

UNITED STATES DEPARTMENT OF LABOR  
L. B. SCHWELLENBACH, *Secretary*  
BUREAU OF LABOR STATISTICS  
EWAN CLAGUE, *Commissioner*

Summary of Proceedings  
of  
Conference on Productivity

October 28–29, 1946

*Bulletin No. 913*

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## Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,  
BUREAU OF LABOR STATISTICS,  
*Washington, D. C., May 1, 1947.*

THE SECRETARY OF LABOR:

I have the honor to transmit herewith a report which summarizes the Proceedings of the Conference on Productivity, held in Washington on October 28 and 29, 1946. This summary of the voluminous proceedings was prepared by Mrs. Celia Star Gody, of the Bureau's staff, and was submitted to the participants in the conference, for their editorial approval. The report also includes an evaluation of the conference by Solomon Fabricant, of the National Bureau of Economic Research, who acted as chairman of the executive committee which planned the details and agenda of the conference.

The conference brought together an outstanding group of research workers from labor, industry, government, and the universities for a mutual exchange of views on a topic of great current importance. The conference may confidently be expected to have a beneficial effect on the content and direction of research activities in the field of productivity for many years to come. This report is designed to make generally available the discussions and results of the conference.

EWAN CLAGUE, *Commissioner.*

HON. L. B. SCHWELLENBACH,  
*Secretary of Labor.*



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*Bulletin No. 913 of the  
United States Bureau of Labor Statistics*

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## Preface

After the close of the war, in 1945, increasing attention was given in public discussion to the subject of productivity, and in some instances sharp controversies arose. Some differences of opinion seemed rooted in divergent interpretations of scanty data; others could apparently be traced to such basic difficulties as lack of agreement on the meaning and significance which should be attached to the term productivity. Many persons felt that under these circumstances a mutual exchange of views on the conceptual and measurement problems in the field of productivity might help materially to substitute agreement for argument.

The Bureau of Labor Statistics of the U. S. Department of Labor and the Division of Statistical Standards of the U. S. Bureau of the Budget joined in sponsoring a Conference on Productivity to be attended by representatives of labor, industry, private research groups, and government agencies. The agenda and details of the conference were planned by an executive committee which included members representing labor and industry, selected with the advice and assistance of the major labor and business organizations.

The conference was held on October 28 and 29, 1946, at Washington, D. C. It was attended by about 100 active participants and approximately an equal number of observers.

This bulletin is intended to make available to others the ideas which were developed during the two days of the conference. The following pages present an evaluation of the conference by Mr. Solomon Fabricant of the National Bureau of Economic Research, who acted as chairman of the executive committee; the official program of the conference; and a digest of the proceedings of the conference. The digest was prepared by Mrs. Celia Star Gody of the Bureau of Labor Statistics, a member of the executive committee. This digest was submitted to the participants in the conference for their editorial approval.

The membership of the executive committee which made arrangements for the conference was as follows:

Henry B. Arthur, Swift & Co.

Solomon Barkin, Textile Workers Union of America, CIO.

George Brown, United Association of Plumbers and Steamfitters, AFL.  
Katherine P. Ellickson, Congress of Industrial Organizations.  
W. Duane Evans (Secretary), U. S. Bureau of Labor Statistics.  
Solomon Fabricant (Chairman), National Bureau of Economic  
Research.

Celia Star Gody, U. S. Bureau of Labor Statistics.  
Everett Hagen, National Planning Association.  
Douglas H. Holmes, Westinghouse Electric & Manufacturing Co.  
Thomas Mills, U. S. Bureau of the Budget.  
Margaret Scattergood, American Federation of Labor.  
Ernst Swanson, U. S. Chamber of Commerce.  
Samuel Thompson, U. S. Department of Commerce.  
Charles Young, Westinghouse Electric & Manufacturing Co.

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# CONFERENCE ON PRODUCTIVITY, OCTOBER 28-29, 1946

## *An Evaluation of the Productivity Conference*

The aims of the conference, as set forth by the executive committee for the conference, in inviting participation, were as follows:

The subject of productivity is generally recognized to be of unparalleled current importance. It is directly related to the employment and unemployment problem. It is at the center of any discussions relating to wages, prices, and profits. It affects the ability of the United States to maintain its position in international trade. It is the means whereby a constant improvement in the living standards of American families is achieved. Despite the importance of productivity, there is lack of agreement on the concepts and measures which are appropriate to its evaluation and on the implications of current measures.

In this situation, a technical conference is planned as a forum for the discussion of productivity concepts and measurements, in the hope that this will clarify and resolve genuine differences in viewpoint which now exist in the field. The conference will also provide a vehicle for discussing the current state of knowledge regarding productivity and labor cost, the adequacy of present programs, and related questions.

The conference is sponsored jointly by the Bureau of Labor Statistics of the U. S. Department of Labor and the Division of Statistical Standards of the U. S. Bureau of the Budget. The conference is not intended to act as an official advisory body, but rather to be a discussion meeting. Papers will be presented by invitation on selected subjects, but there will be ample provision for general discussion. Further conferences may be scheduled, depending on the wishes of the participants.

A limited number of participants will be invited from labor, industry, government, private research agencies, and academic institutions, and will be present in their individual capacities, not as official representatives of organizations. The participants will be selected from among those who may be expected to contribute to the discussion of productivity.

Parents are always a little startled to find their infants grown up and with a bulk and personality of mature proportions. The sponsoring agencies and the executive committee were similarly surprised to discover what had come out of this invitation. Instead of a small group of technicians mulling over some rather abstruse concepts and measurements, there assembled over 200 people, all told, from labor, business, government, research, and the academic world, engaging enthusiastically in a broad discussion. Interest was fully as great at the end as at the beginning of the two solid days of discussion.

Yet it should not have surprised us too much. The American people have come to see the value of a wide and firm basis of accepted fact and mutual understanding as a common meeting ground. They know that

it is the only sure foundation for threshing out common problems. They realize that concepts and measurements are essential in the building of this foundation, and therefore that concepts and measurements are well worth discussion. The conference provided a forum for a free discussion and demonstrated the value of joining persons of diverse points of view in it. This was a real accomplishment, perhaps the outstanding accomplishment of the conference. It showed how wrong are those who stress only differences and clashes of interest, who deny the possibility or value of meeting on a common ground of accepted fact and standard usage, who see all things simply as matters of opinion.

The conference of course also yielded fruits of immediate bearing on the question at issue, namely, concepts and measurements of productivity. The abstract of the proceedings which follows summarizes fairly extensively the successive statements and remarks of the various participants, and clearly indicates the value of the discussion. The reader will want to study this record with the care it deserves. It is desirable, however, to preface the abstract by a review of and commentary on what came out of the conference, along other than chronological lines; and to indicate, at the same time, plans for the future work declared so necessary by all who attended.

### *Definitions and Measurements of Productivity*

First of all, the discussion clearly brought out how general is the term "productivity." The term relates to a whole family of concepts rather than to any specific member of that family. Almost any comparison of output with input is covered by it. Output may be defined in various ways, however, and input may be measured by one factor or another or by several factors in combination. Further, productivity may be the relation between output and the input of one factor, all other input factors being kept constant, as in an experiment under controlled conditions; or it may be the relation between output and the input of one factor, with changes occurring in all other factors. Still further, productivity may be the relation between the total output and input of a period, or it may be the relation between the increment in output associated with the addition of one unit of a given factor of production; that is, it may be "average" or "marginal." Thus, economists writing on the "theory of marginal productivity" use the term quite differently from statisticians who compute indexes of productivity. Even statistical measures of productivity may differ among themselves, fundamentally, as well as in detail. To avoid confusion, therefore, it was agreed that the term "productivity" be used only in a general way to describe the area with which the conference was concerned, and to use more specific terms in referring to particular con-

cepts or measurements. "Physical output per man-hour," for example, is better than "labor productivity" as a term descriptive of most currently published indexes. Since no reasonably short term can be completely descriptive, however, it was felt that terminology should always be defined as explicitly as possible whenever used.

Stemming from the acceptance that there is a whole group of productivity concepts was the realization that a variety of measures is possible. Measures may be made of output per unit of capital equipment or per unit of labor; of output per man or per man-hour; of physical output per man-hour or value output per man-hour; of "net" physical output per man-hour or "gross" physical output per man-hour; and so on. There is no way of deciding which measure is appropriate, except with relation to a particular purpose. For different purposes different measures may be suitable. Even for a particular purpose, several different measures may be better than one; they may complement, rather than compete with, one another. With a variety of measures possible and desirable, it is of course all the more necessary to label each carefully and define each accurately. Just what these purposes are and what indexes are most suitable for particular uses remain subjects for further investigation. Here the conference pointed up a job to be done.

Considerable attention was given to currently prepared measures of output per man-hour, and also to some historical measures; and various questions were raised concerning their scope and accuracy. It goes without saying, of course, that no current or even historical statistical index can hope to attain complete coverage and perfect accuracy, but there are degrees of accuracy and coverage and it is well to strive for the highest in both. The discussion and critical comments brought out at the conference will, I am sure, stimulate even greater efforts on the part of compiling agencies to better their indexes. Almost as important, it will lead them to indicate as fully as possible the margins of error and the limitations of representation inevitably still resident in their measures. A number of the criticisms raised at the conference had already been considered by the compiling agencies and had been determined to be of small significance. However, the discussion taught one clear lesson: results of such considerations and evaluations of limitations should be made public, preferably in advance of the appearance of criticisms. The range of doubts that beset consumers of statistics concerning their validity must be narrowed.

Many of the points raised in criticism were, in essence, that alternative methods and measures are possible and perhaps desirable. Some of these criticisms can be satisfied by a variety of carefully defined measures of productivity. Others require further examination and discussion before

their comparative merits and demerits can be understood, and the discussion thus provides a list of topics for further investigation, such as the following:

- Choice between value weights and man-hour weights, in combining diverse physical units of output.
- Adjustments for changes in coverage of output or employment by samples of products or samples of establishments.
- Hours paid versus hours worked.
- Machine-hours versus other measures of capital input, such as deflated capital assets.
- Quality changes in products and materials, and the development of entirely new products and materials.
- Ways of combining different types of input and the related problems of choosing between weighted and unweighted aggregates of labor input.
- Treatment of overhead, maintenance, and other indirect labor.
- Analysis of the representativeness of the sample group of industries for which current indexes of productivity can be prepared.
- Attainment of consistency of measures at the national level with measures at subsidiary levels, such as the industry, the plant, or the job level.
- Measurement of productivity in long-cycle or custom industries.
- Measurement of productivity in service and trade.

We need, especially, to learn the quantitative importance of some of these questions.

### *Limitations of Basic Data*

Discussion of the limitations of current indexes indicated their obvious dependence on the availability of basic statistics. No index can be much better than the data which it summarizes. A deeper appreciation thus came out of the conference of the great need for more and better basic-data collections. Many of the questions raised concerning the accuracy of the current indexes, for example, can be answered finally only when we can check our current sample statistics against complete surveys such as the Censuses of Manufactures and Mines. Indeed, if such "benchmark" data were made available at reasonably frequent intervals, many of these questions would never arise. We need not only more Census surveys, but also to collect more information in them; for example, information on capital assets, equipment, and kinds and quantities of materials consumed. This information should be presented in detail—for example, by size of plant. In addition to complete surveys, there is of course need for broader and more intensive current surveys by government and private organizations, if the information on contemporary changes in productivity is to possess the accuracy and scope desired. One of the interesting facts brought out was the rather widespread lack even of private plant records on productivity changes. It is probably fair to report

the conference as favoring wholeheartedly the most comprehensive statistics possible, as a basis for learning from the past, reporting on the present, and guidance to the future.

### *Factors in Productivity*

With the discussion ranging over the full list of different kinds of input—materials, fuel, and use of capital equipment, for example, as well as labor—attention was drawn to the possibilities of reducing the requirements, per unit of product, of factors of production other than labor. Besides labor savings there could be—and the historical records show have been—savings of materials and other factors. The more efficient extraction of energy from coal is an example.

This may be put differently, to fit the view of many of the discussants. Labor can be and has been saved directly, by cutting man-hour requirements for a given job or volume of production. Labor can be and has been saved also indirectly, by cutting fuel and capital and other requirements for a given job or volume of production. Fuel, for example, embodies in large part labor put into production at earlier stages of production. To save a ton of coal means to save the labor of coal miners, of railroad workers, of distributors. These indirect labor savings contribute to our advancing standard of living as definitely as do direct labor savings themselves. The gain from increased productivity is equal to the sum of all these direct and indirect savings, and not merely to the savings of one factor of production.

With this recognized, conference discussion advanced to another, related, point. When material or capital savings occur, these are to be added to direct labor savings to get a measure of productivity increase; but when more materials or more capital are required to turn out a unit of product, then direct labor savings must be offset correspondingly. To what extent increases rather than decreases in unit material or capital requirements have occurred is determinable only by appeal to the facts. It was suggested by some speakers that, on the whole, material requirements per unit of product have been reduced rather than increased; and that the period of increasing capital investment relatively to output, so characteristic of early industrial development, had more recently been followed by a period in which many industries' capital requirements per unit were reduced. It is important to distinguish carefully between long-term trends and shorter movements, however, and between one industry or plant and another. Broad generalizations always imply exceptions. Here, too, there is open a field for serious research and historical study.

The recognition that in an industry or plant various factors cooperate in the job of production, that these influence one another, and that they

are also influenced by factors outside the industry or plant, advanced understanding in still another way. The discussion at the conference highlighted the dangers of imputing responsibility for advance—or decline—in productivity to any one factor. To isolate the influence of a single element in a complex process has always been the most difficult problem of science. It has been solved, satisfactorily, only in the physical sciences where experimentation under controlled conditions has been developed. In the social sciences, statistical methods to accomplish the same aims are still in the process of development, and in any case, the data to which to apply these methods and the skill with which to interpret the results are largely lacking. This does not mean that now and then the immediate cause of a particular change cannot be determined; but this is probably rare, and determination of the ultimate cause is quite another thing. As one speaker so well put it, shall we try to figure Lord Kelvin's contribution in assessing the factors aiding in recent developments in electric motors? To try to determine credit or responsibility is to enter an endless maze. Only in Heaven will judgments of this kind be made and gracefully accepted.

As planned, emphasis was placed in the conference on questions of concept and measurement. Effort was made to avoid such controversial and speculative matters as how to divide the gains from productivity. Inevitably, however, the talk at the conference touched—even if lightly—on such matters as wage rates, profits, and prices, as well as numbers of workers, volume of equipment, and volume of goods produced, for obviously there are important questions of developing and maintaining incentives to raise productivity. There are questions of the bearing on productivity of “balance” among industries, plants, and factors of production, of “equilibrium” of costs and prices, incomes and expenditures. The important fact could not be overlooked, that raising the Nation's productivity is an economic problem, not merely a problem of technology or engineering. More must be learned not only about concepts and measurements but also about the economics of productivity, if the factors determining our economic progress are to be ascertained. The conference members showed great awareness of our ignorance of the economics of productivity. It is for this reason that they stressed the need for more work in analyzing this intricate set of relationships. Only by coming to grips with this problem can a decision be made as to the concepts and measurements needed.

### *Work Still to be Done*

It is hoped that this quick review will give the reader a notion of what went on and stimulate him to read the more detailed story that follows.

Although, naturally enough, the main points of agreement have been stressed, in a sense the conference may be summarized also by saying that it accomplished not so much explicit agreement on particular points as better understanding and appreciation of diverse points of view. This too, however, implies agreement that more work has to be done.

This means more work of the type that has been done. Understanding of the facts concerning productivity and the factors stimulating (or retarding) advances in it is furthered by the preparation of current indexes reporting changes in such quantities as output per man-hour and labor cost per unit of product. These indexes can be increased in number and improved in construction. They are valuable. Understanding can also be broadened and deepened by other types of work. Studies of marginal costs and of the functional relation between production, labor and capital (the "production function"), are interesting approaches which should be continued. Studies of such relationships as the following also need to be continued and expanded:

- Changes in productivity in relation to changes in selling prices, employment, wages, and other economic quantities.
- Variation in productivity among plants of different size, age, and organization.
- The extent of and reasons for international differences in productivity.
- The origin and diffusion of technological developments of all sorts.
- The economic histories of particular industries and of the relations between industries.
- Obstacles to the introduction of technological advances.
- Cyclical changes in productivity.
- Productivity differences among individuals.

In attacking a set of problems with such wide ramifications, no approach or aspect should be neglected.

It became apparent during the conference that the participants not only realize that much work remains to be done in this field but expect the conference, acting through the executive committee, to carry on a good deal of this work and stimulate its undertaking in other quarters. It is appropriate therefore to report the plans now being made by this committee to carry out the mandate laid upon it. It is hoped to start a series of round-table discussions at which experts will be asked to present papers or otherwise lead discussions bearing on particular and well-defined questions related to productivity. These questions will be drawn from those given above and from additions to them. Participating in the discussions will be not only members of the committee but also other persons qualified to contribute. It is hoped to keep the groups small and active—essentials for intensive discussions of technical subjects. The discussions will be made available to the public in the form of papers or abstracts published in appropriate journals or bulletins. It is expected, also, that as experience

with the discussions accumulates, it will again be desirable to arrange a large-scale conference, open to a wider audience, to discuss the past work, bring to public attention the work currently being done in this area, and plan for the future.

Obviously, no one group can hope to do all the work required. Consideration should and must be given to these various questions by men and women throughout industry, labor, academic circles, and government. Experience with particular industries and access to special bodies of data are real advantages possessed by many of these persons. It is hoped that they will bring these advantages to bear effectively on the common problem. It is hoped, too, that they will advise the sponsoring agencies, through the chairman or the secretary of the executive committee, of the work they are doing. With all thus working intensively, in constant touch with one another, there is hope of enlarging the broad conceptual and factual basis so valuable as a common meeting ground for persons and groups with diverse points of view.

SOLOMON FABRICANT,  
*Chairman*, Executive Committee,  
Conference on Productivity.

# Summary of Proceedings

OCTOBER 28—MORNING SESSION

Chairman, Leon Henderson, Research Institute of America

## *Welcome to Conferees*

STUART A. RICE (Assistant Director of the U. S. Bureau of the Budget) : A warm welcome is extended to the members of the conference. The conference was arranged through an executive committee composed of representatives of management, organized labor, the Department of Labor, the Department of Commerce, and the Bureau of the Budget. The work of the National Income Conference in clarifying and developing concepts in that field should be noted. It is hoped that the Productivity Conference will contribute to greater agreement on productivity concepts and to the improvement of measures of productivity.

## *Scope of Conference*

EWAN CLAGUE (Commissioner of Labor Statistics) : The conference was not called to discuss means of improving productivity or the methods whereby the social benefits of production economies should be divided or distributed. Its purpose is to reach agreements, if possible, on what physical facts of the economy the word "productivity" should cover. The conference may wish to differentiate the various concepts now encompassed by the term "productivity," both in definitions and measurements. The participants will discuss the indexes and measures of productivity now available, what they cover in the way of physical facts, and what physical facts they ignore or obscure. The meeting will also consider means of improving measures of productivity, extending them, and making them more useful to greater numbers of persons. It is hoped that the conference will give direction to all research in this field, both private and public.

The conference is to be a discussion meeting in which the members participate. A transcript of the proceedings will be taken but will not be made available for general distribution. A summary of the proceedings will be distributed to all participants. After approval of the participants, this summary may be made available to the public. A limited number of publications representatives have been admitted to the conference, with the understanding that no quotations will be attributed to individuals except with their express permission. Moreover, all individuals represent themselves only and not their organizations.

## *Productivity and Its General Economic Setting*

ROBERT NATHAN (Robert Nathan Associates): Although the conference is concerned only with the questions of concepts and measurements, clarification of these questions would help in policy considerations.

Over the past half century, there has been a tremendous increase in productivity in terms of the relationship between output and every factor of production. The increase in productivity has not been limited to a rise in production in relation to man-hours worked. It is probable that productivity has also increased as regards the relationship between production and capital equipment, provided capital equipment is measured not in dollars but in terms of the efforts and resources put into capital equipment.

This increase in productivity has many implications, one of the foremost being its relationship to the question of employment. In the past, when the problem of technological unemployment was discussed, it was thought that there was only a given volume of production to be created and that when increased output per unit of effort was achieved, the total effort previously used would not be required. However, as a consequence of analysis of what people can consume, the concept of technological unemployment has begun to be replaced with positive and constructive thinking of full employment. The benefits of increased productivity should be considered in terms of standards of living rather than of technological unemployment. The more rapid technological development and the more speedy increase in productivity that may take place in the future is not a threat and must not be regarded as a threat to full employment. Society must make certain that, as output increases, employment is maintained, so that participation in consumption and production shall not be narrowed to a limited and decreasing percentage of people.

On the basis of the speaker's experiences overseas, it appears that the rest of the world is just beginning to recognize the importance of productivity in the development of the tremendous economic power of the United States. In France, for example, there is a keen recognition of the need for industrial development, modernization, and higher productivity if the nation is to be able to compete in world activities with the United States, Great Britain, and other countries. Moreover, other countries look to the United States for leadership, for guidance, for "know-how," for help.

Productivity also has significant implications with respect to domestic policy on wages, prices, and profits. Increased consumption can emerge only through production. Monetary benefits to any group mean nothing unless expressed in terms of real output and real consumption.

*Problems of Concepts and Measurement in the  
Field of Productivity*

HIRAM DAVIS (Director of Industrial Research, Wharton School, University of Pennsylvania): Most persons, in using the term "productivity" have meant the physical output obtained for a given physical input. The usual measure of productivity—output per input of labor—is inadequate, however, since one input factor is used to represent all input. The change in output per man-hour may be greater than the change in output per unit of total input, for example, when power or machines have been substituted for labor. On the other hand, even though man-hour output shows no change, the input of other factors may be changing materially. Thus, capital consumption may be speeded up by obsolescence or reduced by improved machines with a longer service life. Input factors cannot be measured by money costs, since money costs are both a measure of input and a measure of what the input agents receive.

Several methods of measuring input have been suggested. The embodied labor method involves the expression of machinery and other factors in terms of the labor content represented. One difficulty is that it is not possible to express risk-bearing, for example, in terms of labor content. Moreover, it is extremely difficult to express capital consumption in terms of labor content. Another proposal is the use of costs at constant prices. However, there is the practical objection that the compilation of appropriate indexes for correcting the value series is extremely difficult. Because of the many difficulties in the measurement of total input, it might be more useful, for analytical purposes, to develop a series of ratios relating output to each of the important input items.

Change in the composition of output, the substitution of new products for old, and changes in quality all make it extremely difficult to measure output. The equivalent-unit method—the method of reducing output of different grades to an equivalent grade—involves the problem of the method of conversion used. If prices are used as weights, the output measure may be influenced by differences in marketing methods or differences in demand for the various classes of products. If labor time is used as weight, the output series would correspond to the man-hour series. Another method proposed is the potential service of the commodity, for example, tire-miles. Although this measure is useful for certain purposes, it has its limitations. In the case of tires, it would credit the tire industry for improvements in automobiles, in highways, and in the quality of crude rubber, that were brought about by other industries. Many indexes of physical production are weighted by value or value added. Since value added changes from year to year, depending upon profits, it may be

desirable, where possible, to refine the value-added weights to the point where they represent manufacturing costs.

Since the problem of measuring output falls particularly at the industry level, it is hoped that out of the conference may come a decision to develop working committees in each of the important industries.

In connection with input measurement, it might be desirable to consider not only the input used up, but also the input supply assembled for an undertaking. Another important concept is the measurement of output not only in relation to physical factors, but in relation to real costs.

In relating output to man-hours, it might be preferable to express the results in terms of labor requirements per unit of output rather than output per man-hour. A similar form might be used in showing the ratios between output and capital and other production factors. The term "productivity" might well be restricted to those cases in which it is possible to present more than one measure of input or in which the broad sweep of developments over a substantial period is considered.

### *Concepts and Measures of Productivity at the Job Level*

MARTIN GAINSBROUGH (National Industrial Conference Board):<sup>1</sup> A questionnaire was sent out to the NICB panel of business executives, concerning changes between the prewar and current period in labor productivity on comparable jobs performed under comparable conditions. The reports indicated a general dissatisfaction in industry with the term "labor productivity." Some replies indicated a belief that the number of labor hours per unit was determined primarily by the type of equipment and not by human factors. Many companies had no measures either of productivity on comparable jobs or of output per man. Several measures were used in the replies—output per man, dollar value of products per productive man-hour, dollar sales per employee, etc. Although the survey indicated that there is an interest in labor productivity, few plants have quantitative information on this subject.

NATHAN SPERO (United Electrical, Radio and Machine Workers, CIO): Management has been carrying on a Nation-wide publicity drive, singling out worker effort as the important factor in productivity and implying that worker effort has decreased. This campaign obscures the fact that the effort of the individual worker is inseparable from many of the other important factors that affect productivity. Worker effort is affected by such factors as patriotism, the cost of living, profits, and other influences. A constant flow of materials of the right quality is

<sup>1</sup> EDITOR'S NOTE—The remarks of Mr. Gainsbrugh, scheduled for the morning session, were actually delivered in the afternoon. They are given here for the sake of clarity and in order to round out the presentation of the subject. The same was done in a few other cases.

extremely important to efficient production at the worker's level. Shortages of materials have resulted from speculative stock piling to anticipate price increases or hoarding to force price increases. In addition, the nature of the plant's physical equipment determines, to a large extent, the worker's efficiency. The efficiency of the workers also depends on the efficiency of management. Frequently management has raised the cry of decreased workers' effort to hide its own shortcomings. Similarly, systems of wage payment influence worker effort. Incentive systems provide some estimate of the extent of productivity increase and of the extent to which management passes along the gains resulting from increased productivity. However, even incentive systems can sometimes be turned into their opposites, resulting in a lack of incentive for production. Finally, relations between the company and union have an extremely important effect on worker efficiency—for example, the way in which negotiations are conducted, the way the grievance procedure operates, and the nature of supervisory relationships.

### *Discussion*

SOLOMON BARKIN (Textile Workers Union of America, CIO) : Management has employed numerous measures which allegedly measure output. The one which is very widely used is the time study. It is not a true measure of productivity. It provides a method of judging, through inadequate means, the increase in output expected for varying additions in the application of human effort and skill. Many incentive systems are based on the premise that labor should be compensated only for the additional output which arises from more than normal effort and skill. They therefore recapture all increases in output arising from causes other than human effort and skill. They do not measure output. Measures of physical output which do not seek to distinguish the source of the increased output more nearly conform to the measure which is being sought. Thus, for example, incentive systems which provide payment for output and which do not allow for the change of this rate for any cause more nearly approximate compensation for increased productivity from all sources. During the war certain plant-wide incentive systems were based on this principle.

H. B. MAYNARD (Methods Engineering Council) : Difficulties are involved in establishing performance ratings. With fixed methods, the contribution of the worker to production is dependent on his skill and on the effort with which he works. While performance ratings are based on a process of judgment, it is possible to achieve a fair degree of consistency by using carefully worked-out definitions, motion pictures representing different performance levels, etc. Another approach to this

problem is effort rating, which endeavors to arrive at an evaluation of performance level by judging the speed of the motions made by the operator. A different approach being evolved establishes, as the result of considerable research, predetermined motion time standards which, if once accepted, will take the element of judgment out of the problem.

**LAZARE TEPER** (International Ladies' Garment Workers' Union, AFL): Mr. Maynard has discussed the question of measuring efficiency at the job level under fixed conditions, but the main problem arises when conditions change. If a particular operation is changed, for example, from a 5-motion job to a 4-motion job, efficiency is not always measured in relation to the former 5-motion standard but in relation to a new 4-motion standard, and the worker loses the benefits of increased physical productivity. If labor is not to pass judgment on management's efficiency, performance on the job must be judged in terms of the physical units produced.

**H. B. MAYNARD**: When a worker, through his own ingenuity, reduces the number of motions involved in a job, he should have a substantial award. However, the standard should be reset and rewards for ingenuity should not be included in the incentive plan. If they are, the earnings structure is distorted, with some workers earning considerably more than others for the same expenditure of effort; the workers themselves consider such a wage structure unfair.

**RUFUS TUCKER** (General Motors Corporation): Although it is perfectly true that bad morale and bad labor relations result in decreased productivity, output is reduced only because such conditions cause the laborer either deliberately or unconsciously to hold back. Consequently, such conditions should not be charged to management, since the effect in reducing output depends wholly on the laborers' attitude.

**MR. CLAGUE**: The problem of measurement of productivity at the job level leads quickly to the problem of shares in the output. For example, assume that man-hours per unit were reduced because of the workers' ingenuity, wages were raised proportionately, and the same number of people were at work. Production would be increased, but it would not be possible to sell the whole output at the same prices. One is thus forced to a consideration of wages, interest, rent, and payments for other factors of production. Nevertheless, it is desirable to work out methods of measurement that will not be confused by the issue of sharing the profits. Another difficulty is that the job is constantly changing, and any measure of productivity at the job level cannot be put into a long series. In view of these difficulties, it appears that measurements of productivity at the job level are the concern of labor and management at the particular

plant, and both labor and management will have to get into the study of job output.

**GARDNER MEANS** (Committee for Economic Development): In a boom period there is a small proportion of overhead workers relative to production workers. In a depression, the number of overhead workers may be the same, but the number of operating workers is reduced, with the result that total man-hours per unit of output are increased, even though each worker is just as productive in his particular job. There is a question as to whether such a change should be called a decline in productivity or whether the effect of changes in the proportion of overhead workers should not be separated from other changes.

**HIRAM DAVIS**: It would be possible to develop a series of ratios, relating output to the various categories of labor and not merely to labor input as a whole. Changes in the proportion of overhead workers may not be only a cyclical relationship; it has been suggested that there is a decided trend in this country toward an increase in the proportion of overhead workers.

(Seth Levine of the CIO Maritime Committee, Charles E. Young of Westinghouse Electric & Manufacturing Co., and Rosalind Schulman of the Industrial Union of Marine and Shipbuilding Workers of America also discussed briefly the relationship between productivity and the level of output.)

**DUANE EVANS** (U. S. Bureau of Labor Statistics): Cyclical changes are not so likely to affect measures of productivity at the job level as at the industry level. Physical output per unit of labor input is of primary importance, rather than per capital input or input of other factors. On the one hand, the physical output produced determines the standard of living. On the other hand, the labor force is the one resource whose utilization cannot be deferred. Tremendous numbers of separate things determine the output of the individual worker—management factors, mechanical factors, machine factors, materials factors, and worker factors. A very big element in the high productivity of the United States is the accumulated skill and experience of the labor force, which is not wholly industrial but is due, in part, to familiarity with mechanical devices in daily life.

There is no typical situation with respect to reports concerning worker effort. Some plant managers have stated that their labor force is better today than when we entered the war, while others hold strong opinions to the contrary.

**ROBERT W. BURGESS** (Western Electric Co.): Referring to remarks

by Mr. Barkin and others which questioned the accuracy of available measures of output at the job and plant level, as a matter of concept, measures of productivity (according to the orthodox definition of output divided by man-hours worked) could readily be constructed in plants which use the piece-work system with predetermined "standard" costs and standard times for each job. The point is that the concept of productivity in such cases is clear-cut and its measurement available without question. How accurately and fairly standard costs and standard times have been established in any plant is another question, separable from that of the concept of productivity. There is still another question of the operating type: whether day-by-day adjustments should be made in the application of piece-work rates to recognize unusual current irregularities in production conditions.

**SOLOMON BARKIN:** A piece-rate system does provide for payment in proportion to output. In contrast, engineered incentive systems are based on the concept that there should not be compensation for increased output if the increase is attributable to some factor other than the worker's effort. Thus confusion arises because of the attempt to identify worker's effort and output.

### **OCTOBER 28—AFTERNOON SESSION**

**Chairman, Robert Nathan, Robert Nathan Associates**

#### ***Concepts and Measures of Productivity at the Plant and Company Levels***

**BENJAMIN HASKELL** (United Textile Workers, AFL): The statistical approach to productivity—the measurement of the relationship between output and labor—has very serious and dangerous inadequacies. The desire of the statistician for some single over-all measure is a stumbling block to obtaining genuine knowledge. For example, a variety of very different products may be called by the same name. The averages presented by the statistician often obscure rather than disclose what should be measured.

The statistical approach ignores the meanings and explanations. However, the explanations and qualitative factors are just as significant as the figures. For instance, when a strike broke out at a cotton mill, it was discovered that the employer had bought a poor batch of cotton. On the basis of production during that period, one might conclude that labor was falling down on the job, but the factor of poor cotton had as much importance as the time input. In the same way, the organization of the plant, labor relations, the kind of machinery, and the flow of materials

affect the volume of output. Those who handle statistics have a moral obligation to give explanations, because the tendency has been to imply responsibility whenever the statistics show an apparent decline in physical output per unit of labor input.

The farther productivity statistics depart from the plant level, the more obscure and meaningless they become. The statistical approach should therefore be supplemented by the case-history approach at the plant level. The case-history approach will provide the qualitative factor, the explanation of why things are as the statistics claim them to be. The information will be based on actual experience of management and labor and not on reported statistics which have many flaws. A valuable by-product of this approach will be to increase the cooperation of local labor and management in matters of common concern, such as productivity.

H. B. MAYNARD (Methods Engineering Council) : In considering productivity at the company level, it is necessary to include not only the productivity attributable to the application of the worker but also that attributable to methods. First, productivity is affected by methods determined by job conditions, including design. For example, in the dress industry, productivity will depend on the presence or absence of sleeves, collars, pockets, frills, and the like; in coal mining, on the presence or absence of gas, the height of the seam, the hardness of the floor, and similar factors. Second, methods determined by physical equipment affect productivity—whether the operations are performed by hand or machine, and the types of machines used. The third method variable, under given job conditions and physical equipment, is the sequence of motions employed by the operator.

Because of these factors, the measurement of productivity is difficult. The various yardsticks used (volume per man-hour, volume per man-day, volume per crew-day, volume per machine-hour, dollar value of sales per man-year) measure productivity incompletely and must be used with understanding. General units like tons, molds, and pieces do not correlate well with the time and effort required to produce them, if the range of sizes, weights, etc., is varied. In many instances difficulties have been experienced with incentive plans because differences in the design of the products handled resulted in large variations in earnings.

The solution is generally to establish additional units of measure, with a standard for each. In coal mining, for example, instead of a single tonnage per man-day figure, it would be necessary to establish standards for gaseous and nongaseous mines, for various ranges of seam height, for various grades of coal, and for various types of physical equipment. Management officials, through long experience, are able to establish empirical relationships so that even incomplete measures take on value

and meaning. However, in order to obtain productivity figures that are comparable and useful at the plant level, it would appear necessary to establish well-defined classifications of product, job conditions, and physical equipment. Then any differences may be attributed to labor effectiveness, including in the latter term such factors as skill, effort, heat, light, ventilation, training procedures, morale, managerial skill, and so on. Such information would appear to be most useful in raising productivity throughout a given industry.

CHARLES E. YOUNG (Westinghouse Electric Co.): Output per man-hour of factory labor is only one of several interrelated productivity concepts that are important in managing a manufacturing enterprise. For purposes of reaching valid business judgments, comparisons of results with costs must ultimately be expressed in monetary terms. Analysis of physical output per man-hour is useful primarily as a refinement of technique aimed at eliminating the vagaries of money as a means of measurement. However, the concepts and measurements must eventually be reinterpreted into monetary terms.

Physical measurement of productivity at plant and company levels is necessarily inexact. Even if a plant or company produces a single product all the units of which are identical, problems may arise. If the plant has been generating its own electricity but later buys its power, for example, the man-hours per unit of finished product will be reduced, but it is questionable whether this change should be called an increase in productivity. Measurement becomes more complex when a second product is introduced, for this involves a weighting problem. This lack of homogeneity also applies to man-hours, since there are differences in skill and effort between different individuals and in different occupations. Another problem concerns what part of the total hours worked in a plant or company shall be used. Because of these difficulties, comparisons purporting to show differences in productivity must be subjected to the most careful scrutiny. Possibly the proper function of physical measurement of productivity at the plant or company level is to delineate broad trends rather than to support detailed conclusions as to management action or wage policy.

Many of the improvements in manufacturing efficiency come about product by product, or even part by part. There is no reason to suppose that each and every operation included in an average has become more efficient in the same degree. An example of productivity change operating virtually on a plant-wide level is the redesign of the electric-motor line of the Westinghouse Electric Co., which resulted in a 30-percent reduction in the man-hours required to produce a given motor. This program involved investigation of the characteristics that customers desire

in motors, extensive development work, and the investment of 20 million dollars in a new plant. The number of parts required for the new motors was reduced by over 90 percent. This example indicates that substantial improvements in productivity do not accrue merely by the passage of time, but must be conceived, studied, implemented, and backed by substantial investment.

Many of the forces which operate to increase productivity have little connection with the earnestness and skill of the individual worker. Among the foremost requisites of growing efficiently is alert aggressive management. Friction between management and workers, however, can hinder and even undo many promising technological gains. If friction is replaced by mutual confidence and respect, management and labor can go forward together, to their mutual advantage and to the benefit of the general public.

### *Concepts and Measures of Productivity at the Industry Level*

SOLOMON BARKIN (Textile Workers' Union of America, CIO): This is a summary of two papers already distributed to the participants.

One, "Measuring Man-Hour Output in the Synthetic-Yarn Industry," discusses the deficiencies of the index prepared by the Bureau of Labor Statistics as well as of an alternative measure prepared by the Textile Economics Bureau. The Textile Economics Bureau production index, which is based on the total yardage of rayon yarn, is invalid, for there is no direct relationship in the synthetic-yarn industry between yardage and man-hours. The Textile Economics Bureau and Bureau of Labor Statistics indexes have a number of deficiencies in common. The companies in the industry produce many products in addition to rayon yarn and the proportion of these products has continuously increased; for example, two plants are devoted exclusively to the production of nylon. It is incorrect to derive output per man-hour by dividing an index of rayon-yarn production by a man-hours index which includes nylon and other products, as well as rayon yarn. Moreover; the man-hours figures are primarily the number of man-hours paid for and not man-hours worked. As unions obtain provisions for more liberal vacations and sickness and lunch-period pay, the discrepancy between the index of man-hours paid for and the actual hours worked is constantly widened.

MR. YOUNG: The experience of Westinghouse Electric Co. is that "net allowed hours" are about the same as in 1941. Elapsed hours for the incentive workers are somewhat lower, and indicate a gain in efficiency. However, for hourly paid workers, there has been a considerable reduction in the number of "net allowed hours" as against the elapsed hours. In addition, there has been a large increase in the number of salaried

and staff people, brought in on the expectation of a high volume of output. The company is currently making inefficient use of some labor; this is no reflection on the willingness or skill of the workers, but may be bad management.

Per capita income has been growing at an accelerated rate and it is important that the remuneration of labor be reviewed quite frequently. This should be done by considering total productivity and sharing the increases, making only such distinctions between workers as are possible through very detailed studies of performance at the job level. The general movement of wages must be based on the general movement in productivity. It is possible, by studying the changes in real per capita income of the country as a whole, to determine what changes should be made in the income of labor as a whole to provide equilibrium in the economy. About a year ago the speaker made an attempt of this kind. Assuming that wages, prices, and productivity were in balance as of January 1941, making allowances for the increased cost of living, and projecting the annual productivity increase of the years before the war, it was found that as of August of last year [1945] there was a needed adjustment of 18 or 19 percent in the general wage level. Although this study yielded only a first rough approximation, it was a starting point.

JOHN D. GILL (Atlantic Refining Co.): Repeated attempts to make measurements of labor productivity in the petroleum industry have been unsuccessful because of changes in equipment, in processes, in the quality of output, and in the quality of raw materials. The chief reason for attempting to measure labor productivity is with respect to the remuneration of labor. However, it makes no difference whether labor productivity can be measured at the plant and industry level. It is possible to depend on competition from department to department, from plant to plant, and from industry to industry, for high labor productivity, in the sense of the workers' attitude and qualities of mind and muscle. It is absurd to think that there can be vast differences in the remuneration of, for example, Number 1 machinists in different plants because of differences in productivity at the plants. The apparent differences in productivity between the plants may be almost entirely the result of management efforts, which are quite irrelevant to the value of the machinists.

The original interest in man-hour output centered in the question of displacement and reemployment, but current interest centers in the creation of new wealth for distribution. Therefore, it is necessary to consider how the results of our industrial activity may be more rationally distributed. Output per man-hour gives one phase of the approach to productivity, but it is also necessary to consider other phases of productivity in the sense of creation of wealth at a lower cost. Enormous savings

occur in industry through more economic use of materials and savings of overhead items.

The second paper, "Measuring Productivity Rather Than Man-Hour Output In an Industry," discusses changes in total productivity in the cotton-textile industry between 1937 and 1939. The value of products, less wages and profits, corrected for price changes, is used to show the input of factors other than labor. Output per unit of input of these factors must be considered along with output per man-hour. This paper is presented only as an approach to the problem of measuring total productivity and may need refinement.

### *Discussion*

**NATHAN FINE** (Research Director, Metal Trades Department, American Federation of Labor): Mr. Young's implication was that shares should be based on the contribution of the various productive factors. The common assumption is a very static one. It is assumed that the worker stays pretty much on the same level, but that the research division has no limitation. The status of the industrial arts, which is so largely determined by the universities and Government agencies, is taken for granted. In the last 4 or 5 years, the Government has invested hundreds of millions of dollars in machinery and has given it mostly as free goods to industry. That contribution will automatically be assumed to be the contribution of research of the companies. No effort is made to determine what part of the workers' products goes into the company treasury for depreciation or research, which in turn becomes a company contribution to further development. When analysis is made from the viewpoint of relative contributions and it is assumed that management takes over everything except the workers' contribution, the whole question of productivity implies something which is a little pernicious from the labor standpoint. If studies were made plant by plant, or job by job, and all the factors were analyzed, the common assumptions would not necessarily be shown true.

**MR. YOUNG**: It is agreed that the integration of research activities make it difficult to determine the specific contribution of any one group.

**HARRY MAGDOFF** (U. S. Department of Commerce): There is need for relating what is being measured to the purpose of measurement. Different measures are needed for different purposes. There is the national aspect of distribution of income, from the standpoint of adequate balance to maintain full production and full employment. Secondly, a measure is needed for negotiations with respect to wages. Third, measures are needed for management problems with respect to controls and effi-

ciency. In the opinion of the speaker, there is no scientific method of measuring performance on the job. The only constructive way is for labor and management to get together and to settle on techniques and standards.

MR. GILL: Industrial engineers can do much to affect productivity, in the sense of power to produce, but the individual who might be operating at 80 or 85 percent of his personal effectiveness cannot have that effectiveness greatly increased. The main concern is productivity, in the larger sense of capacity to produce. The problem is to increase total production; this can be done only by attaining and maintaining equilibrium in the economy.

MR. BARKIN: Industrial profit figures are not real indicators of productivity. There is, first, no set rule as to how much industry should receive; nor is there uniformity as to the methods of calculation. The figures usually discount increases in productivity which have been passed on through lower prices and reflect the bargaining powers of the various economic groups. It is therefore necessary to study the relations of various factors that enter into productivity at the industry level.

EVERETT HAGEN (National Planning Association): There is a method by which it is possible to get double entry bookkeeping into our thinking. The changes in productivity—total physical output divided by man-hours—together with the change in prices and the shift in the nature of the output should add up to the change in the value of output per man-hour. A study made by Sam Cohn, under the direction of the speaker, on the change in the value of output per man-hour between 1939 and 1945, both for all nonagricultural industries and for manufacturing showed that for all nonagricultural industries the increase was 55 percent. The increase in prices may be estimated at 28 percent. Thus, the increase in physical output per man-hour, plus shifts in the nature of the products, must have accounted for a 20-percent rise in the value of nonagricultural output per man-hour. It is possible to estimate the change in physical productivity, the effect of the shift in the composition of output, and the change in prices. If all three will not add up to the change in the value per man-hour, then something is wrong with one of the four measures.

DUANE EVANS (U. S. Bureau of Labor Statistics): One way of approaching economies in the use of input factors other than labor is by the use of the interindustry relationship technique. The Bureau of Labor Statistics, for the year 1939, divided the entire economy into major industry groups and investigated quantitatively the kinds and amounts of products which proceed from each industry to the others for further

processing or for use. For example, over the past 20 years there has been a marked reduction in the amount of coal required to produce a kilowatt-hour of electric power. This change does not show up in the productivity figures either for the coal industry or for electric power, but it does show up on the interindustry balance sheet.

Many different types of measures can be useful. In the tire industry, for instance, one can measure the number of tires produced or the total tire-mileage. These may be related to total man-hours, skilled and unskilled, together and without differentiation, or it is possible to separate the man-hours worked by skilled workers and unskilled workers and to weight them to derive an adjusted figure. None of these measures is intrinsically wrong, and each may convey useful information, but the user must understand what is included, what is excluded, and what is ignored.

#### OCTOBER 28—EVENING SESSION

Chairman, George W. Taylor, University of Pennsylvania

#### *Concepts and Measures of Productivity at the National Level*

MARION HEDGES (International Brotherhood of Electrical Workers, AFL): Whether the United States operates under a free economy, a planned economy, or a mixed economy, its achievements depend upon production. Productivity is a secondary concept, of importance because it bears directly on the question of equitable distribution of the results of production.

The salient fact about American industry is that it is mechanized. Our weakness has been that we have never clearly visualized our destiny with relation to mechanized production. Mechanized production enables industry to pass from piecemeal production with high unit costs to mass production with low unit costs. Mass production with low unit cost, however, must depend upon high income for each citizen. The United States has elected to follow the free-enterprise concept in the operation of our economy. Our economy can be operated under this concept, but not without controls.

An article by Benjamin Graham, in the Commercial and Financial Chronicle, presents a point of view in business that may be of great moment. Mr. Graham traces mass unemployment in time of prosperity to a persistent tendency for productivity to expand faster than per capita income and to a recent tendency for the working force to expand relative to population. Mr. Graham states that wages should advance with productivity, while the workweek should decline to the extent needed to maintain full employment.

Some way must be found to take into consideration, in any productivity index, intangible values. Moreover, in some industries, as in building construction, productivity cannot be measured quantitatively.

Labor can hope to profit by a more scientific operation of industry, with national goals in mind. Labor believes generally that labor is not now receiving and never has received a just share of the fruits of production. Labor wishes to see the gap closed between the growth of productivity and the income distributed. Labor does not believe productivity can be quantitatively measured, since intangibles are all-important. Labor believes that any gauge of productivity will be advantageous—even physical output per man-hour, but labor wants such a gauge, when promulgated, to be seen for exactly what it is, and advocates that a complete description be published with each set of periodic figures.

EVERETT HAGEN (National Planning Association): The first conceptual problem in the measurement of productivity at the national level relates to the weights to be used to combine into one index the trends for the different types of goods, when the proportions of the different goods change. As an example, assume that the two types of goods are automobiles and tables, with tables representing forest products in general, and that the wage payment per man-hour and the value of output per man-hour are higher in automobile production. The increase in productivity in the automobile industry has been much more rapid than in the forest-products industry. If the two industries are weighted together in accordance with the number of man-hours in each, there will be one result for the combined productivity index. If the weights are the wages in each industry, on the basis that a man-hour at \$1.50 is not the same as a man-hour at \$1.00, a different index will be obtained. If the price that the final purchasers of the products put upon them and weight by value of product are considered more relevant, still a different combined index is obtained. In general, weighting by value of product is most appropriate.

Another problem is, which year is to be selected in weighting the two series together. If automobiles and forest products are weighted in accordance with their relative importance in 1940, automobiles will be weighted much more heavily than if relative importance in 1900 determined the weights, and the index will therefore go up faster.

The problem of shifts in the proportions of different goods arises between the goods-producing and service-producing industries. In the services, the growth in productivity has been much more slow than in the goods industries. In the thirties, the service industries grew greatly in relative importance, because of disguised unemployment of persons who shifted into small businesses and attempted to sell services. A marked

reverse shift occurred during the war. If the trend in productivity for the economy as a whole is estimated by comparing the deflated value of output with man-hours, the effect of shifts between industries is included in the estimate. In the opinion of the speaker it is correct to include the effect of such shifts. Because of such shifts, it was estimated in the Hagen-Kirkpatrick study that the increase in over-all productivity between 1939 and 1950 would be 2.3 percent per year, compared with 1.7 percent between 1923 and 1939.

Another conceptual problem which enters at the national level is the difficulty of measuring output in some industries. There is no definable unit of output in such fields as the law, services of government workers, banking, and the like. A final problem is the lack of data for some fields, even where there are no conceptual difficulties.

The conference might consider why there are no data in certain areas, whether there are conceptual problems and, if so, what problems. In this way, it could make some technical advance in the problem of measuring productivity.

ROBERT W. BURGESS (Western Electric Co.) : Studies of productivity at the top level may lead to the formulation of decisions on particular operating questions; studies at the plant level may facilitate the task of management; studies at the industry level may furnish a standard of comparison of industries. At the national level two types of measures of productivity would be desirable. To measure the typical gain in productivity that the economy as a whole is making, a composite should be constructed by the use of constant weights applied to the productivity series for the different industries. On the other hand, to meet the problems raised by Mr. Gill and others concerning changes in total product to be distributed, a measure based on current varying weights for different industries is needed. This measure is probably one of the most fundamental in the application of productivity studies to wage questions, since it is the over-all gains in national productivity which have justified, during the past century, the continued improvement in our standard of living and similar over-all gains which are expected to justify corresponding improvements in the future.

The concept of gross national product is more helpful in this problem than the concept of national income. Gross national product is the primary concept, since national income is derived by subtracting from gross national product depreciation accruals; i. e., the capital assets supposed to have been consumed. Annual depreciation accruals never were very satisfactory as measures of the capital value used up per year since they were never designed for that purpose, but are simply the results of convenient and conventional accounting procedures for spread-

ing capital costs by years. During the next few years, annual depreciation accruals, as recorded in the books of manufacturing companies, are going to be still less satisfactory measures of capital value used up since many companies are going to use, without any depreciation charges, equipment that was paid for and amortized during the war, and in addition, depreciation accruals based on plant cost will be much lower than the value of plant used up as measured by replacement cost.

A defect in both national income and gross national product is the inclusion of interest on the public debt. In the speaker's opinion, it would be preferable to consider only nongovernment output, even though it is possible to justify the inclusion of some of the government expenditures because they represent consumer services. However, most government services are not valued in the market place and the only value that can be assigned to them is the conventional one of what is paid for them.

It is important that measures of national production reflect gains through technological improvements and replacements. Natural gas will perhaps be brought to the eastern part of the country, replacing some coal. If it serves the same purpose, gross national output is increased or is maintained at less input.

In some industries, it is very difficult to consider productivity as due to the efforts of the workers immediately concerned. In the exhibition of motion pictures, for instance, there is, according to the formula, greater production per usher where the theater is filled than when there is a small audience. In fishing, again, production depends mostly on natural factors which the individual fisherman merely accepts. It is difficult to think of productivity as having anything to do with efficiency of labor and management factors in such cases.

### *Discussion*

DUANE EVANS (U. S. Bureau of Labor Statistics): An illustration will show the difference in results attained by weighting with man-hours and with value added. The number of man-hours required to produce a thousand cigars decreased about 30 percent from 1939 to 1945, and the number required per thousand cigarettes decreased about 20 percent. If we determine how many man-hours it would have taken in 1945 to reproduce what we actually did make in 1939, we will get a figure between 20 and 30 percent as our average. If we determine the value per man-hour, in constant prices, created in these two industries together, we get a 60-percent increase.

Value-added weighting is useful for some purposes but not for others. One cannot conclude, on the basis of such a measure, that it is possible to increase profits, to lower prices, or to raise wages to the extent of

a 60 percent increase in efficiency. The change is due partly to a shift of production from industry to industry, and no single plant in either industry is necessarily 60 percent more efficient.

For the national economy, it becomes virtually impossible to measure physical productivity and it is necessary to use the value concept. Each has its own field of use. The physical concept has a much more immediate relation to economies in the usual sense.

SOLOMON BARKIN (Textile Workers Union of America, CIO): As suggested earlier there are sources of increased efficiency which are not reflected in the measures of output per man-hour but which are relevant to the process of trying to distribute increased productivity among the various components of our productive system. For example, in a number of industries chaotic competition has been ruinous. As a result of stabilizing controls there will be fair-trade practices. In some industries, as for example in the apparel group, the unions have contributed to greater stability, and the result of such stabilization is a diminution of the amount of capital that gets destroyed.

Another illustration is the cotton-textile industry, in which the function of selling is being integrated with the function of manufacture. The integration of these two operations will not show up in any of the figures that we have. However, it will mean a reorganization of the systems of production and designing, of fabrication, and of marketing, which will stabilize the industry and possibly result in less loss and less capital involved in the industry for the same output. In wage negotiations, the union will be tapping this economy because it will tend to show up in a higher level of profits. Another example is the tendency in the men's clothing industry for the manufacturer to have his own retail store.

MR. HAGEN: Where there is an economy in a given industry which is associated with a saving of material, without any saving of labor, a study of man-hour output in the separate industries will not reflect it. However, because of the reduction of employment in a previous industry which was producing the material, without reduction in the Nation's total output of finished products, the economy as a whole will show such a saving.

### *Concepts and Measures of Productivity at the International Level*

JULIUS HIRSCH (Consulting Economist): Professor Rostas has tried to show that for manufacturing industries as a whole, output per person employed was roughly twice as great in the United States as in the United Kingdom, and a similar result was obtained for the textile indus-

try by the Textile Mission. He states that it is possible that American supremacy in manufacturing is obtained only at the cost of relative inefficiency in the other four-fifths of the economy.

Comparisons made by the speaker for the year 1944<sup>2</sup> showed that British labor received, in dollars, approximately two-thirds of what American labor received, but purchasing power probably would not have been so far from that of American labor.

It is greatly one-sided to measure productivity only by considering output in relation to human labor hours. For national and international comparisons various other standards have been developed, especially those of net output per kilowatt-hour and net output per installed horsepower. Data from the British Census of Production for 1935 show that where there is much human labor and little machinery, net output value per kilowatt-hour is high. Where there is little labor and much machinery, the reverse is true.

A specific German approach to the question of efficiency was a systematic nation-wide comparison of costs and performances in industry. Professor Schmalenbach developed schemes for uniform cost accounting for more than 60 industries, and industry and government assisted in this work. In this way, it was possible to compare every individual cost element in a business with those in other businesses in the same industry. These methods brought about an enormous increase in efficiency. German statistics show an increase in value added by manufacture per man-hour of about 50 percent from 1926 to 1936.

In the Soviet Union, there is a decided attempt to bring about an increase in productivity with all means available to the concentrated power. Production quotas are allocated to every factory, every department, and ultimately, every laborer. The goals of the 5-year plan called for an average annual rate of increase in productivity of 12 percent in all industries, and 15 percent in the heavy industries. The Russian publications say that in most cases the performance of the Russian industry is somewhat better than the plan; the statistical evidence, as far as we have it, does not yet show how far this has been the case.

In the field of international comparisons, the first work was done on distribution—wholesaling and retailing. The great area of retailing has been neglected in the usual discussions of productivity. It is, however, probably the area where there is the greatest need for a change. The Harvard Business School has stated that the costs of distribution, including transportation, absorbed 54 to 59 percent of the total cost of producing and distributing goods. International collaboration in eliminating sources of waste has been adapted to great advantage by the members

<sup>2</sup> Mr. Hirsch's comments were based on tables on "Productivity and Productivity Measurement and International Cost Comparisons," which he had distributed to the members of the conference.

of the International Association of Department Stores. There are new attempts in the United States, as in Sweden and Switzerland, to lower the increasingly heavy burden of distribution costs, though none has as yet had decisive results.

Comparison of materials, wages, overhead, and profit in the main manufacturing and mining industries for Sweden, England, and the United States in three different years at different stages of the business cycle shows that the share of materials in the total is almost identical. The share of wages is highest in England and lowest in the United States.

The best international exports we can make are those of knowledge—how the suffering nations may soon reach the level of highest productivity. We have ourselves reaped enormous profits through such exchanges. In showing others how to increase productivity, we teach them how to help themselves to better and better standards of living.

CHARLES MERWIN (International Monetary Fund): All of the difficulties encountered in making comparisons of productivity at the national level, the industry level, the plant level, and the job level arise in an accentuated form in international comparisons. The problem of index numbers is even more difficult to resolve on a spatial basis than on a temporal basis. In using broad measures, there is the difficulty of determining what exchange rates to use. Finally, differences in definition and classification usually present more practical problems in an international comparison than in a temporal comparison.

Nevertheless, a comprehensive comparison of productivity at the international level should be attempted, and the appropriate time is the present, when we can profit from wartime experience. It would be necessary to have an international working party. This working party would try to define the problem, uncover usable data, and determine differences in productivity for the economy as a whole, for particular industries, for particular products, and even for particular jobs. Finally, such a working party would appraise the strategic factors accounting for the differences in productivity.

Such a study could be sponsored on a nongovernmental basis by, say, philanthropic foundations in two or more countries, or it could be done on the governmental level. Since the Board of Trade in Great Britain has engaged Professor Rostas to study the productivity of competitor countries, an obvious international working party would be, say, the Board of Trade and the U. S. Department of Labor. Private business enterprise should participate in such a study. Corporations which operate on an international scale should be an ideal source of information as to details concerning productivity on the job and in the plant.

HANS STAEBLE (International Monetary Fund): The usual procedure

in dealing with the question of comparisons of the change in productivity over time within one country with the change in another country, is to compute a production index, which is weighted by value added at one particular moment of time. On the other hand, the employment index usually is the unweighted, unadjusted sum of all man-hours worked.

In any kind of index-number computation it is always conducive to clarity to consider an index number as a weighted average of some variable. Since the variable usually measured is the ratio of output to man-hours, such an index gains in clarity if it can be built up as a weighted average of such ratios, and then combined into some aggregate expression.

Interpretation of the usual type of index (based on a production index weighted by base-year value added) in terms of the original industry indexes is extremely difficult and leads to a weighting system which looks at least awkward in symbols. If a weighted average of indexes pertaining to particular industries is desired, then of necessity weighting by man-hours should be used. In this case, the index is clear-cut, and its computation would not exclude such other extra measures as might be found useful or necessary for other purposes. Such an index would measure the *average* change in productivity per man-hour actually worked. The weights should be the man-hours worked currently, year for year, in each industry.

For the purpose of checking on this idea, the speaker had taken 15 out of 17 of the industry groups that Dr. Fabricant presents in his work, and had computed output per man in each one, weighting them together with shifting weights, year for year, by the number of men actually at work. Finally, an over-all and very rough correction was made for the disproportional change in total man-hours as compared to total employment in terms of the number of men.

For the period 1899 to 1939, the speaker computed from Dr. Fabricant's productivity index an average annual rate of increase of 2.98 percent. Taking the index computed with changing employment weights, the result of 1.95 percent a year—a tremendous difference—was obtained. For the period 1899 to 1929, Fabricant's index leads to an average increase of 2.94, whereas the speaker got 1.79 percent.

The speaker by no means subscribes to the idea of a normal continuing increase in productivity. Conceptually, there is no doubt whatsoever that there can be no automatic, virtually self-perpetuating increase in productivity of that sort.

Any rates of increase, over time, of productivity in a country are only loosely related to the increases in real income as it can be measured, for example, by deflating money incomes. Thus, if a country imports a large part of its food supply and food becomes cheaper, real incomes will

increase. However, if that decrease in food prices is due to increased efficiency in other countries, it is one more instance of the world solidarity in greater efficiency.

### *Discussion*

PROF. J. R. HICKS (University of Manchester, England): The more price and value are used as weights, the closer you bring the discussion to the general field of national income. Possibly the next thing which needs doing is to get the national accounts divided up properly by industries, so that the contribution of different industries becomes clearly appreciated. A good deal of the discussions at the conference have tended more in that direction than in the direction of productivity. Productivity work proper does have a further function, in the direction of trying to explain why the real national income, or contributions of particular industries to the real national income, move the way they do.

SOLOMON FABRICANT (National Bureau of Economic Research): The differences that Mr. Staehle mentioned in the indexes of manufacturing output compiled with different weights were very much larger than those found by the speaker's own experimental computations along the same line, and it would be well for Mr. Staehle to check his computations. The consistency criterion mentioned by Mr. Staehle can be met in several ways. One way is to define the output figures for the individual industries so as to attain that consistency. An index of "net physical output," something analogous to net value added, will yield a measure for an individual industry such that when averaged for all industries the result is consistent with deflated national product. Moreover, such an index of net physical output takes into account some of the points Mr. Barkin mentioned. For example, savings in materials would result in a greater rise in net output than in the usual indexes of "gross physical output."

CHARLES ROOS (Econometric Institute, Inc.): It would be desirable first to define the purpose for which a productivity index is to be used and then to build one to meet that purpose. Since the greatest productivity changes are in the newer and growing industries, national productivity might be the summation of growth functions and it is thus wrong to use a logarithmic function to describe productivity. With respect to costs of distribution, if the customer is willing to pay for services, it is up to industry to provide the service and it is not our province to say that the cost of distribution should be lowered. Finally, it is important to state very clearly how any index is constructed. If that is done, there will be a use for almost any weighted index.

E. J. RICHES (International Labor Office): The I.L.O. would welcome

suggestions on means to insure that the basic data collected in different countries are as nearly uniform as possible and that methods followed in making measurements of productivity are standardized internationally. In drafting proposed international standards for employment statistics for submission to the Sixth International Conference of Labor Statisticians, which will convene in Montreal in August 1947, careful consideration will be given to the discussions of this Productivity Conference and to suggestions which members in the conference may send to the ILO.

### OCTOBER 29—MORNING SESSION

**Chairman, Isador Lubin, President of the American Statistical Association**

#### *Scope and Limitations of Existing Measures of Productivity*

DUANE EVANS (U. S. Bureau of Labor Statistics) : All the participants have received a bibliography which attempts to list the main references to quantitative work in the field of productivity. The Bureau of Labor Statistics should be informed of important omissions, since the bibliography may be reissued later.

The Bureau of Labor Statistics has been working in the field of productivity since at least 1898. Its present work owes a substantial debt to the activities of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques. Continuing work in the Bureau of Labor Statistics was started in 1941 with a staff of 25 people, but within the past year the number has grown to about 65.

At one time or another, the Bureau of Labor Statistics has done some work on almost every aspect of productivity. That part of its work which has probably received the most attention is the preparation of productivity indexes, or indexes of physical output per man-hour. Before the war, there was the invaluable help of a Census of Manufactures every 2 years, but such a census has not been taken since 1939. There may be one covering the year 1947, but the results will probably not be available until 1949. The census is especially valuable because it presents necessarily comparable production and employment statistics for the same establishments.

Since 1939, employment reports have been obtained from one source and production reports from others. The question of comparability between the production and labor reports presents continual difficulties. The Bureau has systematically examined the statistics collected by all agencies, trade as well as government, to see whether there is any material which can be used to prepare additional indexes of output per man-hour, and this work will continue.

None of the indexes is perfect. It is a commonplace to the statistician that all figures of broad coverage include imperfections. The real question is the permissible range of uncertainty. The guide on this question is the following: Would anyone be likely to reach a different policy decision because of errors or imperfections in the figures?

The Bureau naturally receives criticisms of its indexes and suggestions for improvement. These are all carefully examined and appraised. Moreover, there is a substantial amount of self-examination and self-criticism, and a continuous effort to improve the validity and field of use of productivity figures.

One of the criticisms made is that the man-hour figures include, to some extent, hours which are paid for but not worked. If such hours could be excluded, the indexes of output per man-hour would be somewhat higher. The Bureau's figures on employment and pay rolls are not collected primarily for the purpose of computing productivity measures. The series are in part designed so that there will not be erratic variations in average hourly earnings. The inclusion of paid vacations in the man-hour figures tends to balance out the average hourly earnings figures during those periods of the year when vacations are common. It may be possible that some correction can be made to exclude hours paid for but not worked, but productivity work is not the prime factor in determining what type of information is collected.

Another problem is that the employment series collected by the Bureau are based on month-to-month changes in identical groups of plants. Such series require periodic adjustments to a benchmark. At present, many of the series are not adjusted, and the general direction of the bias is downward. The speaker is more concerned about this problem than any other single source of bias which might affect the indexes.

Several statements which had been made, to the effect that the field of use of these indexes is limited, are heartily endorsed. The indexes have been incorrectly used, and as a result there has been criticism of the BLS. It may be that the BLS has failed to qualify the indexes sufficiently, but even when extensive and lengthy qualifications are attached to an index, the index is sometimes stripped of the qualifications and presented as immutable fact. For example, the Bureau has not been able to prepare any measure of output per man-hour which covers all manufacturing during the war period. Measures have been prepared for a limited number of nonwar industries, mostly those producing nondurable goods or materials. The average for that limited number of industries has been used in some instances to represent manufacturing as a whole. This is misuse or misrepresentation.

The Bureau of Labor Statistics is compiling a brief report for each industry for which it has published indexes of output per man-hour.

These reports will include all the basic figures, all the weights, and such analysis as can be made of the effects of various possible revisions. The BLS will send these reports to interested people in the unions and companies in the industries concerned; their criticisms and comments will be invited. No promise can be made that this will be done for all the industries, but an effort will be made to complete the task before final indexes covering the year 1946 are published.

A new program, now under way, is designed to yield for a number of industries more satisfactory measures of annual change in output per man-hour than have been available in the past, and more particularly it will give productivity measures for durable-goods industries about which nothing previously was known. In each industry selected for study, a group of products is chosen to represent the industry. Careful specifications are drawn up for each product, and a sample of plants manufacturing each product is selected. From each plant, the Bureau is attempting to secure an annual report on the average number of man-hours required to produce the specified product. The direct reporting arrangement eliminates many questions of comparability, makes productivity measurement independent of secondary sources of information on production and employment, and permits the collection of collateral information explaining the reasons for changes in output per man-hour. The survey in each industry can be designed to accommodate the special problems and operating characteristics of the industry.

Statistics of productivity, or of anything else, are tools; they are not themselves things. Recognizing that figures are tools, it is up to us to understand them, to polish them as well as we can, and to apply them to the particular jobs which they are best fitted to do.

#### **LIMITATIONS OF PRESENT BLS MEASURES OF PRODUCTIVITY AND LABOR COSTS**

KATHERINE POLLACK ELLICKSON (Assistant Director of Research, Congress of Industrial Organizations): The BLS indexes of productivity and unit labor costs have serious shortcomings and have expanded unduly to fill the void in this important field. It is the responsibility of the BLS to try to avoid this result, first, by hemming in the indexes with a sufficient explanation of their limitations and, second, to seek to fill in the gap in other ways so as to present a properly balanced picture. In addition, the indexes should be carefully reviewed in order to improve them where possible, or to terminate them if they are unreliable.

The following are specific limitations of the indexes which the Bureau should both seek to remove and explain fully in all releases and statements:

(1) Production patterns within many industries were greatly changed by the war, so that the degree to which the output series represented each industry undoubtedly fluctuated considerably. Government-procured items generally were made to higher specifications and required more work than civilian items, as for example paratroopers' boots as compared with ordinary shoes. It would seem to be incumbent on the BLS to make an analysis of this matter generally available.

(2) Various systems of weighting may be used to combine the component parts of the production series for each industry. It would be helpful to explore the effect of different bases for weighting, to indicate the possible range in which the indexes might vary if different methods were employed.

(3) If the employees covered in the man-hour series are making products not represented in the production series, then obviously errors result. Many companies changed their products during the war but continue to be classified according to the 1939 basis in the compilation of the BLS employment and man-hours data. Although the BLS dropped indexes for industries in which it knew that a considerable shift in the nature of products had occurred, no thorough canvass was undertaken in the remaining industries to make sure that the employment and man-hours figures actually matched the products with which they were compared.

It should be possible to make some check for at least some of the industries, in the same manner as attempted by Mr. Barkin for the synthetic-yarn industry. At the very least, this limitation should be mentioned, not just here but in all publications.

(4) The BLS employment and man-hours data are artificially inflated by the inclusion of time paid for but not worked; that is, vacations, holidays, call-in time, lunch time, sickness for which benefits are paid, and so on. The BLS specifically asks the reporting firms to include in their employment and man-hours reports all hours which were paid for but not worked. Since unions have won very marked gains along these lines in recent years, a definite downward bias results. Thus, each week of vacation with pay during which no work was performed adds 2 percent to the man-hours reported for the employees affected. The BLS Industrial Relations Branch reports 2 million workers as covered by union contracts with provisions for paid vacations in 1940, but 11½ million in November 1944. Vacation time is only one of the types of time that are paid for but not worked. This question requires careful investigation and possibly some adjustments; it could mean an error of 3 to 5 percent.

(5) Also, the BLS employment and man-hour series are affected by a downward bias that results in part from delay in securing information on new firms. Unemployment-compensation data are used to check BLS

employment reports for major industry groups, and some subgroups are also being adjusted by these benchmarks, but some downward bias remains. This operates to offset the upward bias in the man-hours data etc., but there is no reason to assume that the errors cancel each other out.

(6) The BLS indexes of unit labor cost are derived by relating pay rolls to output per man-hour. All the errors already mentioned therefore are carried over into the labor-costs series, and some may well be compounded. The pay-roll figures include items, such as premium pay for night shifts, which are granted labor not merely because of the inconvenience to the workers but also because of the savings resulting to employers. Obviously, running two or three shifts produces savings in overhead which are likely to more than offset the premium pay, so that including it in unit labor costs produces a misleading result.

(7) Output per man-hour as measured by the BLS is too narrow a concept of productivity. Economies in production brought about by better integration of industries, substitution of improved materials, and more economical use of fuel and power are not taken into account. The BLS should place its series in proper perspective by discussing these factors.

(8) The 29 nonmunitions industries for which the BLS has issued indexes in recent years are unrepresentative of all manufacturing because they are industries in which the effects of the war tended to impede rather than enhance productivity advances. Autos, aircraft, ship-building, steel, and all the metal-fabricating industries are omitted. A good many nonessential industries are covered, which suffered especially from shortages of manpower, materials, repairs, and equipment. As a result, the BLS release for 1945 and earlier releases have erroneously conveyed the impression that productivity did not rise during the war, and in 1945 was only slightly above 1939 levels. Since the data have already been released, the BLS should immediately issue an official statement on their proper interpretation.

Although the preprint of the December 1946 Monthly Labor Review article partly covered the speaker's proposals about interpretation of these indexes and putting them in proper perspective, the article still relied too heavily on the indexes and implied that they had a degree of accuracy which cannot be substantiated. All releases should carry an explanation of these limitations.

Special industry studies are being undertaken by the BLS, which will follow through changes in man-hours required for specific operations or production processes. This approach is worth exploring, but there is grave danger that the products of operations selected will be considered representative of the industry when they are not. The most stable operations are those which can be most easily studied. In areas where rapid change is taking place, continuous measurement may well prove impos-

sible. The reporting companies know very well that labor may use the results to seek wage increases. There will be a temptation to err on the side of understating increases in productivity, not through misrepresentation of the figures so much as through selecting processes which, for some reasons, the employer may think are more representative of the industry, but which in many ways are not.

The planning of these special studies, including the choice of operations and the review of results from time to time, should be done in consultation with union representatives. Although the BLS may be placed in the dilemma of making the studies on the employers' terms or not making them at all, the Bureau should take a firm stand against employer pressure and should explore the possibilities of compulsory reporting of essential information.

The BLS should explore new methods of approach along lines suggested by this conference. It should offset the erroneous impression created by its indexes of output per man-hour and labor costs by explaining the wartime factors which interfered with full development of production potentialities. It should also stress the tremendous increases in productivity which occurred in war industries, the vast effects that can be expected from plant expansion, the significant increase in machine tools with harder cutting edges, the pooling of research information, the stimulation of research by the Government, the acquisition of German patents, etc.

Instead of simply assuming that the long-time trend of a 3-percent increase in productivity will continue after the war, the BLS should be alert to explore whether this long-time trend may not have been accelerated by the wartime developments. Only through a broader approach can the BLS place its indexes in proper perspective and avoid the harmful, even though unintentional, underestimation of the increase in productivity in our economy.

#### **PROBLEM OF PRODUCTIVITY MEASUREMENT IN THE SHIPBUILDING AND SHIP-REPAIR INDUSTRY**

**ROSALIND SCHULMAN** (Research Director of Industrial Union of Marine & Shipbuilding Workers, CIO): In peacetime shipbuilding, like large locomotive production and large turbine building, is custom production. There has not been, except during wartime, any measure or attempt at measure of production in this industry. The Bureau of Labor Statistics has published a study of productivity changes during the war, when large numbers of vessels were built, but this study has absolutely no use for peacetime production.

In any form of custom production, certain operations remain compara-

tively stable over a decade or so. It might be possible to develop a series of ratios measuring operational cost as adjusted to quantity of operational production. Such a series of measures would reflect, over a short period, major technological change and improvement and major changes in labor utilization.

Rapid technological changes in phases of construction, which perhaps cannot be measured on an operational basis, could make the index for one particular operation meaningless, but if a series of common-denominator operations were developed, the limitations of any single operation might be overcome. Another limitation is that the earnings figures may be inadequate because of modifications of rate structures and modifications of the operations themselves. Continual changes in design will also invalidate this approach.

However, if a series of operational ratios is developed and used over not too long a period, valuable information may be obtained on the custom-production industries which cannot be derived in any other way.

#### SCOPE AND LIMITATIONS OF EXISTING PRODUCTIVITY MEASURES

ANDREW COURT (General Motors Corporation): The speaker cannot agree that Government wartime research has made a large contribution to all types of manufacturing industries. It has in some areas, but it has not in others.

In the auto industry, the poundage of product per man-hour, computed according to a crude formula developed by the U. S. Department of Commerce, showed 18½ pounds per man-hour in 1941. For 1946, the output per man-hour has been running less than 14 pounds.

It is possible to compare accurately the productivity of different individuals on the same job. Where the union permits, such comparison enables the employer to reward individual effort and skill. This tends to maximize the income of the workers. Comparison of different jobs at a given period, or of jobs which change from period to period, is extremely difficult or impossible. For any industry that is evolving, productivity comparisons over a long time span are likely to be crude, at least. In the speaker's opinion, attempts to measure or compare plant productivity are practically useless as factual tools in negotiating changes in wage levels or other union-management economic issues. The whole idea of attempting to base wage rates on productivity in a specific company or industry is inconsistent with equal pay for equal work.

Much of the change which occurs in productivity is due to forces developed outside the industry in which the results appear. Major factors in the high productivity of the American motor-vehicle industry include a large market free of tariff walls, good roads, and progressive

supplying industries such as rubber, steel, glass, and machine tools. Another important factor is the American ideal of free competition. Industry-wide production planning and pricing have probably restricted competition and the growth of the industry in England and Europe. Standardization is also of great importance in the motor-vehicle industry. It is possible because Americans are willing to buy cars which look alike. Thus, it is very difficult to interpret industry productivity data.

On the national level, there is a great delusion that productive capacity is unlimited and that the only problem is to provide mass purchasing power. Actually, the farms and factories of this country have never produced nearly enough to provide a fully satisfactory standard of living for everybody. For example, the amount of meat and fat and cheese required by the BLS maintenance budget was about twice the amount that could be purchased with ration points in 1944 and 1945.

### *Discussion*

**BORIS STERN** (U. S. Bureau of Labor Statistics): The productivity data published in the past by the Bureau of Labor Statistics have been extremely useful in describing, in general terms, developments with respect to machinery, increased productivity, higher wages, and shorter hours. The work the Bureau may do in the future may become more effective because it is now a more-integrated agency, it has more skills, and the need for productivity data is more generally recognized.

There is a serious danger, however, in that this new tool is being used for purposes for which it is not intended and cannot be effectively used—collective bargaining. The data hitherto available cannot be used for collective bargaining except in a general way for describing the history of the industrial arts or the effect of the use of machinery on our standards of living.

If productivity information is desirable for collective bargaining, labor and management should agree, industry by industry, on what methods should be used to develop such data. With such agreement, the Bureau of Labor Statistics would be ready and able to work with labor and management in the development of the data, provided labor and management also agree that the results obtained will be acceptable irrespective of whether they show a decline or an increase in productivity. Unless there is such agreement, it must be recognized that although productivity data are useful to illustrate certain developments nationally or in various types of industries, they should not be used for collective-bargaining purposes.

**FRANK R. GARFIELD** (Federal Reserve Board): The concept of production is basic to productivity measures. If the concept of production

is considered in relation to the final product and the scale of living, it is clear that many factors enter into the production process. In any particular industry, materials and fuels are consumed and transposed into finished products by workers, machinery, and management. Electric-power consumption obviously is not a satisfactory measure of the whole production activity in an industry, and neither is man-hours. In the textile industry, it takes a great many man-hours to produce \$10 worth of net product; in the chemicals industry, very few man-hours. For measures such as gross national product and national income, the whole community of statisticians is agreed on including all of the product and including it in value terms.

It is true that when values added are used as weights, elements of the market enter into the picture. Value is influenced by decisions of the customers as to what they are willing to pay and by the decisions of the producers as to what they are willing to receive for their services and their goods. Granted that there are elements of monopoly and of Government price fixing, the value-added figures reflect, as nearly as anything, the combined judgments of the community. Therefore value added for the most representative period for which data are available should be used as weights.

**SOLOMON FABRICANT** (National Bureau of Economic Research): The National Bureau of Economic Research has published studies on productivity, production, and employment in manufacturing, agriculture, and mining, and is now working on other sectors of the economy. Its indexes are simply byproducts of these studies. The National Bureau is interested in the factors affecting the growth of our industries, or, in some cases, the decline. Studies are made not only of the factors affecting productivity, but also of the relations between trends in productivity, in employment, in production, in capital, in prices, in wages, and so on.

**JOHN D. GILL** (Atlantic Refining Co.): Regarding Dr. Stern's remarks, we can use the present productivity measures in bargaining, but we need to understand that they are not accurate and to use them as approximations. Unless there is a balance between our power to produce and the ability to clear the market of that production by appropriate measures of compensation, there will be severe dislocations; thus we need to know something about the increase in production which becomes the basis for collective bargaining.

Economic measures which lack the dollar mark should be used only when it is impossible to make a report based on dollar magnitude. Because of competition, it is possible to lean heavily on accounting profit-and-loss statements which make possible a comparison of the results of any operation with the operations of comparable firms elsewhere.

If the general change in production—either gross national product or national income—is used to measure the general change in compensation, there remains only the problem of administration. A 10-percent increase in wages in a mass-production industry may be possible without an increase in prices, but a 10-percent increase in wages in a firm hand-tooling belts, for example, may require an increase in prices and may result in the loss of the market. We should anticipate such changes and prepare either to substitute machine-worked belts for hand-worked belts or go out of business.

MARTIN GAINSBROUGH (National Industrial Conference Board): One desirable result of the conference might be that the BLS prepare a reply to the CIO criticisms of the BLS indexes of productivity.

CELIA STAR GODY (U. S. Bureau of Labor Standards): The questions raised by Mrs. Ellickson concerning the BLS productivity indexes might be separated into three categories. The first question is whether the measures are correct for what they are intended to show. It is agreed that the indexes are not correct to the last decimal place, but many of the factors mentioned are much less significant than they are generally believed to be. For example, on the question of the time paid for and not worked, if every worker had a 1-week vacation, there would be an error of something less than 2 percent in the man-hour series. The actual average is doubtless considerably less, since many workers are not covered by vacation provisions, many who are covered have not worked long enough to be eligible, etc. The error in the man-hours index is the difference between the extent to which there are paid vacations in the base year and the extent to which there are paid vacations in the year under consideration, and may be in the neighborhood of 1 percent. When there have been more significant changes in the reporting of man-hours, the BLS has made explicit adjustments; for example, in coal mining, for which, after the change to portal-to-portal pay, the reported hours figures included travel time.

It is true that there have been, in many industries, changes in the specifications of products, new types of goods, and changes in the proportions of different products. The BLS has not continued to show indexes for those industries in which such changes were so great that it was impossible to make any comparison. For the remaining industries, the Bureau attempted to learn all it could about the changes in the nature of the products and to make tests of the accuracy of the published indexes. For example, it has been stated that the index for the shoe industry is too low, since military shoes are bigger and heavier and presumably better than civilian-type shoes. The information obtained indicates that the military work-type shoe does require more

labor than a civilian work-type shoe, but less labor than a civilian dress-type shoe. If the index is reweighted to take this factor into account, the result differs by only 2 percent from the published figures.

In cases in which the indexes incorporate weights for some old period, tests have been made, changing the weights to the year 1939. In practically all cases, this reweighting has resulted in only small changes in the indexes.

Two problems raised by Mrs. Ellickson—the possible bias in the employment series, and the comparability between the production and employment series—cannot be solved completely until there is another census. Many of the industries for which indexes are shown are fairly well defined and it is possible to state with confidence that the indexes include their total production and that the production figures are comparable with the employment series. In other cases, varying amounts of products are not included in the production series and there is no information on whether there has been any shift in the importance of such products. A complete evaluation cannot be made until there is another census; until then, all that is possible is to determine from available sources whether there is any indication of such shifts.

A second question concerns the factors which make the indexes go up or down. These are not limitations, but rather explanations, of the indexes. For example, where there are special wartime factors which make for declines in some of the indexes, it is important to know them, not because the indexes are not good measures but because it should not be assumed that the wartime levels will be the levels in the future when those factors have disappeared. In the building-materials industries, for example, there were substantial drops in output per man-hour during the war simply because of the decline in production. It is important to know the reason, because it can definitely be expected that as soon as production increases, output per man-hour will also rise. This has actually happened during 1946.

A third question is what additional measures would be desirable. Output per man-hour is only a partial measure; the ratio of output to man-hours in itself does not give a complete story of what is happening in the economy. For example, data on unit labor cost must be used together with other information. It is necessary to consider changes in costs of materials, in overhead, and in all the factors which enter into the cost structure. The Bureau would like to do as much as possible in the way of providing additional measures of productivity in this broader sense. Whether it can do so depends, first, on the availability of information on these other factors — materials, overhead, etc. — and, secondly, on the availability of staff for such work.

DUANE EVANS: Mr. Garfield's comments on the desirability of weight-

ing with value added were probably based on his experience with the Federal Reserve index of industrial production. Conceptually such a measure tells us what the value of our production would be, relative to the base period, had there been no changes in the prices paid for all factors used in production, including labor. The speaker knows no better method of measuring the general level of industrial activity than the one used by the Federal Reserve Board.

In the use of man-hour weights, there is an attempt to answer a different, clearly stated problem: If we were to reproduce the physical amounts produced in some base period, how many man-hours would it take relative to the man-hours used in the base period? This physical approach is useful at the plant and industry level. The bigger the sphere encompassed, the less the utility of this approach because the necessary figures cannot be obtained.

It is believed that the other points which have been raised will be met by the analyses of the indexes which will be sent to the interested parties, and that these statements will also answer Mr. Gainsbrugh's point.

#### OCTOBER 29—AFTERNOON SESSION

Chairman, Thomas Blaisdell, U. S. Department of State

#### *Need for Additional Productivity Measures*

LAZARE TEPER (International Ladies' Garment Workers' Union, AFL): The significance of the physical output man-hour ratio will be examined, first under a set of theoretically controlled conditions and then under conditions complicated to bring them into relation with reality.

First, consider a single plant which turns out a single product and assume that the product manufactured by this plant did not undergo any changes in its specifications; that the raw materials used remained similarly unchanged; and that there were no changes in any of the manufacturing methods or equipment. Under such conditions, variations in the physical output/man-hour input ratios can be interpreted as indicators of changes in the relative average efficiency of the labor force. Of course, the ratio does not, in any way, throw light on the causes responsible for the changes.

Next, assume that the theoretical plant changed its methods and techniques of internal operations (including installation of different capital equipment). Since the factors responsible for changes are no longer exclusively on the labor side, this concept of efficiency changes must be deemed a function of the many independent and interdependent forces which take labor, management, and equipment into account.

If the specifications of the product turned out by the plant have also been evolving, the ratio of physical output to man-hour input will reflect not only the changes in efficiency, but the effect of changes in the specifications of the product as well. When additional factors are permitted to influence the quanta of the physical output/man-hour input ratios, the meaning of the resultant statistics is complicated to an even greater extent. Thus, the nature of integration between the productive processes of a given plant and those of its suppliers and customers changes over a period of time, and such changes either increase or decrease the need for workers. Similarly, changes in the specifications, character and nature of raw materials may also affect the plant's worker requirements. As long as it is impossible to segregate the various factors which may be responsible for the fluctuations in the physical output/man-hour ratios, the designation of such ratios as measures of productive efficiency seems hardly tenable.

On the other hand, a statistical series showing the ratios of man-hour input to physical output does serve as an indicator of manpower utilization—measured in units of time input—within the confines of a particular plant, needed to turn out a unit of product by changing specifications under the conditions of changing efficiency of the various factors of production and of changing position of the plant in the economy. These conclusions apply equally well to a group of plants manufacturing a single article.

If a plant is engaged in the production of two or more commodities, the meaning of the data is further affected by the inability to combine noncommensurate entities without converting them into some other quantities, commensurate with each other as a matter of statistical convenience. Thus, the technique recommended by the National Research Project and the Bureau of Labor Statistics permits the computation of a combined index for a group of products by weighting "manpower utilization" figures for the individual commodities by the units of physical output for some preselected "weight" base year. An index so computed for more than one product, in accordance with the NRP-BLS techniques, should be described in terms which denote its significance as an index of manpower utilization (measured in units of time input) needed to produce "weight" base-year units of physical output, as influenced by changes in the product specifications, efficiency of the different factors of production, and the nature of the plant's (or industry's) relationship to the economy.

The theoretical advantage of an index computed on a fixed-weight base lies in the fact that it measures but a single element of change, to the exclusion of others. Yet, in this case, there is the infusion of many factors, each of which changes in time. As long as such influences are

not eliminated, one can properly raise a question as to whether an index number, which would incorporate in its make-up the effect of all of the dynamic changes which affect the economy, including changes in the relative importance of the different products, would be of greater significance for economic analysis. Such an index would reflect changes in the relative importance of the different products in the course of time, and would permit the inclusion of new products as they make their appearance. It could be described, in terms of its significance, as an index of manpower utilization (measured in units of time input) needed at different times to produce a unit of physical output in accordance with specifications, efficiency, and nature of economic organizations at each of the periods under consideration.

Since "productivity" indexes do not portray changes in productive efficiency, their designation as such should be abandoned and full qualifications made as to their meaning at the time of publication. At the same time, it would seem desirable for the investigators of productive efficiency to direct their attention, to a greater degree than heretofore, to the collection of descriptive information which is a necessary prerequisite before refinements in the productivity measures are attempted on a large scale. Research should be undertaken on the plant level to find out, in greater detail, how changes in productive efficiency are brought about and the influence thereon of machinery, management, individual effort, flow of work, demand for goods, specifications and variety of product, nature of raw material, and so on. Such studies should investigate how changes within the plant affect the skills and composition of the labor force, and what displacements, if any, changed methods of production bring. Statistical investigations, dealing as they do in averages, may actually conceal the full importance of such changes.

More information is needed about the effects on workers of management pressure for higher output, and the necessity for earning a living. Are there socially desirable optimum levels of human effort beyond which it is undesirable to go? What is the effect of the existing methods of incentive payments on the workers' well-being? What is the effect of management's behavior on the efficiency of workers and the enterprise?

More information is needed on the influences, from outside the plant, on its productive efficiency. To what extent do changes in the demand for goods or competitors' activities induce variations in the production methods? How rapid is the process of change as between the different plants? What is the relation between capacity output and productive efficiency? How is productive efficiency affected by changes in the nature of integration between the plant and other businesses? What is the effect of developments in the field of communications and transportation on the plant?

The present interest in the question of productivity stems from a universal desire to find the clue to a better standard of living. If it is held that the answer lies in greater productive efficiency, there is no question but that econometric studies must be supplemented by investigations of cause, effects, and byproducts of such change. It is to this area that the attention of investigators of productive efficiency must turn.

In making studies at the plant level, it is particularly important that such plant studies be undertaken by an impartial agency such as the Government, with joint cooperation of advisory groups representing both labor and management.

(Mr. Teper presented an additional paper criticizing the formula used by the Bureau of Labor Statistics in computing its indexes of unit labor cost. The paper indicated that the appropriate weights for a production index to be used in deriving unit labor cost were pay rolls per unit of output and not man-hours per unit.)

### *Presentation of Productivity Measurements*

SOLOMON FABRICANT (National Bureau of Economic Research): The speaker, in behalf of those who produce productivity measurements, believes they must do the best possible job of presenting such measurements. They should continue to review terminology and should define terms. They should make clear what the figures mean and note some of the things they do not mean. They should be explicit about the sources of the data, about accuracy, about limitations. They should note the methods of combination, the weight systems, the weight-base periods. They should compute alternative measurements and publish them now and then, if only to dispose of questions concerning the importance of the difference between them and the figures issued regularly. They should have a base book, revised and expanded every so often, to which they can refer in the shorter public statements.

They should call attention to the representativeness and homogeneity of their samples. When the samples are not homogeneous, they should avoid combining the individual items into an average. When an average for a homogeneous group is prepared, but the group is not representative of the whole of which it is a part, they should avoid implying that it is.

When they don't know, or are not sure, they should say so clearly and emphatically. Whenever they revise, they should spell out the reasons for the revisions, and the uncertainties still remaining even in the new figures. They should dissociate questions of fact from matters

of policy. They should dissociate guesses about the future from statements about the past.

It is hoped that the consumers of productivity data really read the notes and textual qualifications and refer back to the more-extended discussions provided before raising questions; that when they think of a reason why the figures *might* be off, they won't jump to the conclusion that they are in fact off, or if off, that the error is always and *necessarily* important.

Producers of productivity data welcome questions and suggestions, but hope that such questions and suggestions would not be made, at least in the first instance, via the public press. They have a weakness in particularly liking constructive suggestions.

All of us must have some common meeting ground, if our kind of economic and political system is to survive. Established fact is an essential ingredient of this common meeting ground. There are enough differences dividing us on which it is not easy to come to common agreement. Facts need not be among them. Our fact-finding agencies should be kept nonpartisan, for our mutual advantage.

From the discussion, during the conference, of the limitations of the BLS indexes of output per man-hour, it is feared that some people may get the impression that these indexes are of little value. That impression would be quite wrong. The indexes for the period since 1939 cover only a few industries. It is true, too, that they are subject to adjustment when the censuses come out. Indeed, like all statistics, they are surrounded by a margin of error. This does not mean, however, that BLS indexes are subject to so much error that they are worthless. On the contrary, for the industries to which they relate and which they are intended to cover, they convey useful and valuable information.

### *Discussion*

IRVING H. SIEGEL (U. S. Veterans Administration, formerly with the National Research Project and the Bureau of Labor Statistics): Consumers of productivity statistics have apparently expected too much, or have ignored the cautions accompanying such measures as long as the indicated changes conformed to their intuitions or interests. Though the available indexes are probably the best that can be made with available data, they have outstanding limitations which must be taken into account especially if they are used beyond their original purpose. In any case, the differences concerning the definition and measurement of productivity do not seriously impede solution of the important practical problem which motivates much of the theoretical discussion, namely, the maximization of output, however defined, of a given work force through

the improvement of production processes and of labor-management relations.

GEORGE BROWN (United Association of Plumbers and Steamfitters, AFL): Labor people want to see accurate productivity figures developed and want those figures to reflect efficiency. The study of productivity can occur at two levels—first, in the area of academic interests, in the development of industry and national figures; and, second, in the area of practical application, at the plant level. Enough deficiencies have been pointed out to indicate there is a large area for work at the plant level.

LYLE COOPER (United Packinghouse Workers of America, CIO): The speaker's union has not found the BLS index for slaughtering and meat packing good for bargaining purposes. The index is computed by weighting with fixed prices. The Federal Reserve index, which is on a 1935-39 base, shows that man-hour output went up substantially more after 1939 than the BLS index indicates. There is a good reason for using several years as the base period, particularly in meat packing, where prices of the different products fluctuate considerably. Between 1944 and 1945, the BLS index went up about 9 points, but a company negotiator pointed out that this change was due to the fact that hog slaughtering had decreased and beef (which is higher priced) therefore received a greater weight. The BLS itself has indicated in correspondence many limitations of the type described.

HENRY B. ARTHUR (Swift & Co.): The explanation of the change in the BLS index for meat packing is the fact that BLS uses the total value of the product as weight, rather than something approximating value added. This gives importance to the two species—beef and hogs—which represent the total input of the farmer as well as the packing-house worker. Between 1944 and 1945, there was no change in the total weight produced, but there was a decline in the amount of work to be done because pork production, which requires a great deal of processing, declined.

In the presentation of productivity ratios, we have conventionally shown a ratio in which the whole (production) is divided by the part (man-hours), and this convention has occasionally led us into thinking in terms of labor productivity. If a series of ratios is prepared, with the various inputs in the numerators and the output in the denominator, one might say that the relationship which changed least from one year to the next was probably the factor which most nearly accounted for the change in production. As an example, assume that man-hours per unit of product decreased 20 percent and the amount of all the other input factors per unit decreased 20 percent except power, with the kilowatt-hours used showing no change. As a first step it might be pre-

sumed that the increase in production was a result of the application of kilowatts. These ratios show that it was something other than the factor in the numerator that caused the change in the denominator.

In working with measurements, we are operating within a part of the total field. Even the broadest measures omit about a third of our total economy—the output in households. From a social point of view, there should perhaps be an appraisal of the total values of our economy.

SOLOMON BARKIN (Textile Workers Union of America, CIO): The emphasis which originates from the collective-bargaining process and from the study of national incomes is on the desirability of obtaining more all-embracing mathematical techniques for gaining insight into increased productivity. It is also necessary to evaluate the importance of our neglect to use some of our resources—both capital and labor—and the importance of that part of our output, such as that of households, which is not converted into monetary business terms. Perhaps what is needed is an assimilation of the concepts of measurement of physical output with some of the concepts in the national income field, plus some approach on the problems of untapped resources and untapped manpower.

MARGARET SCATTERGOOD (American Federation of Labor): The AFL members met during the noon period and made unanimous recommendations on two points: (1) They wish to emphasize the importance of the case-study method and to urge its use, with representation of unions and management on committees cooperating with the government agents. (2) They believe the work of the conference should be continued through a continuing committee on which labor, management, and government are represented. They would like to refer to such a committee the question of whether a set of figures for the economy as a whole can be developed and, secondly, the problem of defining or perhaps changing some of the specifications of the present Bureau of Labor Statistics indexes.

EVERETT HAGEN (National Planning Association): One of the reasons for dissatisfaction with the use that has been made of productivity data is failure to agree on the meaning of the term "productivity." In economic theory, the term means the contribution of a particular factor to production; statisticians in the field use the term simply to refer to output per man-hour, whatever the reason for the change. Another difficulty arises in the use of data covering more than one product. Such an index can change simply because of shifts in the proportion of the commodities, depending on the weights used. We should not criticize the figures because we are not sufficiently mathematically trained to understand them, but should realize that a figure cannot be all things for

all purposes and a technician is required for its proper use. A third difficulty is the inadequacy of the figures because of failure to take account of all relevant circumstances.

The conference should create a continuing smaller body to continue to examine the existing productivity series, to clear up misunderstandings, and to investigate changes which might be desirable for new purposes.

**HIRAM DAVIS** (University of Pennsylvania): It might be more productive to develop a series of ratios relating various input factors to output than to attempt to measure total input. The conference might consider whether it would be worth while to form working parties in some of the industries in which there is disagreement over how output should be measured.

**DUANE EVANS** (U. S. Bureau of Labor Statistics): Even the most precise productivity figures are not necessarily a definite guide to the way in which the production economies of the system can be divided. In the long run, output per man-hours has been going up, but there are segments of the economy in which productivity has not increased, such as some of the service industries. It cannot be maintained that wages should not increase in such an industry if, over a period of time, general earnings have gone up. If society wants the products, it has to pay a high enough wage to keep people in that industry. On the other hand, there are some industries, such as rayon, in which there have been extremely rapid increases in productivity. If wage levels in such an industry were increased accordingly, it would be necessary to have a guild system to keep people from entering the industry, because wages would be so much above the general level.

**MR. BARKIN**: Those who suggest the need of data for collective bargaining certainly do not have the ideas imputed by Mr. Evans. To pose these theoretical alternatives does no service to the discussion of the problem, but bars constructive thinking in this field. The problem is to get a measure of productivity, so that the parties can then rationally discuss and possibly bargain about the methods of distributing the gains.

**H. H. BOOKBINDER** (Amalgamated Clothing Workers of America, CIO): The speaker represents the workers in the shirt industry, where the union expects wages to rise in the future, but hopes that productivity as affected by worker effort will decline. Mechanization seems to have reached its maximum limit, and the rate of production of a shirt depends mostly on the fingers of the operator and not on the machine itself. Because of the piece-rate structure of the industry, the worker has driven herself beyond reasonable human levels in an attempt to

increase her earnings. On one important operation, for example, the top stitch on the collar, a girl may work on as many as two to three thousand shirts a day. This type of work has led to countless cases of physical and psychological breakdown. In the future, it is expected, of course, that general productivity in American industry will continue to increase. Shirt workers should benefit from this general increase. However, it is hoped that some decent production standards can be agreed upon for industries like the shirt industry. As for sharing the benefits of increased productivity, there will be times when labor will ask for the extra share at the plant level, at times the industry level. In the long run, however, it must be the economy level, either in the form of generally higher wages or generally lower prices.

EWAN CLAGUE (U. S. Commissioner of Labor Statistics): A government agency can do effective work in studies of individual plants or jobs, but only if there is general management-labor agreement on such studies. Such data, while valuable locally, have very little significance nationally. On the other hand, the general indexes were not necessarily drawn up for collective-bargaining purposes. When any of them are used for specific purposes, they should be reexamined to see if they will fit. It is hoped that some of these measures can be made useful for collective bargaining, at least for a first approach.

### *Summary of Conference*

SAMUEL H. THOMPSON (U. S. Department of Commerce): The conference has been made up of people who believe in progress, in improvements, in the continued movement upward of the human race and of our own industrial civilization and of the United States. The conferees have agreed on several major areas.

The first is that, since it is desirable in the interests of all of us to increase productivity, measurements are needed that will help find out how to increase it. We need measures adapted for use as tools in the analysis of the productive process that will help us improve the total quantity and quality of production. We need many different kinds and styles of tools. We certainly need physical measures of productivity, based on physical production and the number of man-hours or man-years. We also need monetary measures. There are many other measures we need—for example, kilowatt-hours per unit of output, pounds of coal per kilowatt-hour, etc. The conference has agreed that we must be clear as to what the measures we use mean and what they are useful for. In index numbers, we necessarily put together things which are not commensurate; we have to use index numbers, but must not forget that fact. Speaker after speaker has emphasized the need for a clear under-

standing of the purpose and then a careful design of the instrument. At the same time, it is interesting to note how amazingly few people are keeping systematic records from which the tools could be forged.

It has also been emphasized that we need to do a better job with what we already have. The conferees have agreed that we use these measures to analyze the factors that enter into production. It has been emphasized that there are many factors which affect production and productivity.

The conferees have also agreed that the ultimate responsibility for improvement in productivity or production cannot be assigned to any single factor. The technological progress of our industrial civilization arises from the whole of our society, perhaps the whole of mankind. Mathematically, every individual of the race contributes in some measure, to either his own generation or the next. We can improve our performance, and ultimately we all gain from each man's individual effort.

There are other areas which were omitted or in which there was some disagreement. One is the matter of the use of indexes in collective bargaining. There has been general agreement on the need for further analysis leading to the design of better tools for specific use in reaching collective bargains. The conference has not discussed very thoroughly the need for both physical and monetary indexes and therefore physical and monetary weights. It has not discussed at any length the actual techniques that are available or should be devised for getting the basic data.

The executive committee wishes to announce that there will be a transcript of the meeting available for inspection, but there will be no attempt to make it generally available. A summary will be prepared by the executive committee which will be sent to all the participants, for their approval or correction, which may later be published.

The executive committee will, if the conference approves, meet and discuss ways and means of continuing the work of this conference—whether through subcommittees, through recurrent meetings of this size, or through a combination of these and other means.