Management Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Book Reviews

To cite this article:
(1960) Book Reviews. Management Science 6(2):205-214. https://doi.org/10.1287/mnsc.6.2.205

BOOK REVIEWS

Experimental Designs in Industry. Edited by Victor Chew. New York: John Wiley and Sons, Inc., 1958.

This book publishes most of the papers read at a symposium on industrial experimentation held in Raleigh, North Carolina, in November, 1956. Part I, on Useful Experimental Designs, starts with a thorough review of Basic Experimental Designs by the Editor, V. Chew. This is followed by a long and interesting summary of factorials and fractional factorials by R. L. Anderson. An outline of multiple regression techniques by R. J. Hader and A. H. E. Grandage comes next. A remarkable sixty-page summary by G. E. P. Box and J. S. Hunter of their response surface methodology concludes this Part. Part II contains five papers on Industrial Experiences with Experimental Designs. W. S. Connor writes on Incomplete Block Designs, W. H. Horton on Fractional Factorials, and M. B. Carroll and O. Dykstra on Fractional Factorials in a Food Research Laboratory. R. M. DeBaun and A. M. Schneider give a paper on Response Surface Designs. C. A. Bicking's paper is on Experiences and Needs for Design in Ordinance Experimentation.

Those familiar with current activities in industrial experimentation will appreciate the caliber of these authors and will not need to be told that some of these papers are authoritative. The essays by Chew, Anderson, Box and Hunter form an integrated set that might well be used as a text.

Some readers of *Management Science* are already familiar with the advantages and disadvantages of statistical design of experiments. They will want to know which of the older plans can be used unchanged, what new plans especially adapted to industrial experimentation are available, and what new restrictions and risks are commonly encountered. For these readers this book is highly recommended.

Most of the misprints in the volume, which is photo-reproduced from typescript, will cause little confusion. A few however did cause the reviewer some trouble. In the Box-Hunter paper on page 157 and in Figure 5, only one point of inflection appears and not two. On pages 170–1, the term measure-polytope is thrice used for cross-polytope. On page 172, the tabled values and computation appear correct but the responses given at the center of Figure 12 are in error.

A few defects in presentation noted in a careful reading of the text are on the whole quite minor. The methodology of multiple regression outlined by Hader and Grandage appears quite anachronistic. Since the formulas and algorithm given are to be used on a desk computer, surely the data should be coded around mean values. Failure to do this results in loss of four out of seven figures even in the simple four-variable problem used as an example. (There is no guarantee that the remaining figures are correct.) The loss would be more serious with more variables. The method recommended always requires inversion of an $X'X$ matrix of rank one greater than that made from the mean-coded values. Most regression problems nowadays are handled by automatic computing machinery

for which the methods are quite different. Since many very poor multiple regression "programs" are circulating nowadays, it is a pity that a full summary of the desirable attributes for such a program were not substituted for the out-of-date and inefficient methods offered.

The numerical example of multiple regression used gives an excellent fit to a linear model in the four factors listed. It might have been improved still more by pointing out that there are only *10* different crude oils involved in the 32 data points, each with 2, 3 or 4 gasoline end points and yields corresponding. The principal source of the residual variation is among crudes, rather than among gasoline end points within crudes.

But many readers of this Journal will not be interested in the details or even in the general strategy of industrial experimentation. They might be willing to look at a balanced discussion of the pros and cons of statistical design but even this interest is a peripheral one. Active interest centers mainly on new models, new mathematical methods and new logical pictures of typical management and industrial situations. This book is not for such readers.

Sooner or later the adequacy of new models must be tested against real life. Eventually the unknown parameters in most new models must be evaluated by the use of real data. It will be at these junctures that statistical design problems will have to be attacked. The questions of when, where, how and how much will then become acute. Perhaps it is as well in the meantime not to urge these questions on men already fully occupied with formulation and analysis problems that must in any case be largely settled before the question of data-quality, and hence of statistical design, can be profitably discussed.

For those who must interpret and understand data already taken in industrial laboratories and plants, this book offers little help. The many difficulties of interpreting historical data, not taken according to plan, generally grouped in unknown or unfavorable ways, are not discussed here. This is a book for those who can influence the *plan* of taking data. A book on the statistical interpretation of data already collected is greatly needed. When it is written, if it is a good one, perhaps its main effect will be to persuade many to look into statistical design of experiments in order to avoid some of the worst defects of unplanned sets. The book under review will then be in heavy demand.

CUTHBERT DANIEL
116 Pinehurst Ave.
New York 33, New York

Decision-Making and Productivity. SEYMOUR MELMAN. New York: John Wiley & Sons, Inc., 1958.

The substantive material for this study consists of an examination of the conditions in the Standard Motor Company, manufacturers of cars and tractors in England.

This book claims to be "an exploration of the decision-making processes and productivity in industrial plants where unilateral rule by management has

been replaced by a form of bilateral decision-making." The author identifies four key propositions that he attempts to demonstrate.

"1) There are alternative possible ways for organizing decision-making on production in large mechanical plants.

"2) High levels and rapid growth in industrial productivity can be achieved when industrial workers as well as management do decision-making on production. This implies that unilateral decision-making by hierarchical management groups is not a necessary condition for operation of industrial plants at high productivity levels.

"3) Large and constantly expanding managerial groups are not essential for the operation of large-scale highly mechanized industrial plants.

"4) Changes in the ways of worker and management decision-making are explicable in terms of the interior mechanisms of particular decision systems, rather than as effects of the methods of production themselves."

He goes on to assert that these hypotheses challenge the assumption that a "Thoroughly managerial society with its attendant loss of personal and political freedom, is a necessary condition for rapid advance in industrial productivity." The author does not spell out this provocative relationship so that I cannot agree with it or challenge it without undue speculation as to his meaning. Is a managerial society one in which unions and alternative worker organizations are suppressed completely?

The problems of determining the relevant comparison is disturbing in connection with the first two propositions above. Accepting the author's characterization of Standard's management in the period 1950–1953 as a form of bilateral decision-making what comparisons can be made to test them? Would the author say that operating under the terms of the industry contract constituted unilateral decision-making?

But, let us not be disturbed by terminology. The major point of this book is the fact that after World War II, through a process of negotiation culminating in the 1949 contract, the Standard management made a series of concessions which were unusual for the industry. In addition to a generally higher wage level, the company agreed to consult with union stewards on such questions as overtime, and instituted a group incentive system organized around substantially enlarged "gangs". In one plant the entire production force constituted an incentive unit. The bilateral decision-making then can be thought of as having three components. (1) The terms of the union contract which was negotiated by the company after it had withdrawn from the employer federation.[1] (2) The contractual agreement by the company and the informal practices which developed in this period, to consult with the stewards on overtime, work assignments, manpower needs, and other employment conditions, and (3) the operation of the group incentive system with a minimum of direct supervision and informal reliance on the stewards to help maintain the continuity of production.

[1] The date of withdrawal from the Federation is given as 1945 on p. 189 and as 1949 on p. 255.

These conditions were the result of the interaction of the management and worker decision-making systems, and the working conditions which they establish have important effects on production in the plant. In this sense they constitute decisions on production. The author asserts, in fact, that the mechanization and production organization at Standard were a function of their relatively high labor costs. Although this statement is consistent with previous studies by the same author, the data presented here are less than convincing. It is surely not valid to present the labor earnings based on the incentive program to demonstrate that labor cost is relatively high. If the high wage policy and incentive program of the company was designed to improve production, and if in fact they were successful, the results would not produce pressure to substitute capital for labor, in spite of the fact that the hourly rate and earnings might now be higher. It is true that Standard paid higher rates than other firms in the industry, but as the author points out, they also had quite a different process of production and a different wage payment program. The only example of a decision to purchase equipment by the author is a "spectacular" one which clearly would not have been influenced by the labor differential. It would have been helpful if the author could have presented some idea of the savings that were involved in substituting different types of equipment and compared this with the relevant labor cost data. I would suspect that for the really significant shifts, such as to a continuous production line, eliminating the labor rate differential would not have altered the decision. This point is of particular significance because Melman seems to imply that high labor cost will lead to increased mechanization and so to higher productivity. He credits the pressure on management to conserve high-cost labor hours, for the high productivity (in the U. S. auto industry.) If Melman's focus is on the industry, or a firm, he should not ignore the relationship between costs and profit. A high wage might make a higher capital/labor ratio more efficient, but the new cost level might well cut profits and lead to a contraction of the industry. If the focus is on the entire economy, the impact on capital expenditure of boosting money wages would depend on the elasticity of supply and the marginal productivity of capital and labor. The underlying factors of the productivity and scarcity of labor and capital in an economy operate on both their relative prices and the ratio of their use. It would be incorrect to confuse an intervening mechanism with the causal factors.

The author's examination of the effectiveness of the production organization and wage system during this period leaves a somewhat mixed picture. He assures us that the wage system complies with the criteria for the successful operation of incentive systems established by a colleague at Columbia. But one of these conditions is that "earnings will not create inequities in the wage structure for workers on day-rate jobs," and the author tells us (p. 150) that the production bonus system favors larger earnings for the class of direct production workers. While it may be correct that "results correlate with the performance" of the entire incentive gang, it clearly may not be true for large groups within the gang. For a reasonable evaluation of the incentive program I would like to have more evidence of the impact of the program on the behavior of workers at different levels and on different operations within the plant.

The high level of earnings available at Standard resulted in a relatively low rate of labor turnover and permitted them to recruit a full work force in a period of labor shortage. However, even assuming that the data presented by the author are a misprint (the data indicate the opposite of the statement in the text (p. 165)), he has not really come to grips with the problem of evaluating the results of the company's operation under the 1949 agreement. We are told that there was a 14 per cent gain in average labor productivity within one year after the work organization and wage system were installed. At the same time there was a substantial decrease in the degree of variability of manhours per tractor. Although the author clearly feels that these results are related to the new system, it appears to this reviewer that he fails to present the minimum of information needed to support his contention. The variety of factors which may have created scheduling problems, the transition difficulties to be expected under a new system, and other factors which may have created variability in production are not considered in any way. The author simply notes that the character of the product and the underlying manufacturing equipment and production methods were stable in this period.

At other points the data presented by the author has only a very tenuous relationship to the argument they support. To show that Standard was an outstanding performer in the efficient utilization of plants and inventory Melman presents data comparing different companies on vehicles produced £(000) of fixed and variable assets. Although the product mix of the companies may be similar, the author does not provide this information. He does however warn that the data for net output per production worker, which shows that Standard was comparable to the industry, is affected by the prices received for the product. This fact, considered together with the information that Standard was a low profit company (he gives rough comparisons of profits as a per cent of total assets, but no data on per cent of net worth) at least casts doubt on claims for the effectiveness of Standard's work organization and wage system.

At one point (p. 169) the author argues against the position that high wages were a source of unfavorable profit differentials by blaming Standard's "paying for profits and overheads in other companies through purchase of its components." Earlier (p. 60) he notes that "Owing to the substantially higher rates of pay prevailing at the Standard Company, the management from time to time contracted out some of the work formerly done in its own plant."

The decreased variability of production to which the author points reminds me of the numerous plants in which the incentive rate is a constant 130%, but the observable performance is well below a satisfactory level. To what extent did the informal organization of work at Standard lead to a work pace which met management's objectives, or the goals of the work force? They need not have been consistent.

One of the most interesting claims presented for Standard's procedures is that administrative economies result. In addition to a policy of minimizing managerial and supervisory work, the company has cut its need for supervisory personnel by regulating worker activity primarily "via the system of work organization, the allied system of wage payment, and its relation with the union

organization in the plant, within the framework of the contract." Melman states that for each foreman at Standard there are twenty-five times the number of production workers as are found in a comparable Detroit operation. The foreman at Standard "are pre-eminently concerned with the detailed surveillance of things, rather than the detailed control over people." The importance of this finding should be evaluated in view of the following statement:

> "An important occupational wage classification is that of the 'charge hands' and the full time 'setters.' The charge hands and full time setters are designated as supervisory workers in the basic contract. Their work is primarily that of carrying out detailed supervision over production activities in sections of a particular working gang."

I fail to see the significance of the fact that these men are not called foreman and are not part of management. Their interests are not identical with the work force. In addition to their supervisory duties they are paid at a rate higher than the job rate, and an extra payment may be made at the discretion of management.

In my judgment the author has failed to show that significant savings have resulted from the procedures instituted at Standard, and has frequently been misleading in the use of the data available to him.

The chapters on the process of worker decision-making and management decision-making are in one sense the most disappointing parts of this study, because of the expectation that they would attempt to explain the policies of the organizations and provide some insight into the methods by which these policies are determined. In my judgment the author does neither. For the company, he states some of the policies that have been followed and traces some of their implications. At least one of these policies must be reasonably new (or unsuccessful) since in spite of the statement (p. 109) that "The management endeavors to reduce the proportion of purchased components entering into its vehicles," on p. 169 we are told "at Standard purchased components have been a larger proportion of net sales as compared with the average for the industry."

For the worker decision-making process we are told that:

> "the subject matter of the agreements . . . went through a process of discussion among the workers themselves before becoming a subject for collective bargaining. Indeed the general pattern in the extension of the worker decision system is for internal agreements among workers on desirable decision rules to precede formal negotiations with management."

Since this statement is not supported by any evidence we have no idea how the conflicts of interest within the worker group are resolved, how the interests and policies of the national unions are related to those of the local union and the shop stewards. For example in the course of negotiating the contract, what pressures originated with the national union, the district secretary, the steward's committee and the membership? To speak of this complex decision process in terms of a workers' code deduced primarily from the terms of the agreement is a gross oversimplification. We have no idea which side of the bargaining table originated some of these provisions, and to what extent they represent compro-

mise and trading. The complexity of the balance of interests involved on the union side cannot be ignored.

As is not unusual in Great Britain there was no provision in the contract which governed the order of layoff of employees. Although seniority is accepted practice in many large industrial establishments, it has only rarely been included in written agreements. In our country, seniority provisions have frequently served as the framework within which conflicts of interests within a plant are fought out, and work-sharing arrangements are not all unusual. The Standard Company had planned to introduce new equipment in 1956 without permanently displacing any of its employees. Unfortunately a slump in demand made them unable to fulfill the commitments that had been made to the workers and they prepared to discharge about 3500 men. Although the company was willing to institute a 4-day week, they were unwilling to accept the union's demand for "no redundancy," which would have meant a 3-day week. I am unable to judge whether the company's manner of making the change or an inadequate plan for severance pay were factors in the situation, but the union refused to bargain on the subject of a seniority plan for laying off the surplus workers, and insisted on its work-sharing proposal. Melman's interpretation of the union's refusal to negotiate a seniority agreement or a similar procedure for handling the discharge, and fighting instead for its work-sharing policy of "no redundancy" is that:

> "From the standpoint of maintaining or extending a worker decision process, this move was highly destructive, for it relinquished rights to decision-making over hiring and discharge. By the shop stewards' act of relinquishing these decision rights, the workers' decision system was 'sold' in favor of the requirements of Communist-inspired competition for managerial control. This was the effect on the workers' decision system, independently of the varied explicit political allegiances of these men."

I consider this pure fantasy whether or not the leadership of the strike was in Communist hands. Seniority arrangements or similar criteria are clearly not the only way to share in the decisions concerning management of the work force. The particular path a group of workers choose to take may or may not be realistic, and may or may not be successful, but a work-sharing arrangement would be just as important an extension of the worker decision process as any particular process governing the order of discharged. I cannot claim to know the motives of the Communists involved in the dispute with Standard, but it is impossible for me to accept the proposition that a work-sharing agreement would have been any less successful in alleviating hardship than a seniority arrangement. The leaders could not have received the support they did if the workers were not willing to share the burden of redundancy through a curtailed work week, even if it meant imposing an additional cost on management. This may have been inspired by Communists, but the proposal itself is certainly not communistic, nor in any way inconsistent with the workers' attempts to share the decision process of the firm!

Although Melman states that as of 1956 the policies he describes were successful for the management of the company and for its work force, it is difficult to

understand his criteria. The workers were vigorously resisting a serious layoff and the company was in the process of changing its labor policies. Instead of looking for the communist scapegoat to explain management's shift, as the author does, it might be more advisable to examine the impact of Standard's industrial relations policies on its ability to manage the firm profitably. A writer for the Economist presents the following description of the state of the agreement in 1956.[2]

"At that time Standard had a domestic agreement with the Confederation of Shipbuilding and Engineering Unions and the Transport and General Workers Union which, because of the concessions that the company allowed and the colour of the booklet in which they were embodied was known locally as 'the yellow peril.' . . . They had managed in effect to obtain a stranglehold on the works . . . . To get into this paradise one had to be careful not to annoy the powers that be, and it soon became obvious that among those powers were the shop stewards. It was they who arranged plant meetings, imposed fines, enjoyed freedom from work and kept the paid full-time officials of the unions to heel by (among other things) threats not to collect dues. But after the seven-week stoppage of electrical workers in the autumn of 1956, the management decided that they had had enough. They applied for membership of the British Employers Confederation and withdrew their domestic agreement with the unions."

The action of Standard suggests that increased mechanization does not solve all problems, and that production per man hour is only one of many criteria that must be considered in managerial decision-making.

MYRON L. JOSEPH
Carnegie Institute of Technology
Pittsburgh, Pennsylvania

[2] *The Economist*, March 8, 1958, p. 836.

BOOKS RECEIVED

(Inclusion of books in this list does not preclude their subsequent review.)

Dynamic Management Decision Games. JAY R. GREENE AND ROGER L. SISSON. New York: John Wiley and Sons, Inc., $2.95, July 1959.

Elementary Decision Theory. HERMAN CHERNOFF AND LINCOLN E. MOSES. New York: John Wiley and Sons, Inc., $7.50, May 22, 1959.

Engineering and Organization. EVERETT LAITALA. Homewood, Illinois: Richard D. Irwin, Inc., $6.00, May 1959.

Engineering Statistics. ALBERT H. BOWKER AND GERALD J. LIEBERMAN. Englewood Cliffs, N. J.: Prentice-Hall, Inc., May 1959.

Industrial Organization. JOE S. BAIN. John Wiley and Sons, Inc., $9.25, September 1, 1959.

Inter-Industry Economics. HOLLIS B. CHENERY AND PAUL G. CLARK. New York: John Wiley and Sons, Inc., $7.95, August 19, 1959.

Introduction to Probability and Statistics. B. W. LINDGREN AND G. W. MCELRATH. New York: The Macmillan Company, 1959.

Logistics in the National Defense. HENRY E. ECCLES. Harrisburg, Pennsylvania: The Stackpole Company, $5.00, September 1959.

Mathematical Programming and Electrical Networks. JACK BONNELL DENNIS. The Technology Press, Massachusetts Institute of Technology and John Wiley and Sons, Inc., New York. $4.50, June 24, 1959.

Measurement and Evaluation of Organizational Performance. PAUL WASSERMAN. An Annotated Bibliography. Graduate School of Business and Public Administration, Cornell University. $3.75, May 1, 1959.

Measurement: Definitions and Theories. Edited by C. WEST CHURCHMAN AND PHILBURN RATOOSH. New York: John Wiley and Sons, Inc., $7.95, September 3, 1959.

The Motivation to Work. FREDERICK HERZBERG, BERNARD MAUSNER AND BARBARA BLOCK SNYDERMAN. New York: John Wiley and Sons, Inc., $4.50, September 8, 1959.

The Office Supervisor. Third Edition. HENRY E. NILES, MARY CUSHING NILES AND JAMES C. STEPHENS. New York: John Wiley and Sons, Inc., $5.95, June 26, 1959.

Operations Research, An Annotated Bibliography. JAMES H. BATCHELOR. St. Louis University Press, 1959.

Operations Research, Methods and Problems. MAURICE SASIENI, ARTHUR YASPAN AND LAWRENCE FREIDMAN. New York: John Wiley and Sons, Inc., $10.95, May 1959.

Organization for Production. E. S. ROSCOE. Homewood, Ill., Richard D. Irwin, Inc., $6.75, March 1959.

Portfolio Selection, Efficient Diversification of Investments. HARRY M. MARKOWITZ, Cowles Foundation, Monograph 16. New York: John Wiley and Sons, Inc., $7.50.

Probability and Statistical Inference for Engineers. CYRUS DERMAN AND MORTON KLEIN. Oxford University Press, 1959.

Programming Business Computers. DANIEL D. MCCRACKEN, HAROLD WEISS AND TSAI-HWA LEE. New York: John Wiley and Sons, Inc., $10.95, June 19, 1959.

Sampling Inspection Tables, Second Edition. HAROLD F. DODGE AND HARRY G. ROMIG, Single and Double Sampling. New York: John Wiley and Sons, Inc., $7.50, May 1959.

Teoria Delle Code. G. AVONDO BODINO AND F. BRAMBILLA. Istituto Editoriale Cisalpino. Milan, Italy, 1959.

Unternehmung Und Unvollkommene Information. WALDEMAR WITTMAN. Westdeutscher Verlag: Koln Und Opladen. 1959.