

# From individual incentives to an organization-wide gainsharing plan: Effects on teamwork and product quality

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## Summary

Despite the widespread use of incentive systems in manufacturing organizations, few studies have used a standard, quasi-experimental research design to directly compare the effects of different plans on employee perceptions and work outcomes. In this study, multiple methods were used to assess changes at a company which ended an individually-oriented piecework plan and subsequently began a high-involvement gainsharing plan. This piecework-to-gainsharing transition involved (a) terminating individual incentives, (b) paying plant-wide bonuses for performance improvements, and (c) developing a highly structured 'idea' system which allowed employees limited participation in work decisions. Survey responses obtained two months before the transition and again 15 months later revealed improvements in perceptions of teamwork and concern for performance. Interrupted time series analysis of over four years of objective data showed a significant decrease in grievances and a significant increase in product quality occurring at the time of the intervention. Concerning the latter, defective products per 1000 shipped decreased from 20.93 under piecework to 2.31 under gainsharing. The results are discussed within the framework of Deutsch's (1949a) theory of cooperation and competition.

## Introduction

Traditionally, individual incentive systems have been among the most popular means of tying pay to the performance of production workers in manufacturing organizations (Belcher, 1974; O'Dell, 1987). Despite this popularity, a number of problems have long been associated with piece rate plans: They may incur high administrative costs and can lead to competition between workers and restrictions in output (Lawler, 1971). They sometimes cause perceptions of wage inequity and become a source of grievances (O'Dell, 1981). More recently, the increased use of automation and other advances in manufacturing technology have made individually-oriented systems less appropriate, and have led organizations to consider alternate incentive systems,

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particularly plans which pay group- or plant-wide bonuses for performance improvements (Belcher, 1974; Freund and Epstein, 1984; Nash and Carroll, 1975).

This article reports the experience of an organization which, following this trend, ended individual incentives and began a plant-wide gainsharing plan. The transition represented a change in the reward structure used to motivate employees: movement away from an individually-oriented structure, and toward one in which goal attainment was positively related for many individuals. A theory of cooperation from the social psychology literature (Deutsch, 1949a, 1973, 1980) has been useful in accounting for behavior when reward systems are manipulated under controlled conditions. The present company's transition provided an opportunity to test the theory's propositions in a naturalistic, applied setting.

### *Deutsch's theory of cooperation*

The theory proposes two basic forms of goal interdependence. Promotive interdependence involves a positive correlation between the goals of two or more parties: as one party achieves its goals, so does the other. Contrient interdependence, on the other hand, indicates a negative correlation: as one party attains its objectives, the probability of attainment for the other party decreases. Under the proper circumstances, promotive interdependence is predicted to be superior in producing effective communication, interpersonal attraction, friendliness, helpfulness, coordination of effort, division of labor, orientation to task achievement, and productivity (Deutsch, 1980). Nearly four decades of research conducted in a wide variety of educational, laboratory, and other settings has generally supported these predictions (Deutsch, 1949b; 1980; Johnson, Johnson and Maruyama, 1983; Johnson, Maruyama, Johnson, Nelson and Skon, 1981; Tjosvold, 1984).

### *The performance gainsharing plan*

The performance gainsharing plan (Fein, 1983; Frost, Wakely and Ruh, 1974) represents one of the most ambitious attempts to change employee behavior through the use of promotively interdependent reward structures. The Scanlon plan, the Rucker<sup>®</sup> plan, and Improshare<sup>®</sup> are among the more commonly recognized gainsharing systems, although an increasing number of organizations seem to be developing 'custom' plans to meet their special needs (O'Dell, 1987). The organization reported here had developed a 'high involvement' gainsharing plan — one featuring (a) monthly bonuses, and (b) a structured idea-handling system.

Reviewing the 'multicost' bonus calculation used by the present company (Moore and Ross, 1978) will help illustrate how gainsharing plans structure promotive interdependence between employees. In developing the bonus calculation, 10 years of information about the company's financial performance was reviewed to determine the historical ratio of the cost of sales to total sales. The numerator in this ratio consisted of all variables thought to be under the control of the employees: wages, production materials, overhead expenses, manufacturing supplies, utilities, and some other costs. The denominator was net sales minus the cost of products returned, discounts, and allowances. Each month, the actual ratio of the cost of sales to total sales was determined. In a month in which this ratio was decreased below the historical ratio, all employees were paid a bonus. For example, if a 5 per cent bonus were earned, it would be paid to each employee as an extra 5 per cent of his or her wages. It can be seen that, as the probability of one employee earning a bonus increased, the probability of another earning a bonus also increased.

As is the case with many gainsharing plans, the present system also provided for departmental

teams which solicited, investigated, and implemented employees' ideas for performance improvement. Each team met monthly, consisted of a supervisor plus elected nonmanagement employees, and was free to implement any idea that did not influence another department and did not cost over a fixed amount. Ideas exceeding the authority of these teams were referred to an organization-wide review board which also met monthly and consisted of management, non-management, and union representatives. The departmental team and review board meetings were used to share information, integrate work activities, and set goals. Although there is some diversity in gainsharing plan characteristics from organization to organization, the present plan is fairly typical with regard to the type of bonus system and involvement system used (Bullock and Lawler, 1984).

### *Product quality under gainsharing plans*

As was discussed earlier, research in laboratory and educational settings has generally supported Deutsch's prediction that promotive interdependence leads to productivity improvements. Similarly, studies of organizations moving to promotive interdependence under gainsharing have also documented improvements in productivity (Fein, 1983; Schuster, 1983; U.S. General Accounting Office, 1981). Because these findings concerning productivity have been fairly consistent, this study focused instead on a different criterion variable: product quality. Quality improvement is particularly appropriate for study because it is one of the most common reasons for implementing gainsharing plans. O'Dell (1987) reports a survey of 223 gainsharing firms in which respondents were asked to indicate the importance of various reasons for plan implementation. As expected, productivity improvement topped the list, with 92 per cent indicating that this reason was 'important' or 'very important'. However, quality improvement placed second at 73 per cent, followed by 'better employee relations' (65 per cent), and seven other reasons of less importance.

Despite this reported importance of product quality, there is little rigorous research demonstrating that quality actually improves under gainsharing. Cummings and Malloy (1977) reviewed eight Scanlon plan case studies, and found reports of quality improvement in six of the seven studies in which quality was discussed. Statistical analyses, however, were not provided. In O'Dell's survey (discussed above), although over three-fourths of the respondents indicated that gainsharing had a 'positive' or 'very positive' effect on product quality, objective measures were not reported. In short, the evidence concerning quality improvement under gainsharing is much weaker than the evidence concerning productivity improvement.

### *Teamwork under gainsharing plans*

In this article, the term *teamwork* will refer to group processes characterized by helpfulness, coordination of effort, open communication, and friendliness. Given Deutsch's (1949a) hypothesis that promotive interdependence leads to such healthy group processes, it follows that a gainsharing plan should lead to similar outcomes in organizational settings. In support of this view, the U.S. General Accounting Office (1981) reported improved labor-management relations in 80.6 per cent of the 36 gainsharing firms it investigated; 47.2 per cent reported fewer grievances. Similarly, improved labor-management cooperation was reported in 55 per cent of the 33 case studies reviewed by Bullock and Lawler (1984). However, the latter authors were quick to point out a fundamental weakness in these studies: the absence of rigorous methods for assessing organizational change. For example, none of the 33 studies reported even the administration of a pre- and post-intervention survey. As was the case with product quality, there are theoretical

reasons to expect teamwork to improve under gainsharing, and surveys and case studies provide suggestive evidence, but actual improvements have yet to be documented with the use of standard statistical methods for assessing change.

### *Model and hypotheses*

Briefly, it was believed that the present company's piecework-to-gainsharing transition would consist of two organizational interventions (changes in the reward structure and the introduction of an involvement system) which would lead to changes in two mediating variables (the employee's teamwork and concern for performance) and, ultimately, to changes in two objective measures of organizational effectiveness (product quality and grievances). The variables are described in greater detail below.

#### **Concern for performance and product quality**

Concern for performance refers to the employees' desire to cut costs, improve quality, and in other ways improve the organization's performance. It was predicted that the transition would lead to an increase in employee concern, not only because of the positive effects of the plant-wide incentive, but also because of the negative features of piece rates. Individual incentive plans often lead to low quality because of the heavy emphasis they place on output quantity (Deming, 1982; Nash and Carroll, 1975) and the ineffectiveness of quality procedures often used in conjunction with piece rates (Smith, 1979).

While piece rates provided reason for an employee to be concerned about only one aspect of organizational performance (individual output), the gainsharing bonus provided reason to be concerned about many different aspects, including product quality. When low-quality, defective pieces were produced, they had to be reworked, and these repair costs added to the total cost of sales (the numerator in the bonus formula), making a gainsharing bonus less likely. If defective products were shipped and then returned by a customer, their value was subtracted from total sales (the denominator in the formula), again decreasing the bonus.

#### **Grievances and perceptions of teamwork**

If gainsharing is effective in improving teamwork, this should be reflected in two indicators: (a) employees should perceive greater levels of communication, coordination and other effective group processes, and (b) the grievance rate should decrease. Again, these changes were expected because of the negative features of piecework and the positive features of gainsharing: Under the best conditions, piecework creates an individualistic goal structure for employees — one in which there is no correlation between goal attainment for different parties (Johnson *et al.*, 1981). In theory, such noninterdependent goal structures should have no effect on social interaction. In practice, however, employees on individual incentives often come to believe that the rates set for different jobs are inequitable, leading to jealousy and conflict (Whyte, 1955). In addition, employees on piece rates sometimes compete for resources needed to maximize their individual earnings, thereby hurting the performance of others (Katz and Kahn, 1966; Lawler, 1971). In short, individual incentive systems introduce either a noninterdependent or, in some cases, a contingent goal structure for employees, and according to Deutsch's theory, can be expected to have neutral or even negative effects on team-oriented behavior. Under gainsharing, on the other hand, one employee's probability of earning a bonus was positively related to another employee's probability, making it more likely that they would share information, be mutually helpful, and work together toward this common goal.

The gainsharing plan's involvement system was also expected to have a positive impact on

teamwork. The monthly gainsharing meetings brought together a variety of organizational groups which might be expected to occasionally experience conflict: management and nonmanagement; direct labor and indirect service groups; office and shop. It has been shown that repeated contact in cooperative contexts can be effective in reducing conflict between groups, particularly when the groups are working toward common goals (Blake and Mouton, 1961; Sherif and Sherif, 1969; Worchell, Andreoli and Folger, 1977), and it was predicted that the contact facilitated by the present involvement system would have a similar effect.

Although grievances and employee perceptions of teamwork are discussed separately in the Method and Results sections, both are viewed as indicators of the general 'teamwork' construct described above. While a grievance rate is not always a pure measure of conflict, there is evidence that it is frequently related to the quality of union-management relations (i.e. Gandz and Whitehead, 1981; Turner and Robinson, 1972) making it an appropriate criterion variable for this study. From the present perspective, an excessive grievance rate is viewed not simply as a sign of conflict, but rather as a sign of poorly managed conflict, and it was expected that the cooperative goals and employee involvement introduced by gainsharing would facilitate effective discussion of these conflicts, reducing the number that would go on to become formal grievances.

### *The transition as an integrated intervention*

The quasi-experimental design used here was not capable of determining which of these interventions — ending piece rates, beginning gainsharing bonuses, or soliciting employee involvement — had the greatest effect on the criterion variables. Instead, this investigation treated the termination of piece rates and the implementation of gainsharing as processes which can be logically combined in a comprehensive program of organizational development — an integrated intervention.

This conceptualization of piecework-to-gainsharing transitions is based on two observations. First, there is a genre of plans which routinely combine the two components of plant-wide bonus and employee involvement (Bullock and Lawler, 1984; O'Dell, 1987). The prototype of these is the Scanlon plan, and a number of sources have emphasized the importance of integrating these components in each Scanlon plan implementation (e.g. Frost *et al.*, 1974; Moore and Ross, 1978). It is therefore appropriate to describe a high-involvement gainsharing plan as a 'package' of mutually-reinforcing activities. Second, transitions of the sort described here are likely to become increasingly popular, due to the technological changes and growth in indirect labor costs which are rendering individual incentives less appropriate for many production workers (O'Dell, 1981). For these reasons, piecework-to-gainsharing transitions merit investigation as unitary, integrated interventions.

## **Method**

### *The organization*

The study took place at an American manufacturer of fabricated tubular exhaust components for the automotive original equipment industry. During the last full year under individual incentives, gross sales totalled over \$35 million. The company employed 405 hourly and 59 salaried employees, and 90 per cent of the workforce was male. Hourly personnel were represented by the United Steelworkers Union, and there was a history of labor-management conflict at the site.

## Management interviews

Semi-structured interviews with upper-level managers were conducted to identify (a) background information about the company's product and history, (b) the nature of the incentive plans and interventions, and (c) threats to the internal validity of the study. Interviews were conducted with the company's general manager and gainsharing plan coordinators 13 months after the transition. These individuals, along with the personnel manager, quality assurance manager, and controller were again interviewed 12 months later. A schedule of transition activities is presented in Table 1.

Table 1. Schedule of transition activities

Month	Date	Activity
1	Feb, 1985	Steering committee established New union contract ratified
2	Mar, 1985	Developmental task force established Individual incentives end
3	Apr, 1985	Gainsharing education and training begins Time 1 survey administered
4	May, 1985	Memo of understanding presented to employees Employees vote to implement gainsharing
5	Jun, 1985	Gainsharing plan begins
18	Jul, 1986	Time 2 survey administered Company officials interviewed
30	Jul, 1987	Company officials interviewed

## Interventions

### Eliminating the individual incentive system

For 35 years, all of the company's hourly personnel had operated under an individually-oriented standard hour plan which paid a base hourly wage plus incentive wages for parts produced in less than standard time. The system was terminated via a 'buy out': Groups of employees were given a raise in hourly wages equal to the average incentive wages earned by that group during the preceding five years. The bargaining agreement outlining the buy out was approved by union members, and the piecework plan ended on March 31, 1985.

### Implementing the gainsharing plan

In early 1985, management and nonmanagement representatives began working together on a document which would eventually describe the gainsharing plan's goals, bonus calculation, and involvement system. The final draft of this 'memo of understanding' was presented to company personnel in early May; employees voted to implement, and the gainsharing plan began on June 1, 1985. Employees earned bonuses in 11 of the first 25 months under gainsharing, with the average bonus amounting to 4.35 per cent of the employee's wages. They contributed 957 gainsharing suggestions during the same time period.

As the plan was being developed and implemented, all employees received education regarding the calculation and other aspects of plan policy. During the six-month periods preceding and following plan start-up, managers and supervisors received 29 hours of training on how to manage employees within a gainsharing context.

### Quality control methods

Most of the company's products required three basic manufacturing processes: (a) rolling flat strips of steel into tubes and welding a seam, (b) cutting the tubes to length, and (c) assembling a final product. Under individual incentives, employees from the quality assurance department conducted in-process and final product inspections: Good pieces were sorted from defective ones, and the latter were reworked by a repair department. This form of product inspection continued under gainsharing.

Statistical quality control methods (Grant and Leavenworth, 1980) were also used under piecework. These methods require that operators draw samples of work, measure a characteristic (such as length), and chart statistics (such as means and standard deviations) to determine whether the characteristic is moving beyond predetermined capabilities. Managers reported that employees resisted these methods under piecework because the time required for sampling and charting detracted from their incentive wages. However, interviewees reported that this resistance decreased when the piece rate system was discontinued, and statistical techniques were gradually introduced to additional work stations during the first 25 months under gainsharing.

### Survey participants

Two months before the gainsharing plan began (at time 1), a survey assessing a variety of employee attitudes and perceptions was administered to the 460 active employees, who were asked to complete it at home and return it to gainsharing plan coordinators. Of these, 357 (78 per cent) returned completed surveys. The process was repeated 13 months after the gainsharing plan began (at time 2), with 260 (67 per cent) of the active 388 employees returning surveys.

To increase the likelihood that employees would be frank in responding, both surveys were anonymous. This made it impossible to pair a given employee's time 1 responses with his or her time 2 responses. Because one of our primary goals was to maximize the likelihood that time 1 and time 2 data were provided by the same group of people, a question on the second survey asked if the employee had also responded to the first questionnaire. Only the surveys of those saying 'yes' were retained for further analysis. The integrity of the data was also threatened by the fact that about 70 employees (all of whom had less than three years of tenure) had been laid off between administrations of the surveys, making it possible that the time 1 data would be relatively overrepresented by short-term employees. To guard against this, only responses from employees with at least three years of tenure were analyzed within each data set.

This resulted in 147 usable time 1 surveys and 161 usable time 2 surveys. Because some analyses (to be reported below) required equal  $n$ 's, 14 observations were randomly removed from the post-implementation data set. Chi-square tests revealed no differences between the groups with regard to shift (chi-square (3) = 4.90, n.s.), pay system classification (chi-square (2) = 1.14, n.s.), or department (chi-square (6) = 8.90, n.s.). These reduced samples ( $n = 147$ ) were used in the analyses which follow.

### Perceptions of teamwork and concern for performance

The Appendix provides the 11-item teamwork scale used in the study, where higher scores indicate perceptions of greater communication and coordination between departments and between levels of management. Coefficient alpha for the scale was 0.82 and 0.85 at time 1 and time 2, respectively. With the 5-item concern for performance scale, higher scores indicate

a respondent's perception that other employees desire to cut costs, improve product quality, and in other ways improve performance. Coefficient alpha was 0.80 and 0.79 at times 1 and 2, respectively.

A factor analysis was performed on time 1 responses, utilizing the principle axes technique, squared multiple correlations as prior communality estimates, and varimax rotation. A scree test suggested two meaningful factors which, combined, accounted for 92 per cent of the common variance. An item was retained for a scale if the factor loading was greater than 0.40 for that factor alone, and these criteria produced the scales in the Appendix. This procedure was repeated for the data from time 2, and the same scales resulted. Coefficients of congruence were then calculated (Levine, 1977) to determine whether the factor structure of the time 1 data was similar to that of the time 2 data. Such a coefficient may range from  $-1.00$  (perfect disagreement) through  $+1.00$  (perfect agreement). Obtained coefficients were quite high: 0.98 and 0.97 for the teamwork and concern for performance scales, respectively. These coefficients were statistically significant at  $p < 0.05$ , using tables provided by Korth and Tucker (1975), suggesting a similar factor structure for time 1 and time 2 responses.

### *Measurement of objective criteria*

#### **Grievances**

Total grievance rate was operationally defined as the number of grievances filed at step 1 divided by the number of employees in the bargaining unit at the end of that month. Some of the grievances filed under individual incentives dealt specifically with the piecework system, and it was clear that they would disappear when that system ended. A decline in total grievances, therefore, may not actually reflect a change in underlying management-nonmanagement relations. To guard against this, a nonincentive grievance measure was also calculated — one in which only grievances not related to the incentive plan were divided by the number of employees. In all, 67 monthly observations of total grievances and nonincentive grievances were obtained for the period January, 1982 through July, 1987.

#### **Product quality**

Quality was operationally defined as percentage customer returns: defective products returned from customers as a percentage of products shipped. Company records provided 51 monthly observations for the period October, 1983 through December, 1987.

#### **Product quantity**

Earlier research has sometimes shown a negative relationship between the quantity and the quality of worker output (e.g. Vecchio, 1982). To determine whether worker output decreased as quality increased under the gainsharing plan, an attempt was made to obtain a measure of the efficiency of direct labor employees. However, the organization began a new, computerized labor hour accounting system at the time of the transition. Efficiencies were calculated in a different way, and the new figures were not comparable to the old in any meaningful way. No suitable alternative measure could be developed from existing data.

## **Results**

### *Threats to internal validity*

Semi-structured interviews conducted with managers revealed no serious threats to the internal validity of the investigation. Interviewees were asked about changes in leadership, employee



composition, equipment used, record-keeping policies, human resource programs (other than those related to the gainsharing plan), or other changes which could be responsible for the improvements observed. They reported no significant events of this nature occurring within six months of the time of the transition.

### *Teamwork and concern for performance scales*

Because the employees did not identify their surveys, it was not possible to perform a correlated groups *t*-test on scale responses. A generally conservative alternative recommended by Green and Field (1976) is to calculate an independent groups statistic, and use the degrees of freedom for the correlated groups test to determine the critical value for rejecting the null hypothesis. That analysis indicated a significant improvement in mean scores on both scales: for teamwork,  $F(1, 146) = 31.06, p < 0.001, R^2 = 0.10$ ; for concern for performance,  $F(1, 146) = 11.08, p < 0.01, R^2 = 0.04$ . An independent groups MANOVA using independent groups degrees of freedom suggested similar results: Wilk's criterion = 0.88,  $F(2, 291) = 19.33, p < 0.0001$ .

At time 1 (two months before the gainsharing plan began), the mean response to the teamwork scale was 2.32 (*S.D.* = 0.70). At time 2 (13 months after the transition), the mean response had increased to 2.79 (*S.D.* = 0.75). With the concern for performance scale, the mean time 1 response was 3.65 (*S.D.* = 0.82); at time 2, this had increased to 3.93 (*S.D.* = 0.60). The correlation between the teamwork and concern for performance scales was weak: at time 1,  $r = 0.04, n.s.$ ; at time 2,  $r = 0.19, p < 0.05$ .

### *Objective criteria*

Hypotheses concerning the objective data were tested using interrupted time series analysis (McCain and McCleary, 1979). These procedures involve a number of iterative steps, beginning with the identification of a statistical model of the data. This requires detrending the series if it is not stationary, and reviewing the autocorrelation and partial autocorrelation functions to identify the presence of autoregressive or moving average processes. An autoregressive (AR) component suggests that a given observation in the series is correlated with a preceding observation or with more than one preceding observation. A moving average (MA) component indicates that the data are characterized by the persistence of a random shock from one observation to the next.

Parameters representing these processes are then estimated and tested for statistical significance, and model residuals are reviewed to assess goodness of fit. If estimated parameters are nonsignificant, or if the residuals do not behave as white noise, the analyst returns to the identification stage, and this procedure repeats until a satisfactory model is identified and estimated. Such models are referred to as autoregressive integrated moving average, or ARIMA, models.

The hypothesis that the intervention had a significant effect on a series is tested by adding an intervention component, or transfer function, to the ARIMA model. Transfer functions may be constructed to test different types of effects, such as abrupt, temporary changes versus gradual, permanent changes in a series. The transition at the present company caused immediate changes in financial incentive contingencies as well as opportunities for teamwork, so the hypothesis of an abrupt, permanent change in each criterion was tested. The following transfer function model describes this effect:

$$Y_t = U_0 I_t + N_t$$

where

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$Y_t$  = the  $t^{\text{th}}$  observation in the time series,

$U_o$  = parameter representing the magnitude of change,

$I_t$  = dummy variable, where  $I = 0$  before the intervention. and  $I = 1$  afterward, and

$N_t$  = noise, or the ARIMA model developed earlier.

The joint transfer function-ARIMA model is then estimated and diagnosed. If the ARIMA parameters are statistically significant, the residuals behave as white noise, and the  $U_o$  parameter is also significant, the null hypothesis of no change is rejected.

In coding the dummy variable  $I_t$ , June 1, 1985 was treated as the intervention date. This date was chosen because it marked the beginning of the first period in which gainsharing bonuses would be calculated, thereby introducing a promotively interdependent reward structure for employees. In addition, it was during June that the gainsharing plan departmental teams and review boards first met, providing opportunities for greater communication and coordination.

Results of the interrupted time series analysis are presented in Table 2. Both measures of grievances were diagnosed as (000) models: processes consisting entirely of uncorrelated random shocks. For both series, the parameter  $U_o$  was statistically significant, indicating a decrease in grievances at the time of the intervention. In practical terms, total grievances per 100 employees per year decreased from 29.28 under individual incentives to 17.40 under gainsharing. The analogous figures for nonincentive grievances decreased from 26.04 to 17.40.

Table 2. Estimates of joint transfer function-ARIMA model parameters, objective criteria

Criteria	Model	Parameter	Parameter estimate	t ratio
Total grievances	(000)	Intercept	0.0244	12.30*
		$U_o$	-0.0099	-3.12†
Nonincentive grievances	(000)	Intercept	0.0217	12.57*
		$U_o$	-0.0072	-2.59‡
Percent product returns	(001)	Intercept	2.1950	16.33*
		$MA_1$	0.5148	4.07*
		$U_o$	-1.9672	-11.11*

Follows (p d q) notation where p = autoregressive order, d = degree of differencing, and q = moving average order.

$U_o$  = magnitude of change following transition. MA = moving average parameter.

\* $p < 0.001$ .

† $p < 0.01$ .

‡ $p < 0.05$ .

The series for product returns did not require differencing, and was characterized by a moving average process. At this company, defective products are not returned by customers until about two months after they are produced, so an improvement in quality beginning in June, 1985 (the time of the transition), would not be reflected in the series until August. To account for this, the joint transfer function-ARIMA model included a delay of two periods. The parameter  $U_o$  was significant, indicating a significant decrease in returns following the transition. In practical terms, monthly defective products per 1000 shipped decreased from 20.93 under piecework to 2.31 under gainsharing.

## Discussion

### *Changes in organizational effectiveness*

#### **Grievances and perceptions of teamwork**

As predicted, grievance rates significantly declined and mean teamwork scale responses significantly increased following the transition, suggesting improved employee relations and greater levels of helpfulness, communication, and coordination. The findings regarding grievances seem worthy of additional comment, particularly in light of Gordon and Miller's (1984) discussion of the 'relative intractability' of grievance rates. They concluded that grievances arise from multiple sources, and that only comprehensive, integrated behavioral interventions are likely to affect them. This company's transition may have been effective because it represented just such a comprehensive intervention, changing many of the dysfunctional conditions which led to management-nonmanagement conflict under piece rates (i.e. dissatisfaction with standards set for jobs, poor upward communication, lack of control over working conditions).

#### **Concern for performance and quality**

This study also adds to our understanding of how gainsharing plans, in contrast to individual incentive systems, impact on attitudes and behaviors related to product quality. Responses to the concern for performance scale showed that employees were more concerned about improving quality, cutting costs, and in other ways improving products and service after the intervention. This greater concern was also reflected in the objective measure of quality: Defective parts per 1000 shipped decreased from 20.93 under piecework to 2.31 under gainsharing. The interrupted time-series analysis provided evidence that the quality improvements were, in fact, linked to the transition date, lending support to findings obtained with other research methods (e.g. Cummings and Malloy, 1977; O'Dell, 1987).

The practical significance of this change can be appreciated by reviewing its effect on the company's internal repair costs. These include the cost of sorting defective pieces, reworking them, and performing a variety of related, nonstandard operations. During 1984 (the last full year prior to gainsharing), these costs constituted 4.67 per cent of sales. In 1986 (the first full year under gainsharing), repair costs had declined to 2.58 per cent — a savings of over \$800,000 in that area alone.

### *Deutsch's theory and behavior under gainsharing*

These results generally support the model presented in the introduction which predicted an improvement in concern for performance, teamwork, and product quality under the gainsharing plan. Interpreting these findings within the framework of Deutsch's (1949a) theory of cooperation will not only facilitate a better understanding of how gainsharing influences employee behavior, but may also help identify those aspects of Deutsch's theory which require further development if it is to have wider applicability in organizational research, particularly in research on gain-sharing plans.

#### **Social-psychological processes under promotive interdependence**

According to Deutsch (1949a, 1973), a promotively interdependent reward structure (such as that introduced by gainsharing) causes changes in motivation and behavior by first having a positive effect on three central social-psychological processes: substitutability, cathexis, and inducibility. *Substitutability* refers to the willingness to allow someone else's actions to be substituted for one's own: If one employee is brought closer to earning a gainsharing bonus by

the actions of another employee, then the actions of the second employee may be substituted for those of the first. In a cooperative situation duplication of the same actions is unnecessary and inefficient, so employees can be expected to demonstrate greater substitutability under promotive interdependence. *Cathexis* refers to the development of positive or negative attitudes: If one employee is brought closer to earning a bonus by the actions of a second employee in a cooperative situation, then it is likely that the first employee will have positive attitudes towards those actions, will have positive attitudes toward the employee performing those actions, and will want to cooperate with that employee in the future. Finally, *inducibility* refers to the employee's willingness to be positively influenced by another: If one employee is moved closer to earning a bonus by the actions of a second employee, it is expected that these individuals will facilitate each other's actions, be mutually helpful, and be responsive to one another's requests.

The implications of these processes for concern for performance under gainsharing is clear: The promotively interdependent reward structure may make it easier for employees to induce each other to cut costs, improve service, and engage in other helpful tasks. As an individual begins to positively cathect the actions of other employees and generalizes this cathexis to the employees themselves, he or she can be expected to feel more responsible for their welfare (Deutsch, 1949a) and have a greater desire to win their respect (Deutsch, 1980). The result can be an increase in the employees' collective concern for performance and commitment to achieve that goal which will benefit the entire group — the gainsharing bonus. Support can be found in Deutsch's (1949b) own seminal experiment which demonstrated that promotive interdependence can cause increased inducibility, positive cathexis, and, ultimately, increases in achievement pressure and actual performance.

The improvements in teamwork reported here may best be understood in terms of the likely effect of a gainsharing plan on substitutability. Because it is inefficient for workers to duplicate one another's actions under conditions of promotive interdependence, more substitutability should occur in those situations: Employees should be more willing to divide tasks, coordinate efforts, be mutually helpful, and keep one another informed about the status of work in progress. Because team-oriented behaviors are positively cathected, it should once again be easier for employees to induce one another to engage in these activities. Consistent with this interpretation, Tjosvold (1988a,b) has investigated goal interdependence in organizational settings, and found that employees who believed their goals were promotively linked strengthened work relationships, interacted effectively, exchanged information and resources, and had trusting expectations.

The present model states that improvements in product quality under gainsharing are attributable, at least in part, to improvements in teamwork. Although this study was not capable of directly testing a teamwork-product quality relationship, findings from other studies have shown that various components of teamwork (such as information exchange and the quality of supervisory communication) are related to objective performance measures in organizations (e.g. Snyder and Morris, 1984). In addition, Katz, Kochan and Weber (1985) have argued that a high degree of conflict between labor and management can lead to poor organizational effectiveness because the time and resources devoted to adversarial processes (such as grievance and disciplinary procedures) detract from the resources available for performance-improvement efforts. Consistent with the present model's predictions, they found a measure of grievances to be negatively related to both product quality and direct labor efficiency.

In short, a variety of investigations — including the one reported here — provide evidence consistent with Deutsch's basic propositions. If the theory is to be truly useful in explaining employee behavior under gainsharing, however, future research must concentrate on variables and relationships which were not measured in the present study. For example, employee percep-

tions of goal interdependence (promotive versus contrient) must be assessed to determine whether they do, in fact, change as a gainsharing plan is implemented. The work of Tjosvold (1988a, b) may be useful in this respect. A causal model describing the relationship between perceived goal interdependence, substitutability, cathexis, inducibility, concern for performance, and teamwork may then be developed and tested using path analytic procedures. Multiple-facility research designs, such as those reported by Katz *et al.* (1985) and Snyder and Morris (1984) may prove helpful in understanding the relationship between the preceding variables and measures of organizational effectiveness, such as product quality and labor efficiency.

### **Promotive interdependence and participation**

Deutsch's theory focuses on the social-psychological processes thought to mediate the effect of goal interdependence on performance outcomes. A useful and comprehensive theory of cooperation in organizations, however, must also acknowledge the role played by institutional structures which either facilitate or obstruct the positive effects of promotive interdependence. For example, the model presented in this paper's Introduction states that gainsharing plan involvement systems facilitate the positive effects of interdependence by giving employees more influence in determining how they will perform their work. From this perspective, cooperative systems which also facilitate participation and information exchange can be expected to be more successful than systems which obstruct these processes. Supporting evidence may be found in Klein's (1987) study of 37 employee stock ownership plans (ESOPs), where both management-perceived and employee-perceived worker influence were positively related to ESOP satisfaction and organizational commitment. Although Tjosvold (1987) has discussed the dynamics of participation in cooperative situations, much more work is needed to determine how institutionalized systems (such as Scanlon-type suggestion systems or ESOP communications systems) may facilitate constructive interaction.

### **Conclusion**

The present study has shown that transition from individual incentives to gainsharing can have beneficial effects on employee attitudes and performance, consistent with research on gainsharing reported elsewhere (Bullock and Lawler, 1984; Cummings and Malloy, 1977; O'Dell, 1987; Schuster, 1983). The findings further suggest that Deutsch's theory of cooperation may prove useful in accounting for employee behavior under gainsharing and similar bonus systems. What is needed at this time is not necessarily more research on *whether* gainsharing plans work, but rather research on *how* they work: studies identifying the individual-level variables (such as cathexis and inducibility) which mediate the effect of reward structures on employee performance. The current interest in gainsharing, coupled with the substantial existing body of empirical research on cooperation and competition, provides an excellent opportunity for theory-driven research and movement toward a better understanding of how employees behave under promotively interdependent reward systems.

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## Appendix

### *Teamwork scale*

Employees responded to each item using a 5-point scale where 1 = strongly disagree and 5 = strongly agree. The employee's scale score was the simple average of responses to the following individual items: (1) Departments in the company seem to cooperate with each other well, (2) people in other departments try to help you out when they can, (3) a lot of the time, departments in this company act as if they were working against each other (reverse scored), (4) communication between departments is clear, open, and effective, (5) it does not take too long to communicate with people in other departments, (6) top management communicates well with employees, (7) your supervisor and you communicate well, (8) supervisors do a good job of listening to their people, (9) most supervisors here should receive some training on how to communicate with their people (reverse scored), (10) employee complaints are dealt with rapidly here at this company, and (11) major disagreements between supervisors and their people are not a problem here.

### *Concern for performance scale*

The same response format, and the same procedure for calculating scale scores was used with the following items: (1) To employees of this company, product quality is a big concern, (2) employees feel there is a real need to find ways to cut costs, (3) it is understood by employees that we must have better products and service if we are to remain competitive, (4) most employees here want to cut down on unnecessary waste, and (5) the average employee here wants to do things in the smartest way possible.