921 gave us such a blow that some industries never recovered. That lapse of time means that practically no one under forty remembers what happened in 1931 to those of us who were already in responsible positions in industry, either as buyers or sellers. It means, further, that the percentage of us who can remember 1921 clearly, whatever our age, is very small.

At that time I remember a change in ten days whereby, instead of having an order book of two years full capacity, and instead of being embarrassed to give satisfactory deliveries, we suddenly had difficulty in finding enough work to keep the factory going from day to day. I remember a drop in prices so severe that the differences in price between customers' orders and the current prices were greater than the capital of customers' businesses.

First of all, therefore, I want to emphasize the first and great difference between forecasting in an expanding and in a contracting market.

In an expanding one you nearly always make money or escape punishment for your own mistakes—in a contracting one you nearly always lose money by them.

In an expanding one you can escape punishment for your customers' mistakes in a contracting one, never.

In an expanding one you can escape punishment for your suppliers' mistakes in a contracting one, hardly ever.

These are strong statements, but I have purposely made them so because they lie at the root of the whole matter.

It is a different kind of forecasting which we must now learn—forecasting of events which will hurt us if we are wrong, and not merely reduce our favourable results—forecasting which calls for alertness and quick decision—forecasting of events which are running away further from us and not of those which will let us catch up on them even if we are slow. It would be wrong perhaps to call it a reversal from over-optimism to pessimism, but it is a reversal from advance to retreat—retreat, not defeat—a retirement to well-prepared positions, to winter quarters to weather out the storm—*reculer pour mieux sauter*.

To continue the military simile, many generals have been successful in attack and failures in defence; so we may have to change some of our generals, the emphasis we place upon the use of some of our weapons. The quantity of them certainly must change.

I have already emphasized that in a contracting economy the sales forecast is the paramount consideration—we neglect it at our peril—we should nurse it and cherish it, watch its every movement and not ignore one of them. It will be more difficult to compile than it was when it was expanding, so that to make it as good will require more care—you will have to run faster to keep where you were. In the past we have depended upon our customers' views and forecasts in making our own—but, unless they are as alive to the changed conditions as we are, we shall have to beware of what they tell us—they may be completely wrong and lead us wrong too.

Contraction will affect some goods and not others—it will affect capital goods differently from consumer goods. What industries are likely to contract now? In what industries are marketing problems likely to become most acute? Here the going is extremely treacherous because conditions today—when Governments have assumed much greater responsibilities for the general management of the National Economy and act unexpectedly, even, alas, irresponsibly—are in many respects unlike anything that has gone before.

Yet experience of past depressions is practically our only guide. Previously, 'capital goods' production has taken very serious knock-out blows, but those engaged in projects required for 'public works' would have been helped by a Government programme which sought to absorb potential unemployment in this way. In previous recessions building and constructional trades have dropped in activity, and if a firm is producing an article even remotely concerned with these it must watch that position very carefully.

All industries and services catering for luxury requirements and services, and for high-priced goods, are immediately affected—the consumer becomes 'choosy' in purchases. Even food is affected, the frills and incidentals are passed by; the housewife cuts down on her polish (a very sensitive barometer to the quantity of money in her purse). It is not sufficient to watch your own sales; the effect in others may be a valuable and early guide to your own if recession goes further. It is a feature of modern marketing that the contraction is most and earliest marked in unbranded or less well-known lines—so watch what is happening to competitors.

It is important to decide what is the size of the residual market if one can feel able to retain it practically all at the expense of others—if not all, how much will one retain? At the same time potential customers may be getting less in number. As a nation we are becoming older; industries catering for the older people have had an increasing market. That will continue, but will those older people,

now retained in industry, be some of the first to go out or will they find alternative employment? If so, will their reduced purchasing power be felt even if their numbers grow? At the other end of the scale the birth-rate has been high lately, as is usual after a war; but, as is also usual, it is now declining. Here is a trend which must be watched by anyone engaged in long-term industrial forecasting.

(3) *Statistical data or sales forecasts*

There are, I think, three main sources of material available for the compilation of our sales forecast.

The first relates to the national market: available data includes national statistics of personal expenditure on consumer goods, current level of savings, bank deposits, earnings, unemployment statistics, etc. Use may be made of various indices, such as the Dow Jones Industrial Average, or the *Financial Times* Indices, which are based on the movement of market values in the New York and London Stock Exchanges. Mr John Crabtree, in a paper read to the British Association in 1931, referred to the Harvard Economic Service triple index, which combined indices for speculation, money and business in one chart, and described how it enabled him to forecast in 1927 the advent of the depression. It is interesting to note that he also forecast the end of the depression, before any upward trend became apparent.

The effect of Government control on the movement of Stock Market values, by means of dividend limitations, profits tax, etc., deserves special consideration because such controls are of comparatively recent growth. A study of Stock Exchange movements should not be made without a clear idea of the part outside control has played—remember that the Stock Exchange anticipates movements as well as records them. It is trying to do the same forecasting as you are yourself.

The second class of information required relates to the individual market, or markets, served by your particular firm. A parallel can be drawn here with the methods used by military intelligence in time of war—in a phrase: every scrap of information counts. An intelligent use of competitors' annual balance sheets, salesmen's reports, trade papers, competitors' selling campaigns, investigation of possible substitutes, customer reactions and complaints—all help to build up a picture of the market potential.

The most important source of information should be the records and statistics kept within the Company. Coding of past sales by product type, area of sale, point of production, and so on, allows us to identify cyclical or seasonal trends which may repeat in the future.

(4) *Other budgets and forecasts*

(a) *Production budget.* We are now armed with our sales forecast—the best we can do—we have tried to think of everything, and unless we are very lucky we confront our Production Division with figures which will not enable them to run to capacity; we sit down with them to decide what we can jointly do about it. If a decision results in a policy of reducing production to a lower level on certain lines then we must take steps to bring that into effect as quickly as possible to prevent stocks accumulating.

(b) *Purchases.* In an expanding economy we have many of us been concerned with quotas and allocations below our requirements and we have been striving to find ways and means to purchase more in order to produce more. It may well

have been that the supply of raw materials has been the limiting factor in our ultimate production budget. It may lose this significance and we may find pressure from our suppliers to take more than we require. On the other hand the reverse may be happening; although our own products may be in less demand, enough raw materials may be withheld from us because of priority demands for armaments, or we may be allowed to have what we require only if we find a suitable market overseas. These factors require investigation as part of our forecasting.

(c) *Cash*. To carry out the programme, as we have now determined it, may have serious implications upon our cash resources. Certain trends may be releasing money, others may be absorbing it faster than it is otherwise available. So we must look very carefully at our cash forecast and remember that to get new cash into business is very difficult when the market is contracting, and in all cases within living memory it has tended to cost more than at other times. Financial umbrellas are always in shorter supply when it begins to rain than they are when the sun is shining.

(d) *Labour*. We are now in a position in our forecasting to see what labour force is needed for the output required. It may well be that if the number is lower than we are at present employing it raises problems for our Personnel Department, who may have to consider which sections of the staff will become redundant. The distinctions between key men and others, between skilled men and unskilled, and so on, are all relevant and must be dealt with in relation to the whole picture; otherwise the impact of excessive labour may have an effect upon our costs and overheads.

(e) *Overheads*. In an inflationary period we have been carrying on business for a long time with overheads which tended to grow and which we could afford in increasing business. We may now have to examine, in the new circumstances which we are facing, what margin we have available for overheads. What is the minimum level at which we can operate successfully and show a margin of profit over the break-even position? We have to distinguish between 'frills' and 'essentials'; but in any cutting down, of course, the action taken must be sound. I have sometimes been told that it is impossible to find any other way except by a crude percentage cut. That appears to me to be the negation of good management. We ought to consider what is essential and what is not; it may even be that, in certain directions, it will pay us to increase our overhead costs in order to get, in the aggregate, a reduction in the whole cost of the operation.

(f) *Profit*. Having made these forecasts of individual aspects of the Company's business, we now proceed to formulate our trading budget, i.e. our forecast of profit or loss for the following year. This annual budget, like the other parts of the Company's budgets, will be broken down into monthly components; thus the Board will, month by month, be able to measure its own financial performance against the yardstick which it has created at the beginning of the year.

(g) *Capital*. Any long-term forecasts of sales or production inevitably involve consideration of forward capital developments. These developments must be planned in the light of forecasts of sales, availability of finance, the profitability of the particular investment and, in these days, delivery periods of items of capital equipment. In particular, the assessment of profitability is one which has exercised men's minds as long as men have borne the risk of venturing their capital in hope of reward. Even now, however, the uses of scientific and

statistical forecast techniques can do much to reduce to a minimum the hazards which inevitably beset risk capital.

And so, having completed our forecasting operations, we enter into a period of trading with a complete picture of what we expect the future to have in store for us, and we have a yardstick in every phase of activity by which to measure the results as they come along.

It is, of course, obvious that we must now arrange to have available regular statistics of the same nature and covering the same ground as we have used in our forecasting, so that we shall have the individual yardsticks to measure each particular activity. We may have found in our forecasting that the information available to us has been scanty or non-existent and we have had to do our work without it. We must arrange to build up these statistics for the future.

IV. STATISTICS AS AN AID TO MEASUREMENT OF PERFORMANCE

In addition to the use of statistics in comparing actual performance with the forecast, I should like to draw your attention to experiments in the statistical techniques of measuring what is loosely called productivity. Attempts have been made, unsuccessfully, to compile over-all indices of productivity for individual industries and firms—in particular some attempts to compare similar industries in the United Kingdom and the United States have fallen into the statistical error of not comparing like with like.

I support the opinions expressed by the Joint Committee of the Institute of Cost and Works Accountants and the Institution of Production Engineers that

there is no known measurement (and it seems unlikely that there ever will be one) that accurately reflects over a short period of time, changes in the over-all productivity of a country, industry or firm.

Instead, experiments are being made in measuring the effective use of each of the main factors of production—labour, materials and capital. Ratios of output per man-hour, of materials wastage, of production per machine-hour, and many others, are being used in attempts to obtain statistical measures of performance. The particular ratios which are employed differ from one industry to another according to the type of operations involved. In some industries ratios based on systems of Standard Costs are being used; in others simpler and more direct forms of measurement are proving effective.

I must mention also the progress which has been made in the last ten or fifteen years in the development of statistical techniques for quality control. This is the chief field where techniques involving the application of mathematical statistical theory are used as instruments of management control on the factory floor. In mass production there are many cases where it is sufficient to manufacture an article, not to an exact dimension, but within certain limits of tolerance. It has been found that variations from the mean follow the 'normal' law. Instead of inspecting the whole range of production, periodic samples are taken and the usual sampling theory is used to determine the permitted variation of the sample from the mean in order to ensure, within defined limits of probability, that the universe falls within the required tolerance limits.

V. ADMINISTRATION OF STATISTICS IN INDUSTRY

(1) *Role of accountants*

I am not quite sure whether I am addressing you this evening as a business-man, a statistician or a mathematician. I started my adult life by being prepared to be the last-named; in that I penetrated to an understanding deeper than perhaps business life has called me to use, but I am conscious that although this may have given me an appreciation of the problem from both sides it has also given me a realization that to understand the language of mathematics is not necessarily the same as to follow completely the idiom of statistics, even if the nucleus of that idiom does not itself split and diverge into its own specialist fields. You have, I am sure, in your own particular profession a technique which I should find too hard to follow. But possibly, if you were called upon to explain your working beyond the point of merely giving your results, you might often find that it raised difficulties of its own.

The financial statistician in the shape of the accountant is in a similar position; but, as his penetration into the business field both directly and indirectly is at present wider and deeper, by the very nature of things, than your own, the difficulties that it creates are correspondingly more significant. It may perhaps be useful to dwell upon this point for a little time because it raises certain issues which are very vital in management practice and will serve, I think, to illustrate the point I am trying to make more significantly than any other. I have recently spoken to accountants on several occasions on one or two aspects of this matter. Let us take, for instance, the simple point of accuracy.

The accountant is trained to apply an analysis of quite minute precision to the operation of a business at given points of time. His findings may take some time to calculate, and the reports will necessarily follow after the appropriate moment for action on the various points of detail. Once a year he will call on the assistance of an authority even more objective than himself—the external auditor. Between his own staff and the staff of his auditor the entire financial structure of the Company will have been subjected to the most painstaking analysis, with all the checks and cross-checks that can be devised by the terror of the law and the scruples of his profession. The management may well wait impatiently for the figures, and many decisions on day-to-day matters will of necessity be made before their arrival. But delay of that nature—provided that it is kept within limits—will not impair the true value of the financial accounts. This value lies, and must continue to lie, in the safeguard which the accounts provide over the financial health of the company. They serve to protect the interests of the shareholder, the State, the management and the employees. They constitute both a check on the past operations and a guide to future action. The figures which they bring to light are (or at least should be) above all question, for first and foremost they are presumed to be accurate.

This question of accuracy is one upon which I invite you to focus your thoughts for a few minutes.

Accuracy does not come by chance. It is a positive thing, sometimes a painful thing. Carelessness is so much easier—careless observation, wishful thinking, inaccurate listening, lazy mental habits, indifference. Because accuracy means steady, thoughtful effort, it is irksome to many brilliant natures. Many a fine scheme that looks noble in general outline falls to dismal failure through lack of careful planning and accurate execution.

Is it too much, then, to demand of others that they be accurate in whatever information they may convey to us? Or to demand of ourselves the utmost care against error in our statements to others who may depend upon us for reliable information?

In industry, accuracy more than any other one thing has made possible high speed combined with high quality. Every executive of a large enterprise knows that for successful operation he must rely first of all on the accuracy of statements given to him by subordinates. He cannot hope to visit every department or inspect the whole operation with one pair of eyes, yet he must visualize and co-ordinate the activities of perhaps dozens of departments or plants each day. To manage the enterprise successfully he must have reports and figures upon which he can depend absolutely.

The provision of such information by accountants was the subject of a stimulating paper by Mr de Paula at a conference of the British Institute of Management in 1949. A high-ranking soldier, commenting on this paper, drew the following analogy between the information required for military and industrial operations.

There are two separate types of operations, namely, the set-piece operations and the subsequent more fluid and fast-moving operations. Examples of set-piece operations are Alamein, the 'Overlord' assault in Normandy and the crossing of the Rhine; examples of fluid operations are the advance across the desert up to the expulsion of the Axis armies from Africa and the advance from the Normandy bridgehead to the Rhine.

There is a great difference between these two as far as information is concerned. In the set-piece operations there is comparatively ample time to obtain, sort out and appreciate your intelligence. In fluid operations there is never enough time and this is where the great art of command is practised or not as the case may be. 'Shall I wait for more information or must the decision be made now to be effective?' This is where the military intelligence machine is all important. If it is sluggish or inaccurate, great opportunities are irretrievably missed or great blunders made, just because there was not sufficient intelligence at the commander's disposal when the decision had to be made. There must be parallels in industry.

Any miscarriage or mischance must be reported at once so that the commander who holds the reserves can correct it if he wishes, but far more important is the rapid and accurate reporting of success so that the reserves can be used to exploit it at the right and fleeting moment, which never returns. This is how battles are won.

I would refer also to another, and possibly the chief, contribution which an accountant, and the accountancy profession as a whole, can contribute to a business and indeed to the entire industrial structure.

There are in the fields of finance a large number of terms in use whose very meaning is, to say the least, obscure, and it is upon the interpretation of many of those terms that the whole financial structure of a business is founded. If I refer only to such words as 'costs', 'assets', 'depreciation', 'capital', you will know the sort of thing I mean. Now it is in the understanding of such terms and in the interpretation and application of their significance to the operations of a business that there lies, I believe, the true field of accountancy. It is here that the business man may expect, indeed must expect, all the guidance and help which he can get from his accountant.

I would go further. There are few aspects of the whole field of business management which are more urgently in need of freshness and originality of thought than that of true financial accounting. I say this in no sense of disrespect

for a profession for which I have the greatest admiration, nor in ignorance of the great progress which has already been made since the war. But the accountants have for years been carrying on their struggle to cope with the demands of the Treasury, of the Inland Revenue, of Company Law, of the Stock Exchange, of their Boards of Directors, and of their functional executives. Who can blame them if they have at times become weary of the struggle, and if they have even shown a very natural desire to escape into the freer and perhaps more exciting field of statistical interpretation and general management control. But they would be wrong, fatally wrong, to consider that the fields of financial and cost accounting are too restricted even for the most ambitious amongst their numbers, or that the scope for advance and development in their own technical field has in any way diminished with the passing of the years. Indeed the development of large-scale business and the complexities of modern business life have created opportunities without parallel in the past.

If the management of a business still looks to the accountant first and foremost in his professional capacity, it is not because the accountant has failed to prove himself worthy in the broader fields of business management: it is rather because there lies in the technical execution of his own professional duties all the responsibility that a man can reasonably be expected to assume.

Financial control is a tool of management and as such it must be up to date, always kept in trim and efficient in operation. It is not the master, but the handmaid, and is no substitute for the line authority.

Financial control must, as I have said, keep itself up to date and be technically efficient. Today, like many other things, it finds that some of the anchors which it had grown to think of as immovable have come adrift. Inflation has brought a range of problems in which accountants all over the world are seeking answers to their own questions. The revision of many of the conventional accounting principles, the construction of balance sheets, the effect of technological progress on the replacement of fixed assets, the revision of costings, the methods of calculating taxable profits, the methods of valuing stocks, etc., are all in the melting pot. In this country, where inflation has been comparatively small, realization of these problems is slow to crystallize, but in countries where it has been uncontrolled, there is a general recognition that the old principles are outmoded.

And in striving for a solution to the new problems we may be setting many more for ourselves. Take the new provisions of the Companies Act, admirable in principle, full of safeguards to protect the ignorant and punish the guilty. Do they not in many ways complicate rather than simplify the issue? Have we not experienced cases where directors, in order to comply with the law, publish a jargon which is meaningless to themselves and must surely be even more so to the uninitiated?

We must be careful, therefore, that our financial control in the business does not gum itself—and us—in its own web.

It is a tool of management and must not therefore be content merely to produce evidence and information, but must distil from it what it all means, project forward its advice on what can happen to affect our business, and show us in clear and unmistakable form what is happening—and show us quickly.

I have dealt at some length with this aspect of financial statistics from an accountant's background because it is a very live issue today; and one for which it is very necessary to find a solution, if management is to have through this channel the answer to some of its problems.

But before I leave this particular sphere I would also like to deal with it from another angle. The financial accountant grew up with modern industry and commerce with the emergence of the Joint Stock Company background 100 years ago. The older procedure whereby the individual trading ventures of the great London Companies had been, in effect, individual enterprises each separate in itself, the gains and losses on which were accounted for at the end of the operation, gave place to continuity of operation calling for a new approach, the creation of the Joint Stock Company, a corporate entity from a legal point of view. This has brought into being what has been described as a 'plunge into metaphysics'. Dr Cooke, writing in the *District Bank Review* last year, has shown very clearly how this involved the problem of providing a picture of a Company's position by its balance sheet and profit and loss account which, in his words,

will give to a reasonable man unconnected with the Company, as well as to its members, sufficient information to enable them to draw proper conclusions as to the Company's future.

But at that point judgment replaces fact, and the answers depend not on calculation, nor on verification, but on individual technical judgment. It is, therefore, open to question whether it is any longer appropriate for the financial statistician to be the person to give judgment on such matters. It is, for instance, a tradition of his profession to place great importance on 'playing for safety' and putting figures on the low side rather than on the high. But, as a tool of management, figures are just as open to criticism if they diverge from reality on the under side as they are if on the over side. And that is particularly relevant when they are used for forecasting.

That brings me from the accountant nearer to the realm in which you yourselves are predominant. The manager of today must, in my view, be much more concerned with what is going to happen in the future than with a post-mortem of what has happened in the past. I hold very strongly to the view that we know more about the future than we think we do, and I lose no opportunity of emphasizing this particular point.

I want, however, to place the main emphasis not on the day-to-day recording of financial results, but on the earlier planning which should have taken place in the policy of the business.

I am amazed when I see, as I do from time to time, companies having to announce drastic changes in their fortunes—so different from announcements they may have made some months before. I am led to the conclusion that those in control did not know what was going on, could not see the wood for trees, or were like the little girl who said 'How do I know what I think until I hear what I say?'. There is no excuse for a refusal to have intelligent budget forecasting. Without it, no business can achieve all that is possible. With it, achievement can be immeasurably better than those who have never practised it can even believe. I exhort them to try it and see for themselves. I repeat we know much more about what is going to happen in the future, than we think we do. You may consider this is a very bold thing to say in these treacherous days, when we are not masters in our own house but are only slowly emerging from the mass of controls, quotas, restrictions, etc., inherent in the waging of a war—indeed it may be that a policy of full employment, now accepted by all political parties, may also bring with it a continuance in the same or another form of similar conditions. Of one thing we may be certain: we shall never go back to the conditions before 1939, let alone those before 1914.

(2) *Co-ordination*

Co-ordination of statistics presents a constant challenge, particularly in the large company. Quite simple words assume a multiplicity of meanings within various departments of the Company. A salesman or a sales manager has completed a 'sale' when his customer signs the contract. To the rest of the Company that merely constitutes an 'order', only converted to a 'sale' when the goods leave the factory. A commercial department will calculate the strength of an order book from the total orders placed; a manufacturing department will gauge its strength from the total of orders for which delivery instructions have been given—what they may well wish to term the 'active load'.

A factory manager will wish his factory's performance to be judged by the total goods leaving the machinery lines; irrespective of whether they have been dispatched to the customer, placed into stock, or sold internally to another manufacturing unit of the company. For accounting purposes each of these forms of disposal may require to be returned in different ways, whilst from a commercial point of view the sales of the factory may well be limited to those goods actually passing from the factory to the customer.

Your business statistician can do valuable work by drawing attention to divergencies of this description and to the anomalies which they are apt to throw up in the statistical returns. He may well find it of use to advocate the setting up of an inter-departmental statistical committee. Such a committee forms an attractive meeting ground for those concerned with the preparation of and those who use statistics, and if intelligently directed, can prove of great use. In particular, the committee can check that most notorious of all habits—the tendency of figures to breed more figures. If all proposals for new statistical returns are channelled through the committee for consideration prior to institution, this process will be found to exercise a healthy deterrent to the over-hearty statistical demands of sundry executive departments and advisory committees.

I have referred in passing to a considerable quantity of routine statistical data which is required in the day-to-day running of the business. If every member of the management received every copy of every return, he would never get any other work done at all. The rule should be that statistical information is only passed to those who really require it in the performance of their jobs. The circulation of such statistics to individuals for 'general interest' ought to be rigidly controlled. The compilation of such figures is both a waste of time, and a waste of money.

Just as it is important that statistics should not be given to people who do not need them, it is also important that other people should actually obtain the information they require. In a large company it is quite possible for an individual to be entirely unaware of the existence of such information within the organization. It is equally possible for him to set about trying to fill what he imagines to be a statistical gap, and so to set in motion an entirely surplus and useless series of statistics.

I would advise, also, that statistical returns be addressed to recipients by virtue of the appointment which they hold, rather than as individuals. It happens not infrequently that when an individual passes from one appointment to another he takes with him his whole set of statistical returns. Thus he will continue to receive information which can only be of indirect interest to him: more serious still, the new occupant of his old position will be deprived of the

statistical information which he will require for the proper execution of his function.

(3) *Presentation and interpretation of statistics*

If maximum use is to be obtained from statistics in a business they must be efficiently and systematically produced. First of all, those responsible for the production of statistics must have a clear appreciation of the uses to which the statistics will be put; and, secondly, they must be provided with adequate machinery for their production.

With regard to the latter I do not propose to say a great deal. Punched cards or some other form of mechanized accounting, with all of its facilities for the production of statistical by-products, is obviously of great help to your business statistician. Such systems suffer, of course, from the disadvantage that the physical production of many of the statistics may of necessity have to be subordinated in point of time to the production of accounting information, and to that extent the returns may appear more slowly than could be desired. But for all that, mechanized production of statistics, if properly conceived and supervised—and if the temptation to overloading is avoided—should bring to the company's statistical returns a uniformity, accuracy, and reliability that it is difficult to achieve in any other way. The machine may well fail to provide all the statistics which are required, but it should, at the very least, provide a first-class starting point for deeper statistical research into the company's activities.

In pointing to the advantages of mechanized statistics, I am fully aware that in most companies circumstances may well render full mechanization either impossible or uneconomic. My advice is that such companies should sharply limit their statistical adventures.

In such cases it is useless to expect from functional and executive departments an industry and activity in the production of statistics beyond their power. We must get our own thoughts clear as to what are the really essential returns to be prepared, and direct our entire effort towards ensuring that those returns are prepared as quickly, as accurately and as systematically as possible.

So far as presentation is concerned, the most important point is to ensure that statistical returns should be suited to those who have to read them. In particular we must bear in mind the differing statistical requirements at various levels of management control. At top levels excessive detail is both unnecessary and distracting; supporting information should, of course, always be ready on demand, but there is no reason to display all the goods in the shop window. We must avoid, in particular, excessive footnotes, long-winded headings to tabulations and the giving of undue prominence to the many reservations which must invariably underlie much of the statistical work which is done.

Farther down the line such footnotes and reservations, and much of the background detail, may well be essential for the initiation of executive action. We must see, therefore, that our contacts are secure at all levels; we must not try to make one set of returns serve all purposes. If we do, the chances are that we shall not succeed in serving any of them efficiently.

The responsibility for statistical interpretation has been the subject of much controversy. To my mind the issue is simple enough. There is no necessary connexion between the physical production of statistics and the interpretation of the statistical results from the point of view of management control. Nor is there any strict necessity for all interpretation to be concentrated at one point. For instance, in most companies there is a fairly clear distinction between accounting statistics and general departmental statistics; responsibility for

interpretation might well be similarly divided. The Comptroller or Chief Accountant will undoubtedly comment on the accounting statistics as part of his periodic Board reports. He is not necessarily the person most suited, either by training or background, to comment on the general departmental statistics covering the various aspects of the company's activities. Each executive department will, of course, interpret its own figures from its own particular knowledge.

But I believe that there is a place, in the larger companies at any rate, for some single over-all interpretative function which can draw in the statistical returns and comments from the individual departments and interpret them, objectively and as a whole, and in relation to external statistics, as a guide to the company's progress.

I believe that this might well prove the most important function of all to be performed by the business statistician. In so far as he succeeds in doing it, he steps, of course, out of the strictly professional role of the statistician and is projected into a function of the business manager. The extent to which he achieves this synthesis may well be the measure of his true value to the company.

(4) Statistical research in industry

I should like to refer here to two committees which have recently been established to study different aspects of industrial statistics.

First, a joint committee of the British Institute of Management and the Association of Incorporated Statisticians has been set up to study current statistical practices in industrial enterprises and to make recommendations for the more widespread adoption of the best of those practices. Separate sub-committees have been formed to study statistics in the fields of production, selling, finance, purchasing, personnel, and development and research.

Secondly, a joint committee of the Royal Statistical Society and the Society of Incorporated Accountants has been set up to study statistical techniques applicable to the particular field of accounting.

Each of these committees is fortunate in counting your President among its members.

VI. GAPS IN EXISTING STATISTICS

I have already indicated that, in order to make effective forecasts and judgments, we must have recourse to a wide range of statistics produced outside the Company, e.g. by Government Departments at home and abroad, by the banks, by trade associations, and by research foundations. Notwithstanding the wealth of statistical material that is now available, I should like to draw your attention to some very important gaps in existing statistics.

Gaps in the statistical knowledge of the general public can exist either because the statistics are simply not there or because they are not made generally available. Such statistics may be withheld either because of statutory obligations concerning the secret or confidential nature of the information, or because the manpower is not available to sort and tabulate the information in a way which would make it suitable for publication. Alternatively, even though the manpower could be made available, it might be considered that the total public demand for statistics presented in some particular way would not be great enough to justify, especially from the point of view of cost, the work involved in their preparation. Much of the material required by the research worker is of this order.

It follows, therefore, that to record gaps in our statistical knowledge is not

necessarily the same as to record gaps in the statistics themselves. An awareness of our statistical deficiencies is, however, a necessary preliminary to overcoming them. We may find, as we come back to probe deeper, that many of the defects are in effect more apparent than real and that much of the basic statistical material already exists, though in non-accessible form; if that be the case surely the very fact will itself provide us with tremendous impetus to ensure that there is made available to the *bona fide* research worker both in industry and outside it (subject only to statutory obligations of secrecy) any supplementary statistical material which is known to exist, but which for some reason or other has hitherto remained undisclosed.

Where then do the main gaps lie?

(1) '*End-uses*' of materials

There is a general lack of statistics on '*end-uses*' of basic raw materials, which are needed by both producers and consumers. Not only does the producer require an analysis of his ultimate market, but the consumer, particularly in a time of shortage, requires an assessment of the relative size of his own consumption compared with the total, and of his own trade's consumption compared with that of other trades.

At the present time, when raw materials are in short supply and are coming more and more under Government control, this information is vital—indeed, I would say that it is more vital in this '*cold war*' than it was from 1939 to 1945. For then, the Government exercised the control and it was on their own behalf that materials were almost exclusively used: now, although the Government exercises the control, materials are still mainly used by private firms for private purposes.

For certain commodities, of course, some statistics on '*end-uses*' are available. For instance, during the period in 1950 and 1951 when the distribution of steel was not controlled, the British Iron and Steel Federation did publish monthly statistics of the '*end-uses*' of steel in broad trade categories. For reasons connected with the administration of the steel-rationing scheme, these statistics will now be available annually only, and in a form different from that of the series which has been in operation for the last two years.

This latter series does, however, illustrate the kind of difficulty which is raised by an analysis of this sort. The largest individual item (I quote from the return of the four weeks ending 1 December 1951) in the analysis of net home deliveries of those products whose '*end-use*' is analysed, relates to deliveries to stock-holding merchants and amounts to over 10 % of the total. This steel will eventually find its way into one or other of the '*end-uses*' for which an ostensibly significant figure is shown. This does, of course, impair the statistical significance of all the '*end-use*' figures. *A fortiori*, in the analysis of '*end-uses*' by different types of steel, many individual items appear to have no statistical significance at all.

In the commodity in which I have a particular interest, tinplate, we have as a Company compiled a detailed analysis of our tinplate consumption in terms of the products packed in tinplate containers. We have, moreover, succeeded in reducing our '*other uses*' item to less than $1\frac{1}{2}$ % of our total production and this item is an exclusive one (i.e. it does not overlap with any of the '*end-uses*' specifically analysed).

These are, however, exceptions and our national ignorance about many commodities is appalling. When, for instance, the shortage of sulphur became

apparent a year or so ago it was extraordinarily difficult to obtain any clear statistical picture of its likely incidence on industry.

As a first step I suggest that when the results of the 1948 Census of Production are consolidated, the Board of Trade should tabulate an analysis by consuming trades of the major raw materials in the 'Purchases' section. Such tabulations would, of course, be subject to a number of statistical limitations which would need to be borne in mind when interpreting them; but they would, at any rate, take us a step further into what is, for many commodities, unexplored country.

(2) *Census of production*

I should like to take this opportunity of making a comment on the Census of Production. As I understand it, it appears to be the intention of the Board of Trade to call for a detailed analysis of purchases and output every third year only and to ask for totals only of these on each schedule in the two intervening years. In many cases a schedule covers a large number of distinct and unrelated products, so that we shall get an opportunity only once every three years of seeing output figures for the products in which we are interested.

I can understand the Board of Trade wishing to confine the detailed analysis of purchases and output to three-yearly intervals—I would, however, plead that more individual companies should themselves publish their turnover figures so that we may, by taking representative samples of particular trades, be able to make our own estimates for the intervening two years.

(3) *Stocks and work in progress*

Side by side with indices of sales, we need some measure of variations in stocks—both manufacturers' stocks and stocks in the pipe-line of distribution—and, where it has significance, work-in-progress. Clearly, it is not possible to analyse finished goods stocks as easily as the published figures of raw material stocks, but an analysis by trades, compiled on a sample basis at monthly or quarterly intervals, should give us information which we would have used with advantage had it been available in the past, and which we shall certainly need in the future. The pipe-line kept us going for some years after 1939, although the reservoirs feeding it were drying up. Will it do so again? Perhaps at the present time consumer resistance, by closing the exits, is causing the reservoirs to fill up higher—perhaps too high, with risk of bursting the dams. Who knows? Would it not be safer if we had this knowledge?

The United States Department of Commerce, for instance, publish monthly statistics of inventories by the following states of fabrication: purchased materials, goods-in-progress and finished goods.

(4) *Labour turnover*

I was glad to see the analysis of workers by trades and age-groups published by the Ministry of Labour last summer. In this period of full employment, the age-distribution of workers in different trades is of great importance. The lack of young workers is, of course, one of the major problems of the coal industry.

Another major problem which full employment presents is labour turnover; the cost to industry of the present high rate of labour turnover is simply enormous. Apart from the direct and immediate cost of training new operatives, time is lost, production of a whole line may be slowed down, and the incidence of defective work and material wastage is increased. Conversely, a stable labour

force increases productivity, not only of the individual operative, but also of a group of operatives who become accustomed to working together over a period of time.

We have, however, made little progress in analysing the problem statistically. The Ministry of Labour, it is true, publishes an analysis by trades, but this fails to answer such a problem as 'Why do people leave one job and go to another?' It fails also to reveal whether the high rate of labour turnover is due to a relatively small 'floating population' who take several jobs in quick succession or whether there is a substantial turnover of fully trained operatives who have been in one job for some years. The British Institute of Management recently collected some data to cover this type of question on the basis of a small voluntary sample, which was not, however, sufficiently representative of different industrial groups, localities and size of companies to justify the drawing of any general conclusion from it. This gap in our knowledge—the lack of an analysis of 'leavers' by reason for leaving and length of service—still remains. Until it is filled, we shall be ill-equipped to tackle the problem of reducing the present excessive rate of labour turnover.

(5) *Distribution*

I welcome the Census of Distribution and Services as showing for the first time the framework of the distributive field about which there is at present a minimum of statistical information. Personally, I do not expect any spectacular results from this first census itself. Until now, sample surveys in the distributive field have been very difficult to undertake, since the size and general framework of the universe have not been known. The chief merit of the census is that it should provide this framework and enable gaps to be filled in by sample surveys.

What then are the gaps which will still need to be filled when the Census results are published? The main gap, in my opinion, in our knowledge of distribution is the complete absence of any kind of reliable cost data. Distributive margins for most goods appear to be fixed entirely on a traditional basis; whether or not, for any particular product, they bear any relation to the actual cost of distribution is problematical, there is certainly no statistical basis for the majority of them. Sample surveys into distributive costs should help to ensure that the distributive margins included in official prices bear a reasonable relation to costs of distribution.

One item of distribution costs, which for some goods is of considerable magnitude, is advertising expenditure. At present little is known of expenditure in media other than the press. The Advertising Association has, however, just published a book, *Advertising Expenditure in 1948*, which should help considerably to bridge this gap in our knowledge. It analyses expenditure in all media and through the many advertising channels and, for the first time in this country, presents a statistical picture of the advertising trade as a whole. I commend this book to all of you who are interested in the economics of distribution.

(6) *Indices of sales and prices*

Another large gap in distributive statistics which cannot be tackled until after the publication of the results of the Census could be filled by the creation of a reliable index of retail sales. There appears to be a general mistrust of the present two indices of sales, viz. sales by large-scale retailers and by independents. I know the Board of Trade is aware of the limitations of these indices, whose weights have had to be estimated rather than based on known data for a base-

year, and I know they will welcome the opportunity the Census will give them of compiling a retail sales index on a sound statistical basis. Until then we must remain without any really accurate picture of what the public is buying.

(7) *Capital and capital formation*

Until recently one of the most glaring gaps in industrial statistics has been in the field of capital. One only needs to consider the wide range of statistics available about labour, unemployment, absenteeism, etc., and compare it with the almost complete absence of statistics in the capital field to appreciate the extent of the gap. It is for this reason that I welcome the results of the sample inquiry into capital expenditure in 1948 and 1949, published in April 1951 and incorporated into the White Paper on National Income and Expenditure.

This marks a step forward in our knowledge of annual capital formation in different trades; it is to be hoped that subsequent inquiries will not necessitate any substantial amendments to the current figures. These figures, of course, relate solely to capital expenditure in the past. Of more value to the industrial economist would be an analysis of the capital commitments which industries have undertaken for the future. This was, you will remember, recommended by the Nelson Committee in 1945.

While this recent inquiry has increased our knowledge of the distribution of gross capital formation as between industries, there are still substantial gaps in our knowledge of how it is financed, i.e. to what extent it is financed by the Government and other public authorities, by private companies (either by depreciation provisions or by the allocation of undistributed profits) or by the personal savings of the general public. This latter source, being the marginal source as far as private industry is concerned, is of considerable importance.

A relevant figure (Gross Personal Savings) in the White Paper on National Income and Expenditure appears to be a balancing one which has no reality of its own and is in fact subject to substantial revision from year to year. The figure for 1948, for instance, is shown in successive White Papers as £220, £409 and £317 millions.

There is a real need for the publication of figures of personal savings sufficiently accurate to permit their being used with confidence by industrial economists. I shall return again to this question of statistics of savings in a few moments.

We are still, moreover, almost entirely devoid of information on the total amount of capital in existence and its distribution between various industries.

I appreciate that in these times any assessment and analysis of the total capital resources of the country runs immediately into the difficulties associated with high replacement costs, depreciation scales and so on. Such assessment is, however, necessary as a preliminary to any study of the capital (as opposed to the labour) utilization of our industry and also (as the Nelson Committee pointed out in 1945) 'as a yardstick against which new additions to capital equipment each year can be compared'.

(8) *Purchasing power, savings, etc.*

I should like to refer here to the lack of statistics on short-term movements in personal disposable incomes, i.e. the money which the public has available to buy goods and services. Annual figures are, of course, published in the White Paper on National Income and Expenditure, and quarterly estimates have been published by the Oxford Institute of Statistics. One of the major problems in

business forecasting is to relate the purchasing power of the public to the future plans of the enterprise, and under present conditions statistics for a calendar year published in the following April have only a historic value. We need quarterly figures, not compiled by an unofficial body—valuable though the Oxford figures have been—but supported by the resources of the Central Statistical Office.

The statistics of savings, also, are inadequate. We have, it is true, figures published periodically of National Savings, Post Office Deposits, Endowment Assurance Premiums and money invested in Building Societies, etc. What we chiefly lack is knowledge of how these savings are spread throughout the community. Are they concentrated in a few hands or are they widely spread? If the latter, then how widely? How do they vary within each income group? Do the lower income groups regard savings purely as a short-term matter (e.g. saving for a summer holiday) or is there a substantial degree of stability in the holdings? If, for instance, savings increase over a period, is this due to more people saving or merely to the old savers saving more?

The Oxford Institute of Statistics has recently undertaken in Oxford an experimental survey of saving habits of the middle classes, and a survey (which has not been published) was undertaken on behalf of the National Savings Committee by Social Survey Ltd. in 1948. The Government Social Survey is at present planning an official survey which will, of course, take some time to complete. The book which Mr Hargreaves Parkinson wrote just before he died, *Ownership of Industry*, approaches the problem from a somewhat different angle. In the main, however, there is at present no reliable body of national statistics from which we can glean the answers to these problems.

I would press for a statistical examination of the calibre of the people who save, not only as a guide to future trends in purchasing power but also in relation to the financing of capital investment. While considering the field of the assessment of purchasing power I should like to draw your attention to the absence of any statistics on consumer credit transactions. Hire-purchase is, of course, very much more widespread in the United States than here, and statistics are published there by the Department of Commerce. In the United Kingdom, however, there were signs of a substantial increase in hire-purchase trading prior to the restrictions which have been placed upon it; but there is no measuring rod with which to measure either the previous extent of the trade or any reduction which may occur in the future. Variations in consumer credit have, in the past, had considerable significance in indicating general economic trends, in addition to their immediate importance to anyone selling consumers' goods. It is to be hoped that, in any sample surveys following the Census of Distribution, an attempt will be made to provide us with some indication of such trends.

(9) *Sample surveys*

When considering gaps in our statistics I should like to take this opportunity of urging the wider use of sample surveys for two purposes—first, as I suggested when considering the Census of Distribution, to cover a field which is too large or cumbersome to be covered completely, and secondly, to provide quickly up-to-date figures which can, if necessary, be revised when the data for the whole universe are available. This technique is widely adopted in the United States. There, statistics of inventories, personal income, consumer credit, and many others, are compiled monthly on a sample basis. I commend a more widespread use of sampling to producers of statistics in this country—and with

this, as a very necessary corollary, the appreciation of the 'margins of error' involved. The cost and the value of samples can be conditioned by this, as you all know, to a significant degree, and a proper realization of this would encourage the use of this technique to a degree which would make a major contribution to our knowledge.

VII. CONCLUSIONS

The wide range of my subject has encouraged me to delve into many of the significant problems that await solution before we can achieve the improved efficiency of performance which the wider use of Statistics could bring; and to do so more deeply than my time could really permit.

In the concluding minutes I would like to emphasize what these problems are so that, in the many gaps which I have left in my treatment of them, you may be the more conscious of the opportunity they provide for thought and research.

I place almost in front of them all the over-riding consideration of this 'language of size'. Must we not give more thought to teaching its 'A.B.C.' as well as its idioms, and explain that its use requires study and teaching if it is not to bring ridicule on its users, or indeed lead them actually astray? And, as it is now accepted as a business and economic language, let us remember that, as teachers of it, we must adapt ourselves to the users and give them a vocabulary which enables them to express their own thoughts and actions.

Given these conditions, I want to see a wider use made of forecasting on sound lines. By that I mean more particularly the use of sample surveys, the appreciation of 'margins of error' and of the inevitability of gradualness in trends, the determination of maxima and minima within which our activities must lie, and so on. When we are armed with this our routine statistics become a measure of our approach to our planned activity. It removes the necessity of thinking anew whenever a routine return reaches us and gives us the opportunity of comparison with a previous performance which is really significant and not with one which is dangerous because the comparison is not one of 'like with like'. We have also the security which we attract to ourselves by knowing whether the fluctuations we see are significant or not and knowing that when the unexpected happens we can relate it exactly to our previous expectation and change speed and direction long before we otherwise would have done. This security can only be achieved if forecasting—and a lively control over comparisons of actual results with it—is accepted as efficient by all who have to use it. It is well worth while spending much time and thought in reaching this position, for its possession is valuable indeed.

A realization of that value makes one restive to fill the gaps which prevent it from becoming better.

As a Nation, we see great uncertainties in every part of industrial life, and policies which affect us all developed with a background of ignorance which is frightening. I have indicated a few of the more important lacunae to you tonight and have, I hope, encouraged you to join me in endeavours to see them filled with knowledge.