

The Decline of the Piece-Rate System in California Canning: Technological Innovation, Labor Management, and Union Pressure, 1890-1947



Martin Brown; Peter Philips

The Business History Review, Vol. 60, No. 4. (Winter, 1986), pp. 564-601.

Stable URL:

<http://links.jstor.org/sici?sici=0007-6805%28198624%2960%3A4%3C564%3ATDOTPS%3E2.0.CO%3B2-G>

The Business History Review is currently published by The President and Fellows of Harvard College.

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/pfhc.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact support@jstor.org.

The Decline of the Piece-Rate System in California Canning: Technological Innovation, Labor Management, and Union Pressure, 1890–1947

MARTIN BROWN and PETER PHILIPS

¶ *In the following article, Professors Brown and Philips examine two questions concerning wage payment systems. First, has the prevalence of incentive systems been affected by the rise of the modern corporate enterprise? Second, what has been the effect of institutionalized unionism on the prevalence of incentive systems? Brown and Philips explore these issues through a historical case study of the decline of the piece-rate system in the California canning industry, from which they conclude that in the context of Chandlerian industrial development piece-rate systems tend to give way to more complex incentive and hourly wage-rate systems. They explore this hypothesis further through an examination of historical data on wage payment systems for American manufacturing as a whole.*

The relationship between the form of wage payment and the evolution of capitalist enterprise is not well understood. Economists, historians, and industrial relations scholars have been unable to reach a clear consensus, even about those elements of wage payment systems that appear rather straightforward. This article considers two such questions. Has the prevalence of incentive wage payment systems (such as piece rates, premiums, and bonuses) tended either to increase or to decrease with the emergence and rise to prominence of the modern corporate enterprise? And what effect has the institutionalization of labor unions had on the prevalence of incentive wage systems? This article attempts to clarify some of the conceptual issues involved in these questions and then examines a specific case study, the decline of the piece-rate wage system in the California fruit and vegetable canning industry. The essay concludes with a more speculative discussion of the prevalence of incentive wage systems in a general historical context.

MARTIN BROWN is assistant professor of economics at Howard University. His research was supported by a Howard University Faculty Research Grant.

PETER PHILIPS is assistant professor of economics at the University of Utah.

Business History Review 60 (Winter 1986). © 1986 by The President and Fellows of Harvard College.

CONFLICTING EVIDENCE AND OPINIONS

According to historical accounts, the prevalence of incentive wage systems increased markedly with the rise of modern industrial capitalism in the second half of the nineteenth century. Karl Marx's observation that "the piece wage is the form of wage most appropriate to the capitalist mode of production" is often cited.¹ While a single, reliable time series on incentive wages for this period cannot be assembled, the evidence seems to support the view that incentive wages were almost nonexistent in manufacturing industries at the beginning of the nineteenth century and quite common by its end. But the place of incentive wage systems in the twentieth century, with the establishment of modern corporate enterprise and industrial unionism, is more problematical. Garth Mangum observed that "references to the 'decline of incentives' are frequent in the literature of industrial relations," but a comparison of two benchmark studies done in 1890 and 1958 reveals no evidence of a general decline in the prevalence of incentive wages in U.S. manufacturing over the course of the twentieth century.² A current undergraduate textbook in human resources management even predicts that "we can expect to see more organizations moving to performance-based pay plans. . . . To the extent possible, more firms will adopt individually oriented incentive plans. . . . a wider range of pay increases will be used in an effort to make meaningful distinctions in performance."³

Official statements by the AFL and CIO and other important union organizations condemning incentives and calling for their abolition can be found in abundance, and union opposition has often been perceived by American managers as a major barrier to the implementation of incentive systems. A 1935 report by the National Industrial Conference Board, for example, summarized the opinion of many business executives:

Labor unions have always been antagonistic toward incentive systems. . . . The strategically strong position secured by organized labor through the enactment of Section 7(a) and the anticipated growth in power and control over workers, which seems an inevitable result of the Wagner Labor Relations Bill,

¹ Eric J. Hobsbawm, "Custom, Wages and Work Load in Nineteenth-Century Industry," in *Workers in the Industrial Revolution*, ed. Peter N. Stearns and Daniel J. Walkowitz (New Brunswick, N.J., 1974), 232-54; Daniel Nelson, *Managers and Workers: Origins of the New Factory System in the United States, 1880-1920* (Madison, Wis., 1975), chaps. 3 and 5; Dan Clawson, *Bureaucracy and the Labor Process* (New York, 1980), 168-82; Karl Marx, *Capital*, 3 vols. ([1867]; New York, 1977), 1: 697.

² Hobsbawm, "Custom, Wages and Work Load," 244-47; Garth L. Mangum, "Are Wage Incentives Becoming Obsolete?" *Industrial Relations* 2 (Oct. 1961): 73; Stanley Lebergott, "The American Labor Force," in Lance E. Davis, et al., *American Economic Growth: An Economist's History of the United States* (New York, 1972), 201.

³ Wayne F. Casio, *Managing Human Resources* (New York, 1986), 424.

makes the future of incentive plans, however sound they may be, seem doubtful.

One can also find official statements by major unions, however, that present highly favorable evaluations of incentive systems.⁴ Moreover, no reliable evidence shows a dramatic decline in incentive wage systems in the wake of the Wagner Act and the subsequent unionizing drive.

WAGE PAYMENT SYSTEMS: FORM AND FUNCTION

The overall industrial relations system and its historical evolution are extremely complex, and investigation of the prevalence of incentive wage systems is hampered by the lack of reliable data, especially comparable time-series data over the long term. To provide a body of long-term, coherent data, we have focused on a single industry over several decades, the canning industry in California from 1890 to 1947. We would first like to offer some clarification of the issues involved.

Much of the past discussion of wage systems has failed to appreciate both the multiplicity of wage payment systems and the relationship of these varied forms to different economic functions. Comparison of the 1890 and 1958 surveys of incentive wages, for example, is rendered difficult because the types of wage systems considered by each survey may have varied drastically. The 1890 survey apparently refers only to piece-rate systems, while piece rates play a lesser role in the 1958 survey, where premium and bonus systems predominate. Without disaggregating across these different types of incentive systems, one cannot discern possible evolution away from one form and toward others. Cross-sectional studies that find a relatively high incidence of incentive wages in industries with disparate wage levels, capital intensities, and firm size also require additional data to be of use.⁵ The specific form of incentive systems may vary systematically across these industries as well.

These difficulties have been recognized to some extent in the literature on incentive wage systems, but other factors have received less consideration. Incentive wage systems may serve different functions depending on the technical conditions, industrial structure, legal environment, or historical period under consideration. Moreover, the

⁴ Mangum, "Wage Incentives," 73; Milton J. Nadworny, *Scientific Management and the Unions, 1900-1932* (Cambridge, Mass., 1955), 25, 51; National Industrial Conference Board, *Financial Incentives* (New York, 1935), 34-35; National Industrial Conference Board, *Wage Incentive Practices* (New York, 1945), 1.

⁵ Robert B. McKersie, Carrol F. Miller, Jr., and William E. Quarterman, "Some Indicators of Incentive Plan Prevalence," *Monthly Labor Review* 87 (March 1964): 271-76.

different forms that incentive systems take have greater or less suitability for performing these different functions.

Two early observers of industrial piece-rate systems, Karl Marx and the Scottish economist John McCulloch (1789–1864), each noted different aspects of what we shall call the competitive function of incentive systems. Marx observed that “the wider scope that piece-wages give to individuality tends to develop both that individuality, and with it the worker’s sense of liberty, independence and self-control, and also the competition of workers with each other. The piece-rate therefore has a tendency, while raising the wages of individuals above the average, to lower this average itself.” Marx stressed the piece-rate system’s role in bringing the competition of worker against worker in the general labor market into the internal world of the workplace. Labor organizations, whose goal is to define and regulate the internal relations of the workplace and thus “take wages out of competition,” would obviously be antagonistic to the use of piece rates to internalize competition.⁶

John McCulloch, also observing early industrialization, noted:

[Industrial workers’] strength, skill and assiduity are widely different. And when they are hired by time [wages], it is often impracticable, and is always a difficult, troublesome, and invidious task to arrange them in classes, and adjust the wages of each according to their real deserts. Hiring by the piece or job does away with these difficulties. . . .

From the perspective of the worker, McCulloch concluded, the piece-rate system was a boon to those of less than average productivity, who might otherwise go unemployed. But the piece-rate system also performed functions advantageous to the firm. Use of piece rates allowed employers to increase their labor supply by broadening the potential labor pool and made it possible for the employer to take better advantage of the preexisting external competition of the labor market. Recent theories of the labor market function (collectively called “efficiency wage” theory) also stress the interdependence between the wage (or in this case the kind of wage) set by the employer and the labor supply that is forthcoming to the firm.⁷

In addition to promoting external and internal labor competition, incentive wages, according to more conventional modern economic analysis, perform yet a third function: the automatic monitoring of in-

⁶ Marx, *Capital*, 1: 697. The notion that firms structure wages by taking account of internal as well as external competition has recently been applied in a study of wage-setting policies of British firms. See Peter Nolan and William Brown, “Competition and Workplace Wage Determination,” *Oxford Bulletin of Economics and Statistics* 45 (Aug. 1983): 268–88.

⁷ John R. McCulloch, *A Treatise on the Circumstances Which Determine the Rate of Wages and the Condition of the Labouring Classes* ([1853], New York, 1967), 70, 71.

dividual worker performance and perhaps even underlying attitudes. According to John Pencavel:

incentive systems tend to circumvent some of the employer's problem of accurately screening his employees: it is an on-the-job screening device. So, given a cost to detecting each employee's work performance, the use of piece-rate methods is prompted by a wide dispersion of productivity among different workers. Under time-payments, such differential rewards for diligence and hard work are more difficult to determine since characteristics of workers are incompletely known both prior to and after being hired.⁸

Screening is necessary when the technology or organization of the production process precludes the toleration of workers of uncertain and widely variable productivities. While screening may be necessary, it involves a cost to the employer to the extent that it is based on inaccurate information. As Pencavel suggests, the monitoring function of incentive wages facilitates the screening process because it continuously reveals information to the employer about the relationship between worker characteristics and the production process. The monitoring function may be related to, but is distinct from, the facilitating of internal or external labor competition by piece rates. Workers of different productivity are automatically rewarded differently through the use of piece rates, thus enhancing internal competition; but the information revealed to the employer by such monitoring might also be used to rehire a selective group of workers from one year to the next, or it might be used by supervisors to structure additional wage or nonwage incentives, such as job security or promotional opportunities.

THE PRODUCTION PROCESS AND INCENTIVE WAGES

Hand labor production processes are typical in the early stages of industrialization and of the manufacture of many new products. With unskilled hand labor technologies, the capital extended to each worker usually is low, as are the value and amount of material processed during the working day. Hand tools are often owned by the worker, further limiting the employer's capital investment per worker. Under these conditions, incentives in the form of individual piece rates can

⁸ Janet L. Yellen, "Efficiency Wage Models of Unemployment," *American Economic Review* 74 (May 1984): 200–205; John H. Pencavel, "Work Effort, On-the-Job Screening, and Alternative Methods of Remuneration," in *Research in Labor Economics*, ed. R. Ehrenberg (Greenwich, Conn., 1972), 1: 255–58. Pencavel's use of the term "screening" is somewhat of a misnomer. Screening usually refers to the process by which employers make hiring decisions about workers with certain individual or group characteristics on the basis of *prior*, usually imperfect, information. Pencavel uses it to refer to a process of discovering the proper value of each worker's performance on the job—screening as a sorting device.

be used effectively to expand the employer's pool of qualified workers while preventing overpayment to slack workers. Individual piece rates permit a hiring process that exploits the tolerance of hand production technology for a wide range of labor productivity. By paying piece rates the employer can avoid the costs associated with learning and closely supervising the unskilled hand labor production process. To observers more familiar with later technologies and payment strategies, the piece-rate system for unskilled hand labor may appear to be an exercise in primitive management of an overabundant pool of labor. Yet the piece-rate system is the proximate source of the overabundant, and consequently cheap, labor force that these industries employ. David Montgomery points out that simple piecework was common in turn-of-the-century, low-wage industries such as meatpacking, cigar-making, canning, candy dipping, electrical coil winding, and glass packing. He finds that, although employers believed that the simple piece-rate system was at odds with scientific management, they nevertheless thought it the best pay system for immigrants and women. Montgomery recognizes that the "overabundant labor" available to these industries was associated with "primitive management methods."⁹ From our perspective, however, piece rates maximized external labor market competition for hand labor jobs, driving down wages and increasing labor effort. These working conditions tended to repel workers with better options, leaving women, racial minorities, and new immigrants as the typical work force in unskilled hand labor, piece-rate industries.

Piece rates for the skilled hand labor associated with craft industries serve a somewhat different function. The barriers to obtaining craft skills limit the available supply of craft workers and prevent the use of piece rates to expand the labor supply. Rather, piece rates are used to manage clusters of craft workers in outwork systems or in factories, allowing the employer to treat craft workers as pseudo-independent suppliers of products. This absolves the manager of the responsibility and costs of exploring, designing, and supervising craft labor processes, which are typically complex or arcane. At the same time, piece-rate management of craft labor maximizes the employer's ability to switch from one craft worker to another, with minimal loss of firm-specific human capital. In periods of slack employment within a craft, this method of treating the craft labor process as a market relation is an effective technique for disciplining craft labor. In periods of craft scarcity, such market discipline is less effective. The employer's ignorance of the craft-labor process also limits management's ability to in-

⁹ David Montgomery, *Workers' Control in America: Studies in the History of Work, Technology, and Labor Struggles* (New York, 1979), 37-40.

fluence the relative availability of craft workers through the redesign of work.¹⁰

Piece rates may make feasible employers' ignorance of production technology and avoidance of supervision, but their consequent distance from the workplace also limits the employers' ability to conceive and implement productivity-increasing innovations. As innovative employers discover ways to increase production and lower costs by mechanizing the production process, both capital and material flow-through per worker increase. With hand production, work may be strung out evenly along a detailed division of labor or clustered into work groups performing similar or identical tasks. With incipient mechanization, clustered hand labor jobs are usually created in order to balance the rate of production in the mechanized tasks with the lower labor productivities in the remaining hand labor tasks. Furthermore, as capital and material flow-through per worker rise, labor production standards emerge in order to exclude workers whose slowness or incompetence would idle equipment or block production. When employers screen workers at the point of hiring, however, external labor competition is diminished through the exclusion of unqualified workers. Under certain technologies, especially those involving clusters of workers operating identical machines, individual piece rates may still be used to offset the stunting of external competition by stimulating competition among workers on the job.

The workers who operate identical or similar machines in clustered jobs where they perform identical or similar tasks are, or soon become, close technical substitutes for each other. From the employer's viewpoint, the cost of idling equipment or materials not only requires hiring screens, but also makes individual production quotas desirable as a condition for continued employment. Yet the competitive shelter that hiring screens create for qualified workers make it more difficult to impose or increase production quotas. Employers may seek to offset these sheltering effects and elicit increased work effort among workers by imposing a quota-bonus form of piece rates, which set an individual production quota that must be exceeded before payment bonuses related to production are granted. Quota-bonuses may take a variety of forms, but they share the same function—the stimulation of internal competition among closely substitutable in-place workers. This internal competition is the proximate cause enforcing the speed of a pro-

¹⁰ Martin Brown and Peter Philips, "Craft Labor and Mechanization in Nineteenth-Century American Canning," *Journal of Economic History* 46 (Sept. 1986): 743–56; Jens Christiansen and Peter Philips, "What Do Factories Do? The Transition from Outwork to Factory Production in the Lynn Boot and Shoe Industry, 1830 to 1880," Working Paper, Department of Economics, University of Utah.

duction process which, although partially mechanized, is nonetheless directly dependent on the individual worker for the speed with which the machines are operated.

These dis-integrated, clustered, mechanized jobs represent an early stage of mechanization associated with productive imbalances among the tasks of the labor process and technical immaturity in the mechanical linkage of tasks. At a subsequent stage of mechanization, continuous flow-through, integrated, and mechanized line production supplants dis-integrated, clustered machine operations. At this stage workers are strung along a detailed division of labor. If line production emerges prior to technical integration, quota-bonus payment systems may remain, but their function will be different. The breaking down of clustered jobs and the stringing out of work along a production line eliminates pools of closely substitutable workers, unless all jobs are reduced to quickly learned, unskilled tasks when line production is introduced. Employers who require various skills will introduce job ladders as training devices to prepare workers within the labor process quickly to replace adjoining workers on the line. Training ladders require worker cooperation, however, and therefore discourage strategies designed to stimulate worker competition.¹¹ Under these circumstances, quota-bonus piece rates may still be used to monitor tasks and expose bottlenecks along the technically dis-integrated line. Such monitoring piece rates are part of the employer's increasing role as an investigator and modifier of the labor process. Quota-bonus systems designed to monitor production are aimed at revealing information about both the worker and the technical aspects of the task engaged. From such information, the task may be redesigned to impose greater competitive pressure on the worker and consequently to improve managerial control of the job.

All three forms of piece rates—simple, quota-bonus, and monitoring—seek greater managerial control by altering the conditions of labor competition in favor of management. The first expands external labor supplies; the second stimulates internal labor competition; and the third reveals information regarding the laborer and the task.

As technically integrated line production supersedes dis-integrated line production, the new technology precludes internal competition because it eliminates clustered tasks and replaces piece-rate monitoring with drive monitoring. The manipulation of line speed can bring

¹¹ Peter Doeringer and Michael Piore, *Internal Labor Markets and Manpower Analysis* (Lexington, Mass., 1971); Martin Brown and Peter Philips, "The Historical Origin of Job Ladders in the U. S. Canning Industry and Their Effects on the Gender Division of Labour," *Cambridge Journal of Economics* 10 (June 1986): 129-45.

obvious, physical bottlenecks to management's attention, and individual, quota-bonus piece rates are no longer needed as monitoring devices.

When production becomes so highly mechanized that the main function of human workers is to detect and correct machine errors, the motivational aspects of incentive wages are greatly diminished. In integrated line production, workers have little direct control over the pace of production. Conceivably, they could be rewarded according to the number of errors detected and corrected, but this kind of motivational system is obviously susceptible to perverse results: workers might create machine errors or product defects in order to secure the rewards of detecting and correcting them. Stanley Mathewson recounts a well-known anecdote about an engine cylinder head inspector who discovered that it took less effort to loosen properly fastened bolts and report the head as defective than to tighten loose bolts and pass the head down the assembly line.¹² The development of technology, from hand production, to the batch production of clustered machine operators, to technically separated line production, to integrated line production, leads to a progressive decline in individual piece rates, though group rates associated with plant sections or entire work forces are still technically feasible.

In the preceding discussion we have stressed the relationship between the technology of the production process and the functionality of various individual incentive systems. We should add that technology is not the only factor that should be considered. Product and labor market structure and conditions and the legal and industrial relations environments also play a role. The technology of the production process, however, is likely to be the immediate causal factor in most instances.

UNIONISM AND INCENTIVE WAGES

An explicit recognition of the diverse forms and functions of incentive wages also helps to clarify the question of the relationship between unionism and incentive wages. Because unions wish to reduce, not enhance, external competition, they have often gone on record in opposition to simple individual piece rates. We would not expect union policy to be very effective in this regard, however, for the very conditions that are conducive to the usefulness of piece rates in promoting external competition also militate against unionization of industry. In-

¹² Stanley B. Mathewson, *Restrictions of Output among Unorganized Workers* (Carbondale, Ill., 1969), 125–26.

deed, unions in low-wage industries that are not capital-intensive, like cigar making, shoemaking, and garment making, acquiesced to simple piece-rate systems in the late nineteenth and early twentieth centuries. Unions could, however, successfully challenge piece rates within broad political actions: the enactment of a minimum-wage law, for example, would undermine the use of piece rates to enhance external competition for every firm covered by the law, not just unionized firms.

Unions also seek to replace internal worker competition with administrative rules over which the union has some control. We would expect unions to oppose group piece rates and premium and bonus systems if they were perceived by the union as a means for management to establish internal competition when external competition is foreclosed because of technical conditions or union control. Thus, turn-of-the-century unions expressed more universal and adamant opposition to the premium wage system associated with Taylorism than they did to simple piece rates. A key reason for this opposition was Frederick Taylor's initial insistence that management must have complete control over the setting of work design, work pace, and premium rates. The strategy of union opposition to this type of incentive system, however, has often been quite subtle. Unions have sought to introduce into the system contractual constraints such as guaranteed base earnings, which would limit the effects of a piece-rate system on internal competition. Moreover, unions have often sought to make the various premium rates a subject of the collective bargaining or grievance process. A 1945 AFL contract with a metalworking company, for example, stated: "Piecework rates shall be set by a fair and impartial time study. . . . Before rates are changed, the steward or Grievances Committee shall be notified. . . . A pieceworker shall receive no less than 15% over his regular hourly rate, provided he has made an honest effort on the job."¹³

Once unions have achieved some degree of administrative control over the operation of incentive systems, their opposition to such systems may diminish or even change into support. The source of union opposition is not the incentive wage system itself, but the use of the system to exacerbate worker competition. If this consequence can be blunted, unions may find some advantages in perpetuating incentive systems. When technical change increases labor productivity, for example, unions can then use negotiated delays in piece-rate adjustments to increase worker earnings. One can therefore find instances

¹³ David A. McCabe, *The Standard Rate in American Trade Unions* (New York, 1912), 114; Nadworny, *Scientific Management*, 53; Conference Board, *Wage Incentive Practices*, 6-11.

in which unions have fought for the perpetuation and extension of incentive wage systems, even as management has fought for the discontinuation of such "demoralized" incentive systems.¹⁴

The same principle applies to the monitoring function of incentive wages. The basis of union opposition is not the system's capacity to reveal information about the production process and the work force, but rather the monopolization and control of this information by management.

INCENTIVE WAGES IN THE CALIFORNIA CANNING INDUSTRY

In the 1890s, 95 percent of women workers in San Francisco canneries worked for individual piece rates; in 1937, 85 percent of all California women cannery preparation workers were still on piece rates. Ten years later, after unionization and significant mechanization of preparation work, the individual piece-rate system in California canning was contractually abolished. Premium wage systems were used occasionally for another ten years, but by 1960 all but a few California cannery workers were on time rates.

In turn-of-the-century California canneries, the piece-rate system was used by cannery operators to deal with chronic labor shortages caused by rapid industry growth and the irregularity and uncertainty of production volume in this highly seasonal industry.¹⁵ Cannery preparation tasks involved the working up of a variety of fruits and vegetables, each of a different shape, with a unique size, ripeness, and distribution of blemishes. The irregularities of the raw produce made mechanization of production difficult, so the technology of preparation work in the canneries was compatible with the use of simple piece rates to increase the scope of hiring.

Forced to rely on the judgment and proficiency of hand workers to prepare the raw produce for canning, cannery operators used piece rates to absolve themselves of the responsibility of supervising the speed of preparation work. They employed women floor supervisors at low wages to monitor the quality of each worker's daily output; they paid workers according to the number of paper chits individually accumulated as they completed each bucket of produce. The low value of raw produce that flowed through any preparation worker's hands meant that the slack effort of any individual worker would neither cost

¹⁴ Mangum, "Wage Incentives," 74-75.

¹⁵ California Bureau of Labor Statistics, *Second Biennial Report: 1885-86* (Sacramento, Calif., 1887), 27-28; California Bureau of Labor Statistics, *Labor Conditions in the Canning Industry* (Sacramento, Calif., 1913), 28.



SAN JOSE CANNERY, c. 1880

This San Jose cannery in the mid-1880s employed about fifty women in the preparation and filling room (on the left) and about fifteen men in the cookroom (in the center) and warehouse (on the right). Equipment was minimal, except in the cookroom, where acidic fruit and tomatoes were processed in steam baths and nonacidic vegetables were processed in pressure cookers. (Photograph courtesy of California State Library, California Section, Picture Collection, Negative 3937.)

much in lost produce nor slow down operations in departments down the line that employed substantial amounts of fixed capital. The only fixed capital employed by preparation workers—besides floor space—were simple buckets or bins, table space, and specialized knives, which were usually owned and maintained by the workers.¹⁶

Mechanization of the cookroom was increasing plant capacity in the canneries by the 1890s, and the number of preparation workers required by each cannery grew substantially.¹⁷ Combined with rapid industry-wide growth, the increased demand for labor raised cannery operators' concerns about securing an adequate labor force, especially during unpredictable peak production periods. The inability of can-

¹⁶ *San Francisco Examiner*, 4 Sept. 1881; California Bureau of Labor Statistics, *Labor Conditions*, 31–33.

¹⁷ U. S. Commissioner of Labor, *Thirteenth Annual Report: 1898* (Washington, D. C., 1899), 2: 1055–81.

nery operators to offer more than seasonal employment to most of their workers made it difficult to attach a specific, stable, and reliable pool of workers to a particular cannery. Three typical rural canneries in Marysville, California, had a production season of only eleven weeks in 1912. The average San Francisco cannery ran for twenty-seven weeks in the same year by packing a variety of crops brought in from a wider area. Even in the city canneries, however, half the children were employed for only nine weeks, half the women for seventeen weeks, and half the men for eighteen weeks. While rural canneries were more seasonal, the urban canneries suffered from greater daily fluctuations in production. Perishable raw materials, brought into the city from long distances, had to be processed as soon as they arrived. For five typical San Francisco canneries in 1912, the average workday during the rush season was eleven hours, seven days a week. On busy days work shifts extended to eighteen hours for the same work force. But workdays could also be as short as four hours if little produce was on hand.¹⁸

The composition of the cannery work force in the early 1900s reflected the ability of the employer, using the simple piece-rate system, to hire from a heterogeneous labor pool containing workers of diverse and uncertain characteristics. According to the 1908 report of the U. S. Immigration Commission,

Casual laborers, immigrants as yet unaccustomed to American industrial processes and methods, widows, married women, and children adding to the family earnings are found along with the smaller number of men who might find regular employment in other industries offering, in general, a higher class of employment. It may be said that the vast majority of cannery employees are supplementary to the community's regular labor supply.¹⁹

In 1900, women made up 70 percent of the California cannery labor force, though only 19 percent of all California workers were women. Another 5.5 percent of cannery workers were children, compared to 2.3 percent for all California industries. Eighteen percent of female workers in San Francisco canneries were under fifteen, while 20 percent were over forty-five. In contrast, for the working female population in the city as a whole, only 3 percent were under fifteen and only 14 percent were over forty-five years old. The piece-rate system did not prevent canneries from employing prime-age males in preparation work, but the abundant labor supply to which the piece-rate system

¹⁸ California Bureau of Labor Statistics, *Labor Conditions*, 8–12, 24.

¹⁹ U. S. Immigration Commission, *Immigrants in Industry*, 41 vols. (Washington, D.C., 1911), 25: 251.



YOUNG GIRLS PITTING PEACHES, c. 1890

Hand preparation of produce required very little capital equipment. These workers are cutting peaches with specialized knives that may be their own possessions. The employer provided rudimentary work stations and a simple workshed. The absence of capital equipment and integrated production meant that workers with the widest range of productivities could be hired; individual piece rates ensured against the overpayment of less productive workers. (Photograph from an original in the possession of Peter Philips.)

allowed cannery operators access necessarily drove down average cannery preparation wage rates. Workers with better options tended to move on to better jobs, either within the canneries or elsewhere.²⁰

By allowing the cannery operators to hire from the widest pool of potential workers, the piece-rate system improved the canners' bargaining power in setting the average wage. The heterogeneity of worker-group gender, age, and ethnicity, coupled with the divisive effects of the piece-rate system itself, reduced the prospects for industrial unionization and other forms of worker unity. An 1881 account described the degree of animosity that prevailed among workers on the preparation floor in some canneries:

²⁰ U.S. Bureau of the Census, *Twelfth Census of the U.S.: 1900, Occupations at the Twelfth Census* (Washington, D.C., 1904), table 43; U.S. Immigration Commission, *Immigrants in Industry*, 25:262.

General ill-feeling, ugliness, jealousy and malice were the sentiments mostly characterizing the workers in their treatment of each other. Profane and vulgar epithets were constantly flying back and forth. Impudent girls would run around the tables and steal from others the fruit which was smoothest and most perfect and involved the least labor to prepare. Now and then a tomato, as the only available weapon, was hurled by one angry shrew at another.²¹

While cannery operators expressed great interest in developing mechanical innovations that would increase the flow-through of produce per worker in preparation tasks, they demonstrated little interest in using the incentive wage system to monitor and improve their in-place preparation production process or labor organization. A 1913 study complained of the "almost uniform lack of records of any description for the pieceworkers, in either the California or the Maryland canneries. . . . it is singular that employers who direct other phases of their business along lines indicated by carefully kept accounts should attempt to regulate the supply of so large a part of their labor without the help of adequate records."²²

The situation in turn-of-the-century cannery cookrooms was quite different. Cookrooms were already highly mechanized and required hierarchical supervision and on-the-job training for smooth operation. Slowness or incompetence by any one cookroom worker could result in the shutdown of expensive fixed capital and great financial loss in half-processed produce. Cookroom workers consequently were paid time wages, and owners tolerated a lower level of worker heterogeneity. In 1908, 22 percent of the female work force in California canneries were girls below the age of eighteen who worked in the preparation department. In the same year, only 9 percent of the male work force in the canneries consisted of boys below the age of eighteen, who worked mainly in the cookroom and warehouse. The dispersion of hourly earnings among women workers was about 20 percent greater than for men in the canneries.²³

The piece-rate system used in turn-of-the-century canneries for managing preparation labor was not without its problems. While consistent with the loose attachment and uncertain abilities of seasonal workers, the piece-rate system also encouraged irregular attendance and inattention to quality. An 1881 newspaper account of San Francisco canneries observed that women preparation workers responded to fluctuations in raw produce availability by moving from cannery to cannery during the week and even during the day in order to work where

²¹ *San Francisco Examiner*, 4 Sept. 1881, 1.

²² California Bureau of Labor Statistics, *Labor Conditions*, 29–30.

²³ U.S. Immigration Commission, *Immigrants in Industry*, 25:257–60.



FILLING ROOM, TURN-OF-THE-CENTURY CANNERY

This filling room employed women and girls to hand-fill cans with prepared peaches. Very young children helped their mothers, allowing on-the-job child care. Older girls worked for themselves in filling tasks, while older boys carted the filled cans to the adjacent cookroom. The men in this picture are probably from the cookroom. The employer provided only the empty cans, slightly more elaborate work stations than in preparation, and scales to weigh the cans (visible lower right). (Photograph from an original in the possession of Peter Philips.)

the produce was plentiful and of a quality that could most easily be prepared. Cannery workers responded to this problem by using threats and promises regarding future employment, as well as selective use of time rates. A report on the 1912 canning season noted:

The prevailing method of keeping the force at work during the long drives is to give preference in position and material to those who have shown a willingness to stand by until the fruit is cared for; to threaten loss of work to those who refuse to work the long hours, though the scarcity of labor often renders this threat quite futile. Frequently the last work of the afternoon will not be punched or credited on the paycheck until the employee has returned or stayed through the evening work.²⁴

²⁴ *San Francisco Examiner*, 4 Sept. 1881, 1; California Bureau of Labor Statistics, *Labor Conditions*, 26.

The problem persisted in spite of these tactics. As late as the 1920s, one cannery checker complained that the piece-rate system instilled a sense that each woman was "in business for herself" and, as a consequence, often came to work late and left the cannery early.²⁵

MECHANIZATION AND PRODUCTION STANDARDS

As the technology of the production process evolved with industrial development in the canning industry, the advantages to the employer of paying individual piece rates diminished. With the advent of mechanization in the preparation and can-filling departments, the range of worker productivity characteristics that were technically feasible narrowed and the cost of uncertainty about worker productivity increased. Mechanization narrowed the spectrum of acceptable worker characteristics in two phases. First, as hand preparation workers became operatives of simple, stand-alone machines, the increased cost of equipment and the higher value of raw materials flowing through an individual worker station raised the cost to employers of workers who were slow or inept. At a second phase of technical innovation in canneries, distinct mechanized steps in the production process were gradually integrated into a systematic and continuous flow of production that put a technically determined upper bound on individual worker speed. The integration of production also put a premium on coordinated and synchronized productivity among workers. Thus, the new technology called for a steady and sustained standard effort from each worker, with a narrow tolerance for productivity variation. As preparation work became progressively automated, cannery employers could no longer recruit blindly from the entire pool of available labor, and the key labor recruitment advantage of individual piece rates thus was eliminated.

The initial focus of cannery mechanization was in the cookroom, where the key innovation in California was the continuous cooker. In the East, where nonacidic foods such as vegetables, meats, and oysters were packed, the high temperatures of the pressure cooker were needed. In California, where acidic fruits and tomatoes dominated canning, unpressurized water baths and steam tanks were used. By the 1890s continuous cookers began to replace these baths. The atmospheric cooker automatically loaded and unloaded cans at a preset pace determined by the proper cooking time. Dixon's Automatic Continuous Cooker, manufactured in San Francisco and said to be in use

²⁵ Donald Anthony, "Labor Conditions in the Canning Industry of the Santa Clara Valley" (Ph.D. diss., Stanford University, 1928), 50.



PEACH CUTTERS, EARLY TWENTIETH-CENTURY CANNERY

Even large canneries at the turn of the century had simple equipment in the preparation room. These women are cutting peaches while sitting on bare benches with a used lug crate for a table. The quantity and quality of individual output was inspected by a floorlady, and the worker was credited with a chit redeemable for wages at the end of the day or week. No children are visible in this picture, reflecting the transition to a more standardized work force with the rise of capital equipment in the cookroom and investment in building in the preparation room. (Photograph courtesy of the Oakland Museum, History Department, Del Monte Collection.)

in several large California canneries, was advertised in 1900 as offering “continuous processing which compels the attention of its operators.” When connected to a can-capping machine, the continuous cooker established line production in the cookroom and the beginnings of continuous-flow production in men’s cannery work.²⁶

As cookroom capacity rose with larger and faster cookers, the number of hand preparation workers needed by each plant increased to keep pace. An 1896 study of three canneries, two packing tomatoes and one packing peaches, showed that with the onset of mechanization in the canneries, total piece-rate labor in these three plants rose from 47 to 351 women, more than a seven-fold increase. Individual plant capacities rose by factors of eight, eighteen, and fifty-eight, while flow-

²⁶ *Canning Trade* 22 (19 Jan. 1900): 7; Brown and Philips, “Craft Labor and Mechanization.”

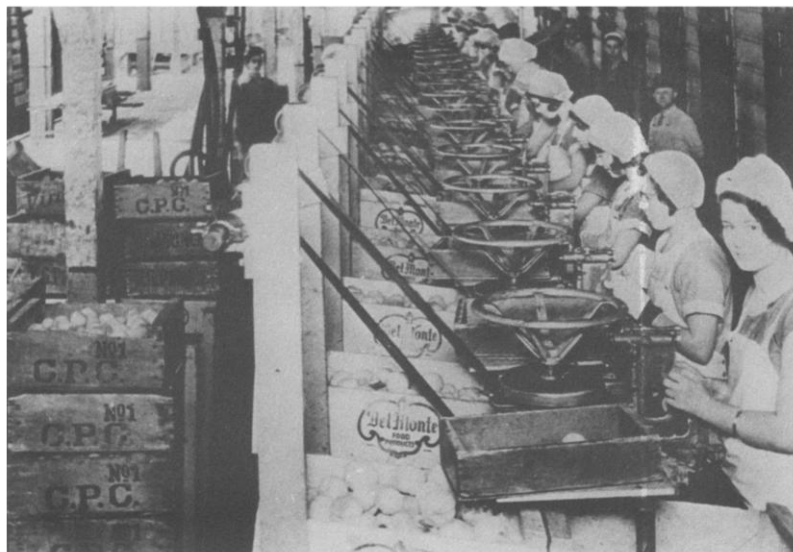
through per preparation worker rose by factors of only two, two, and four, respectively. The growing number of preparation workers needed exacerbated the cannery operators' fears of unskilled labor recruitment problems. Cannery owners and inventors alike knew that a receptive market awaited any reasonably priced machine that would effectively raise the flow-through per worker in the preparation of any major crop. As one observer of California peach preparation work put it in 1891, "A fortune awaits the man that invents a satisfactory and rapid cling [peach] pitter."²⁷

Unfortunately for the cannery operator anxious about the availability of seasonal labor, the mechanization of preparation tasks was technically difficult. The hoped-for mechanical peach pitter is illustrative of the general problem of automating preparation work. Peaches were prepared by skinning, stemming, halving, and pitting the fruit. Using the hand method, cling peaches were pitted in 1891 "by passing a curious-shaped forked knife around the stone, which, true to its name, refuses to come out by any gentle means." By 1904, the Sprague Canning Machine Company was selling, for six dollars, an individually operated, hand-loaded and hand-powered peach-pitting machine. This machine, however, was not fast enough or cheap enough to replace the simple "pitting spoon," which could be purchased for a mere fifteen cents.²⁸

Mechanization of preparation work was given added impetus in California in the 1890s by the emergence of large multiplant canning firms with national marketing networks that could balance the flow of crops from various producing areas among their several plants. Such firms had an advantage in fully utilizing the capital equipment of the cookroom and in bargaining with both suppliers of produce and retail outlets. The California Packing Corporation, better known as the Del Monte corporation, was first assembled in 1899, under the name California Fruit Growers Association (CFGAs), from eleven preexisting companies. It was further enlarged in 1916 with the addition of six more companies, by which time Del Monte accounted for 57 percent of all canning and preserving activity in California. Large, multiplant corporate canning firms provided a stable, long-term market for capital goods, facilitating the emergence of a capital goods industry for canning equipment. In response to the CFGA merger of 1899, two San Jose orchard supply companies merged in 1902 to form Anderson-

²⁷ U.S. Commissioner of Labor, *Eleventh Annual Report* (Washington, D.C., 1898), tables 291, 300, 301; *Overland Monthly* 18 (Oct. 1891): 367.

²⁸ Sprague Canning Machine Company, *General Catalogue of Canning Machinery and General Supplies* (Chicago, 1904), 208; Berger and Carter Company, *Canning Machinery and Supplies* (San Francisco, Calif., 1917), 52.



THE DUNCAN PEACH PITTER, 1920s

The Duncan Peach Pitter, introduced in the 1920s, replaced specialized knives in cutting and pitting peaches and represented a significant increase in the capital equipment invested per worker. The work became increasingly standardized, even to the point of having workers wear uniforms. Both the quality and quantity of individual work could still be inspected, however, because peaches were still delivered to and taken from individual workers. (Photograph courtesy of the Oakland Museum, History Department, Del Monte Collection.)

Barngrover, later Food Machinery Corporation (FMC), perhaps the first company specializing in the development and manufacture of canning machinery in California.²⁹

In 1930, the Del Monte corporation, believing that a satisfactory peach-pitting machine was within reach, approached Food Machinery Corporation and indicated that the canning industry desired the development of such a machine "in the worst way." The first successful peach-pitting machine was the electrically powered, but hand-fed, Duncan peach pitter, which became standard equipment in Del Monte canneries by the early 1930s. The Duncan "beehive" pitter was an improved version of the earlier hand-cranked machine. While the Duncan machine was electrically powered, its operating speed depended

²⁹ Martin Brown and Peter Philips, "The Evolution of Labor Market Structure: The California Canning Industry," *Industrial and Labor Relations Review* 38 (April 1985): 396; Earl R. Anderson, son of W. C. Anderson, founder of Anderson-Barngrover, interview with authors, 11 Nov. 1977, San Jose, Calif.

on the pace and judgment of the woman who hand-fed fruit into the machine. Employers continued to use piece-rate wages in this situation to induce optimal utilization of the new machines. With many of the machines arranged side-by-side in a long row, the women operators could hardly miss the implicit force of internal competition that the piece-rate system was designed to foster. A contemporary observer noted that many veteran hand preparation workers were reluctant to give up the social intercourse and flexibility of work effort afforded by the hand preparation tables for the isolation and intense routinization of the machine lines.³⁰

To facilitate the use of piece-rates, the Duncan pitter was equipped with a mechanical meter which counted the times the machine was fed. A grisly anecdote associated with this meter illustrates the conflict between worker and employer in accurately monitoring worker productivity. A Food Machinery Corporation inventor who refined the Duncan pitter for Del Monte related that workers learned how to flip the counter in the machines to inflate the measure of their production. In order to discourage this practice, he placed the counter behind the sharp rotating knives of the machine, forcing the operators to choose between inflated earnings or the risk of lost fingers. According to a contemporary observer, "quite a number of women really injured their hands seriously, because those knives were very sharp, and they were unprotected. You see, if you just slip slightly, then the finger comes right off."³¹

Mechanization was not limited to peach canning. A tomato peeler had not yet been invented, but by 1910 a system of conveyers was in use which sped the tomatoes from a scalding bath to the women peelers. As mechanization of preparation work spread across crops, canners found it increasingly costly to employ workers with below-average productivity in the preparation room, and after 1920 canneries began to utilize hiring standards to restrict the diversity of their work force. The earliest reflection that mechanization was imposing the requirement of standardized worker productivity on the canneries lies in the decline of child labor. In 1880, 7 percent of all cannery workers in California were under sixteen years old, and in San Francisco alone 12 percent were children. By 1919 only about 3 percent of California cannery workers were children, and in the more mechanized San Francisco

³⁰ Fred Ludorff, Food Machinery Corporation engineer and inventor of the beehive and rotary peach pitters, interview with authors, 17 July 1978, Sunnyvale, Calif.; William Braznell, "California's Finest," *The History of Del Monte Corporation and the Del Monte Brand* (San Francisco, Calif., 1982), 66; Elizabeth Nicholas, labor organizer and cannery worker in the 1920s and 1930s, interview with authors, 7 July 1978, San Jose, Calif.

³¹ Ludorff, interview with authors, 17 July 1978; Elizabeth Nicholas, "Working in the California Canneries," *Harvest Quarterly*, Sept.-Dec. 1976, 12-25.

canneries child labor had been virtually eliminated. As mechanization of preparation work progressed, teenage female workers were also gradually eliminated from cannery work. In 1910, 46 percent of all cannery workers in California were teenage girls, compared to 18 percent for all California industry. By 1940 only 5 percent of all California cannery workers were teenage girls, one percent less than for all industries.³² Since almost all women and children were employed in either the preparation or can-filling departments, the decline in the proportion of children and teenage girls in the canneries reflects a rise in the productivity standards for these jobs.

Mechanization of preparation and other work not only induced employers to seek adult workers with reliable work habits and standard abilities, but it also discouraged seasonality. Expensive machines could be idled by the lack of fruit as well as by inattentive workers. In response, by 1910 a thirty-year trend toward smaller, more rural, and consequently more seasonal canneries had been reversed. More centralized and urban canneries sought to extend their production season by processing a greater variety of crops and by drawing crops from a wider area. In 1916, the average processing season for California canneries was sixteen weeks; by 1948 the average season had increased to twenty-six weeks. As seasonal fluctuations decreased, the canneries could more easily attract committed adult women workers. The advent of unemployment insurance for cannery workers in 1939 further enhanced the ability of cannery operators to retain experienced workers despite the industry's seasonality.³³

As mechanization diffused throughout canning, the capacity of the piece-rate system to accommodate a wide range of worker productivities and therefore broaden the scope of the feasible labor pool was becoming dysfunctional. A work force with a wide dispersion of preferences and abilities was becoming less compatible with production technology as power-driven, hand-fed machines were increasingly introduced. Where women worked clusters of identical machines, simple piece rates were still used to sharpen internal competition and to encourage the optimal utilization of equipment. But the piece-rate system alone was an imperfect tool for these purposes. Simple piece rates

³² U.S. Bureau of the Census, *Tenth Census of the United States: 1880* (Washington, D.C., 1883), 2: 93, 436; U.S. Bureau of the Census, *Fourteenth Census of the United States: 1920* (Washington, D.C., 1923), 4: 60, 523; U.S. Bureau of the Census, *Thirteenth Census of the United States: 1910* (Washington, D.C., 1914), 4: 440; *Fifteenth Census of the United States: 1930* (Washington, D.C., 1933), 5: 204, 213; *Sixteenth Census of the United States: 1940* (Washington, D.C., 1943), 3: 254.

³³ Brown and Philips, "California Canning," 395-96; California Industrial Welfare Commission, *The Regulation of the Fruit and Vegetable Canning Industry of California* (Sacramento, Calif., 1917), 209; U.S. Bureau of Labor Statistics, *Wage Structure: Canning, 1948* (Washington, D.C., 1949), 24; Martin Brown, "A Historical Economic Analysis of the Wage Structure of the California Fruit and Vegetable Canning Industry" (Ph.D. diss., University of California, 1981), 237-41.

allowed workers with heterogeneous preferences and abilities to choose between intense efforts over a short duration or more leisurely efforts over longer periods in attaining the same daily income. This was especially true prior to the establishment of regular work shifts in the late 1930s and during peak season, when extended workdays were common and the work force in the canneries was relatively heterogeneous.

In response to this problem, simple piece rates were supplemented with increased supervision to ensure a minimal level of equipment utilization. "Floorladies" helped to ensure that the productivity standards required by the new machines were met by observing, instructing, and admonishing workers. In 1896, one percent of the preparation workers were women supervisors. By 1938 this proportion had increased to 5 percent.³⁴ By the late 1930s, the piece-rate system, supplemented by hiring standards and increased supervision, began to function, in effect, as a quota-bonus wage system.

In some cases group piece rates were used, putting the floorladies in the position of quasi-internal labor contractors and enhancing internal competition by pitting one production line against another.³⁵ In the context of disconnected mechanization, the piece-rate system could also be used to monitor the performance of individual machine operators or groups. The information revealed could be used to facilitate interseasonal hiring and to redesign the labor process.

INTERCONNECTED MECHANIZATION

The increase in fixed and working capital per preparation worker forced a weeding out of workers with lower productivity characteristics and induced cannery operators to focus on the development of uniform productivity standards linked to the design parameters of the capital equipment itself. In addition, as the value of individual pieces of capital equipment increased, the coordination of the flow of production between successive stages of the production process became more important. Link-belt tomato tables, which were developed to permit continuous and rapid movement of tomatoes from the scalding chambers to the women peelers, were an early and not very successful attempt to address this problem. Buckets of tomatoes moving on an endless chain serpentine among the preparation workers. As a worker fin-

³⁴ U.S. Commissioner of Labor, *Thirteenth Annual Report*, 1055-81; California National Youth Administration, *An Occupational Study of the Fruit and Vegetable Industry in California* (Sacramento, Calif., 1938), 21.

³⁵ Mike Elorduy, cannery worker and secretary-treasurer of the California Council of Cannery Unions, interview with authors, 19 Dec. 1978, Sacramento, Calif.

ished one bucket, she could reach up for a new one and send the finished bucket onward. A 1917 sales pitch for these tables stated that "The heart of a tomato canning factory is the peeling system. Link-belt Sanitary Peeling Tables afford a continuous movement of tomatoes, acting as a fly wheel for the plant by systematizing and regulating the peeling."³⁶

While the copywriter for this advertisement well understood the cannery operators' desires to set a regular work pace and induce all employees to meet that standard, the promoter of the Link-belt Table offered more than the machine could deliver. When the steam scalders sent out more buckets of tomatoes than the women were able or willing to peel, neglected buckets recirculated until their contents grew cold. The women, being paid piece rates, skipped those buckets on the second go-around because cold tomatoes were difficult and slow to peel. If supervisors forced some workers to prepare the unsatisfactory produce, the disgruntled workers responded with charges of favoritism. The ensuing disputes often led to additional production delays and, in rare instances, to organized job actions.³⁷ In the case of the Link-belt tomato table, the incentive effect of piece rates for individual hand peeling and coring was not fully consistent with the attempt to increase the regularity and synchronization of production through mechanical means.

The introduction of hand-fed and self-metering machines, as in peach preparation, greatly increased the need to synchronize the overall flow of production. To accommodate the increased capacity made possible by the new peach-pitting machines, canners moved the pitted peaches through the sorting and trimming processes by conveyor belts (and later, hydraulic canals) that fed the produce directly to the canning department. Since the speed of the belt could not be adjusted to match the work speed of any one of the many workers who attended it, a predetermined pattern of sustained and uniform work was required to obtain full utilization of the belt system. The belt workers monitored the quality of the produce that would be committed to the canning and cooking process, so individuals who worked too fast could cause costly errors as well as those who worked too slow. Belt workers did not work in parallel, each worker potentially competing with her neighbor, but in series, so that the smooth operation of the belt depended on a degree of synchronization and cooperation. For these reasons, belt workers were paid by time rates and were more closely supervised than pitting machine operators. In 1938, the ratio of

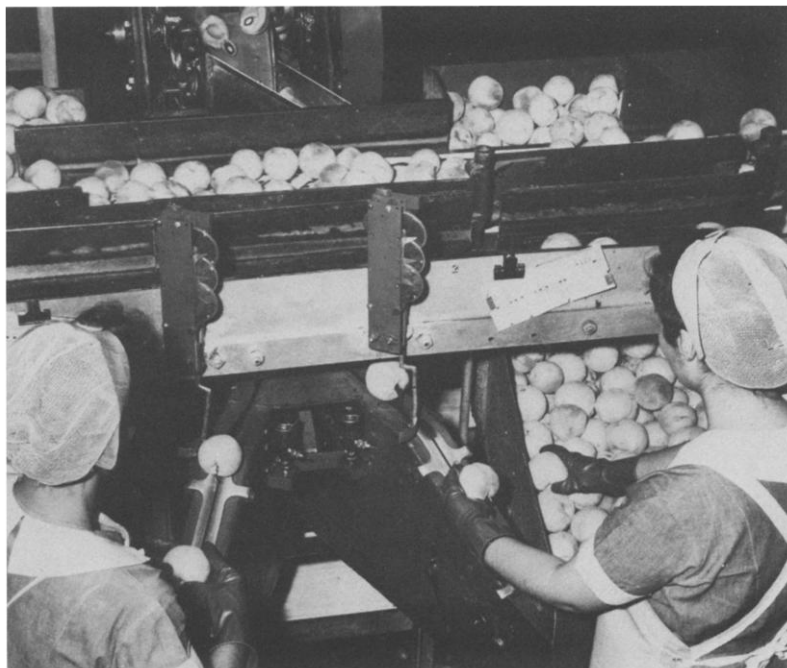
³⁶ Berger and Carter Company, *Canning Machinery*, 52.

³⁷ Elizabeth Nicholas, interview with authors, 7 July 1978.



ROTARY PEACH PITTER, 1930s

In the 1930s the Rotary Peach Pitter replaced the Duncan machine. It was still hand-fed, still dependent on the speed of the worker, and still counted piece rates of individual workers. In contrast to the Duncan pitter, the Rotary pitter automatically carried the cut and pitted peaches away on conveyor belts. The rising capital investment per worker created by each new pitter made the full utilization of these machines increasingly important, and direct supervision of workers by floorladies (white uniform in center) consequently increased. (Photograph courtesy of the Oakland Museum, History Department, Del Monte Collection.)



CLOSE-UP VIEW, ROTARY PEACH PITTEr

A counter system on the Rotary pitter monitored individual output, and workers were paid on a quota-bonus piece-rate system. However, the Rotary pitter mixed the outputs of workers together as the pitted peaches were carried away on belts. This made quality monitoring of individual output difficult, for inspection workers culled poorly pitted peaches without attributing errors to individual workers or machines. The inability to attribute errors made even quota-bonus individual piece rates increasingly dysfunctional. (Photograph courtesy of the Oakland Museum, History Department, Del Monte Collection.)

floorladies to production workers was one to ten for belt workers, twice the rate of supervision applied to piece-rate pitters.³⁸

Table 1 shows the diffusion of hand-fed, piece-rate, peach-pitting machines through the California canning industry in the 1930s, and the effect on the required proportion of time workers in cannery preparation work. For fourteen relatively modern canneries in 1934, only 11 percent of all preparation workers used peach-pitting machines. Fifty-five percent of women working in preparation pitted peaches by hand. Both hand and machine peach pitters were paid by piece rates. The remaining 34 percent of women preparation workers were belt

³⁸ *Ibid.*, 4-8, 18-29.

TABLE 1
Method of Payment for Women Workers in the Preparation
Department of Fourteen California Canneries, Peak
Season, 1934–1939

YEAR	TIME-RATE WORKERS	PIECE-RATE WORKERS	
	SORTERS, INSPECTORS, SUPERVISORS	HAND PITTERS	MACHINE PITTERS
1934	34%	55%	11%
1936	41%	45%	14%
1939	52%	18%	29%

Average number of workers in sample = 7,733

Source: California, Industrial Welfare Commission, "Biennial Report, 1940–1942," mimeographed paper. Industrial Welfare Commission archives, San Francisco, Calif.

workers, trimmers, inspectors, and supervisors who were paid by time rates. The diffusion of peach-pitting machines over the next five years is reflected in the decline of hand pitters, the rise in machine pitters, and the consequent increase in the proportion of time workers assisting the pitting process. By 1939, 29 percent of women preparation workers were using peach-pitting machines on piece rate, and 52 percent of women preparation workers were employed in related time-rate jobs in order to handle the increased capacity that had been made possible by the peach-pitting machines.

The data in Table 1 obscure the uneven character of mechanical diffusion in preparation work during this period. Peaches were an important crop, and the canneries represented in Table 1 were relatively modern. In other crops and in technically backward canneries the older methods of hand labor remained more common and piece rates were more prevalent. Even among the fourteen canneries reported in Table 1, the diffusion of the hand-fed peach-pitting machines was uneven. In 1939, five of the canneries employed fewer than 20 percent of their women workers on mechanized peach pitters. Of these five canneries, only one was part of a large corporation and only one was in an urban location. Six of the fourteen canneries had from 30 to 50 percent of their women workers on pitting machines in 1939. Of these six canneries, four were part of large corporations and all six were in urban locations. Thus, while mechanization in this first phase required time-rate payment for down-line women workers and more definitive performance standards for piece-rate workers, the uneven diffusion of machinery meant that the applicability of such standards varied by crop, firm, and location.

TABLE 2
Prevalence of Piece-Rate Payment in the California Canning Industry

YEAR	PERCENT OF WORKERS PAID BY PIECE RATES			WAGE DISPERSION*
	PREPARATION & CAN FILLING	PREPARATION		
	ALL CROPS	ALL CROPS	PEACHES	
1890	95%	—	—	—
1910	—	—	—	.25
1916	90%	—	—	—
1919	—	—	—	.22
1934	—	—	66%	—
1936	—	—	59%	—
1937	79%	86%	—	—
1938	72%	86%	—	.068
1939	—	—	47%	—
1947	0%	—	—	.038

*Standard deviation of the log of wages divided by the average log of wages

Source: 1890: U.S. Bureau of the Census, *Eleventh Census of the United States: 1890; Industries of the United States*, part 2, Statistics of Cities (Washington, D.C., 1895), 534-35; 1910: California Bureau of Labor Statistics, *Fourteenth Biennial Report* (Sacramento, Calif., 1910), 284; 1916: California Industrial Welfare Commission, *The Regulation of the Fruit and Vegetable Canning Industry of California* (Sacramento, Calif., 1917), 67; 1919: California Bureau of Labor Statistics, *Nineteenth Biennial Report: 1919-1920* (Sacramento, Calif., 1920), 160; 1934, 1936, 1939: California Industrial Welfare Commission, "Biennial Report, 1940-1942," mimeographed paper, IWC archives, San Francisco, Calif.; 1937: California, National Youth Administration, *An Occupational Study of the Fruit and Vegetable Canning Industry in California* (Sacramento, Calif., 1938), 18-25; 1938: U.S. Women's Bureau, *Application of Labor Legislation to the Fruit and Vegetable Canning and Preserving Industries* (Washington, D.C., 1940), 94-99; 1939: U.S. Women's Bureau, *Labor Standards and Competitive Market Conditions in the Canned Goods Industry* (Washington, D.C., 1941), 32; 1947: U.S. Bureau of Labor Statistics, *Wage Structure: Canning, 1948* (Washington, D.C., 1949), 7.

Table 2 summarizes the decline in the prevalence of piece-rate payment to women workers in the preparation and can-filling departments of the California canneries for the years 1890 to 1947. As Table 2 indicates, peach pitting was more mechanized than the preparation of most other California crops in the 1930s. Table 2 also shows a lower proportion of piece-rate workers in the can-filling department than in the preparation department, because can filling was mechanized in most canneries prior to the mechanization of preparation tasks, especially for smaller and for liquid products, such as tomato products, cherries, and pie fruit. Table 2 also gives a measure of the dispersion of actual hourly earnings of women cannery workers. A decrease in the wage dispersion could reflect two things: a decrease in the proportion of jobs that are paid by piece rates, or a decrease in the dispersion of piece-rate earnings due to the imposition of hiring and performance

standards. Taken together, the data in Table 2 suggest that the piece-rate system in California canning declined gradually during the twentieth century, and that this decline accelerated in the 1930s with the mechanization of preparation work and in the 1940s after the industry was unionized.

From around the First World War to the 1930s, piece rates in the California canneries were used less to increase the external labor supply and more as a device to increase internal competition and to monitor the production process. Nascent mechanization required this functional change. By the 1930s, however, the piece-rate system was beginning to malfunction in the technically dynamic environment of the increasingly automated and mechanically integrated cannery. It permitted work irregularity when regularity was required; it bred worker conflict and disputes with supervisors when cooperation was needed; and it created instability in the wage structure and uncertainty about wage policy in the face of persistent technical change. Unionization of the industry in the late 1930s resulted in constraints being placed on the operation of the piece-rate system which further limited its usefulness to cannery management.

UNIONIZATION AND PIECE RATES

As the range of acceptable work standards narrowed and the work force became more homogeneous and attached to the industry, the possibility for unionization of the California cannery industry increased. Earlier grievances by women cannery workers over what they considered to be capricious management of the piece-rate system had led to labor unrest and union organizing drives between 1917 and 1919. While this union drive was defeated, in its wake the canning industry came under the regulatory jurisdiction of the newly established Industrial Welfare Commission, one of whose main functions was to regulate the setting of piece rates in the industry. On paper, the regulations of the commission constrained the operation of the piece-rate system by establishing minimum earnings levels for piece-rate workers. The initial effect of these regulations was to raise the earnings and security of women cannery workers, but after 1921 the commission regulations failed to adjust to technical change in the canning industry; it is doubtful that they posed a serious constraint to the operation of the piece-rate system. The commission did conduct careful audits of the piece-rate system, which for the first time provided cannery management with industry-wide information on piece-rate earnings.³⁹

³⁹ Brown, "Historical Analysis," 377.

Even though the commission regulations failed to place any meaningful constraint on the operation of the piece-rate system throughout the 1920s and 1930s, these regulations did become one of the institutional mechanisms through which the later cannery union would successfully constrain the piece-rate system.

Successful unionization of the California canning industry occurred in 1937, after the initial phase of mechanization in preparation work, but prior to its transformation into a continuous-flow production process. The cannery unions were chartered as "federal locals" of the AFL, and a state-wide Council of Cannery Unions negotiated a master contract with California Processors and Growers (CPG), a bargaining association which represented cannery management. At the original organizing conference of the AFL cannery union, in 1936, members adopted a resolution critical of the piece-rate method of payment and called for a three-dollar daily minimum wage for all piece workers. The Cannery and Agricultural Workers Industrial Union, which seriously rivaled the AFL cannery union in the later 1930s, called for the abolition of all piece-rate or other bonus systems in the canneries.⁴⁰ In its initial contract the AFL union sought only to raise the average level of piece-rate earnings in preparation work, without affecting their dispersion. Within three years of the first union contract, however, the cannery union gained concessions that truncated the lower end of the piece-rate earnings distribution.

By setting a minimum hourly wage for all piece-rate workers, the union's demands were consistent with general technical developments that promoted minimum worker productivity standards in preparation work. But the diffusion of preparation machinery was uneven, varying with crop and by cannery, so technical considerations alone did not warrant the use of a uniform wage standard across all crops and in all canneries. The union's goal was not to accommodate technical change, but rather to use technical trends to help limit the scope of labor recruitment by management in order to enhance the bargaining power of labor.

The first union contract, in 1937, had little effect on the traditional piece-rate payment system in women's preparation work. The contract established a minimum hourly wage for women and required that 50 percent of women piece workers in any one plant meet or exceed the hourly minimum when piece-rate earnings were averaged over a week's time. The California Industrial Welfare Commission was called

⁴⁰ Marjorie Howell, "California Cannery Unions" (M.A. thesis, Stanford University, 1946), 24; Porter M. Chaffee, "A History of the Cannery and Agricultural Workers Industrial Union," Works Progress Administration, Federal Writers Project (Bancroft Library, Berkeley, Calif., 1938), 18.

on to audit canneries to ensure that this condition was met. Should a cannery fail to meet the 50 percent target, all workers on piece rates were to receive an equal increase in their weekly earnings until 50 percent of all piece workers had wages equal to, or over, the minimum hourly wage.⁴¹ This procedure was clearly designed to establish a union hourly wage without disturbing the cannery operators' use of the individual piece-rate system. In fact, these provisions did not vary from the preexisting Industrial Welfare Commission rules.

Other provisions in the 1937 contract aimed at constraining the piece-rate system were more symbolic than real. A callback provision required that an employer who called workers to a cannery had to pay them two hours at the minimum hourly wage if no work was available. The employer was exempt from this provision, however, if no produce was on hand, if the machines were down, or if any other circumstance beyond the cannery operator's reasonable control prevented work from starting up. The employer also could declare an unpaid work recess of up to two hours a day during each work shift, though these recesses were not counted as part of the piece worker's time in calculating hourly earnings averages. In 1938 women preparation workers gained seniority rights; but to enjoy preferential hiring for the current season, a person had to have worked 60 percent of the previous season at the same cannery, a provision that effectively rendered the vast majority of seasonal workers ineligible. The contract set women's overtime rates after eight hours at one-and-one-quarter time, identical to the preexisting Industrial Welfare Commission regulation. In comparison, overtime rates for men were set at time-and-a-half.⁴²

These initial contractual provisions essentially replicated the modified individual piece-rate system already typical of the more mechanized canneries in the late 1930s, though unionization may have guaranteed more stringent and uniform enforcement than the Industrial Welfare Commission alone could provide. Particular plant managers may have lost some degree of personal discretion, and less mechanized rural canneries, which had a greater need to recess work, may have been constrained somewhat by the new provisions. Nonetheless, on the whole the first union contracts merely formalized an in-place piece-rate system that had already been modified by the emerging labor requirements of unevenly diffused mechanization.

As the Second World War approached, the union's bargaining position strengthened. The threat of jurisdictional rivalry also forced the

⁴¹ California Processors, Inc., and California State Council of Cannery Unions, *Collective Bargaining Agreement* (Sacramento, Calif., 1937).

⁴² *Ibid.*, 1937 and 1938.

union to take more aggressive positions on wage issues involving the majority seasonal work force. In the 1940 contract the union sought to clarify its role as the provider of cannery labor. Employers were to notify the union forty-eight hours in advance of any beginning or resumption of production. Seniority lists were established from which the union was to provide workers as hiring began. Employers could hire nonseniority workers only if the union could not present an adequate number of seasonal workers with seniority. Employer recesses were limited to a maximum of a half-hour each. Shift work, which was becoming common in the more mechanized canneries, was regulated. Employers could hire only five nonunion members in the middle of a shift, and the 1941 contract further stipulated that the women's day shift was not to begin before 7 A.M. The 1940 contract required that each cannery designate a central authority responsible for that cannery's hiring who would work with the union to ensure that the regulations covering hiring and work practices were followed. Many canneries had previously relied on lower level foremen to recruit, hire, supervise, discipline, and fire seasonal workers.⁴³ In all these provisions, the union was seeking not only to regulate and manage the supply of labor, but also to demonstrate to cannery management that the union could be counted on as a reliable supplier of labor.

The managers of the more mechanized canneries were also interested in centralizing and rationalizing the management of labor. They too wanted to obtain a more regular work force that could be relied on to utilize fully the valuable preparation machinery. They knew that this meant regular shifts of fresh workers, a minimum of downtime, and bureaucratic control over arbitrary or abusive decisions by foremen. As early as 1913 the California Bureau of Labor Statistics had pointed out that "after a certain point the earning power [of cannery preparation workers] waned as the working hours lengthened," but this was of little concern then, to canneries employing workers on piece rates and with little capital equipment.⁴⁴

By 1938 the managements of highly mechanized canneries were beginning to appreciate the bureau's point. One cannery superintendent observed: "It has been proven that the best efficiency . . . can be maintained at ten hours a day, six days a week maximum, and that any intermittent longer hours reduce the high degree of smoothness in direct proportion."⁴⁵ This cannery superintendent recommended that

⁴³ *Ibid.*, 1940 and 1949.

⁴⁴ California Bureau of Labor Statistics, *Labor Conditions*, 30.

⁴⁵ "Efficiency of the Help as a Major Factor in Costs," *Western Canner and Packer*, June 1938, 19-20.

canneries schedule two regular work shifts a day instead of the customary single shift with extended overtime. Another cannery manager complained that the neglect of sound personnel practices, especially hiring practices, had cost canneries dearly in the past, and he welcomed the “somewhat involuntary entry into this field” forced by unionization of the industry. He complained about the practice of hiring “transient and unknown” workers and proposed that the percentage of workers returning each year be used as a “barometer of employee satisfaction.”⁴⁶

Along with gaining seniority for seasonal workers, the cannery union was politically active in gaining and retaining unemployment insurance coverage for seasonal cannery workers. According to one cannery union official, “The industry is getting a 99% trained work force back every year. . . . The combination of the seniority plus the worker’s income in between seasons from Unemployment Insurance is really responsible for them retaining a qualified work force.”⁴⁷

As labor shortages associated with war production loomed on the horizon, more canneries adopted the preparation machines developed in the 1930s. The diffusion of labor-saving innovations in preparation work was reflected in labor productivity trends for California canning. The decade of the 1940s showed the most rapid growth rate in value-added per worker of any decade in the history of the industry. It took forty years, from 1899 to 1939, for the real value-added per worker in the California canning industry to double—but it doubled again in just the next fifteen years.⁴⁸ The spread of rotary peach pitters, automatic fillers, “turnover tables”—which greatly speeded up inspection belt work—and other devices made this increased productivity possible, and the wartime increase in demand put pressure on canneries to speed up their production. The 1941 union contract reflects concern over this issue. Unfair speed-ups were subjected to grievance by the union, and regular rest breaks were called for. Both clauses reflected the union’s response to the gradual introduction of a drive system associated with mechanization. To ensure against “rate-busting,” the contract stipulated that workers on piece rates must receive the average hourly raise indicated in the new contract through a proportionate increase in piece rates rather than through any increase in the required hourly output.⁴⁹

The existing piece-rate system in California canneries came under

⁴⁶ Randall Tewley, “A Study of Personnel Problems in the Cannery,” *Western Canner and Packer*, Jan. 1938, 39–41.

⁴⁷ Mike Elorduy, interview with authors, 19 Dec. 1978.

⁴⁸ Brown, “Historical Analysis,” 41.

⁴⁹ California Processors, Inc., *Collective Bargaining Agreement*, 1941.

increased scrutiny and criticism with the pressure of wartime labor shortages, jurisdictional disputes in the cannery union, and an increasing frequency of union grievances against abuses of the piece-rate system. According to one cannery union official, piece rates “continually stirred up the work force. As they became aware of what the union was trying to do, and what their rights were, there was a tremendous number of grievances.” The piece-rate system was criticized by the U.S. Women’s Bureau on the ground that it permitted too large a dispersion in earnings. The California Industrial Welfare Commission also expressed dissatisfaction with the system it audited, charging that cannery managers often submitted fraudulent payroll records to the commission to avoid payment of the legally (and contractually) set minimum average wage.⁵⁰

In the 1943 union contract, the operation of the piece-rate system was substantially constrained by changes in the method of calculating the average earnings of piece workers. First, average earnings were to be calculated by group or department and not on a cannery-wide basis. Second, rather than stipulating that 50 percent of the piece worker’s wages had to be equal to or above the hourly minimum wage, the new provision called for the average wage of any group of piece workers to be equal to the contractual standard. For the first time minors, the aged, and the infirm in any group were to be included in calculating that group’s average earnings.⁵¹

The cannery union initially proposed the elimination of the simple piece-rate system to the War Labor Board (WLB) in 1945. The “make-up” system of reimbursing piece-rate workers after the fact would be abolished and replaced by a minimum hourly wage for all workers, though cannery operators could still utilize premium wage payments in addition to the hourly base pay. The California Processors and Growers (CPG), representing cannery industry management in labor matters, vigorously opposed the elimination of piece rates, but the WLB ruled in favor of the union. A year later, however, both the cannery union and management were back before the WLB asking for the resumption of the make-up system, which in the interim had actually continued in operation.

At this time, however, the AFL cannery union was facing a serious jurisdictional challenge from the Food, Tobacco and Agricultural Union (FTA), a CIO affiliate. The FTA made abolition of the simple

⁵⁰ Mike Elorduy, interview with authors, 19 Dec. 1978; U.S. Women’s Bureau, *Application of Labor Legislation to the Fruit and Vegetable Canning and Preserving Industries* (Washington, D.C., 1940), 103; California Industrial Welfare Commission, *Biennial Report, 1940-1942* (San Francisco, Calif., 1942), 1-2.

⁵¹ California Processors, Inc., *Collective Bargaining Agreement*, 1943.

piece-rate system one of its main issues and pointed to the failure of the AFL cannery union to end the make-up system as “the way in which the workers were betrayed by the AFL Cannery Council.”⁵² The “betrayal” charge was designed to support allegations by the FTA-CIO that the AFL cannery union would negotiate “sweetheart” contracts with the CPG in return for covert management support of the AFL in its jurisdictional dispute with the CIO. Perhaps because the radical and egalitarian FTA-CIO made the elimination of make-up payments such an issue, the AFL cannery union, whose jurisdiction was transferred to the International Brotherhood of Teamsters in 1945, did negotiate the final demise of the make-up system, and with it simple piece rates, in the 1947 contract. Soon after, with the passage of the Taft-Hartley Act and the general surge of anti-Communism in the American labor movement, the FTA-CIO was defunct.⁵³

It is probable that management opposition to abolition of the make-up system had dissipated by 1947. The averaging provisions of the 1943 contract discouraged the hiring of low productivity workers, whom the more mechanized plants were already trying to eliminate. Technically backward plants in isolated rural labor markets were more seriously constrained by these measures, and these firms occasionally tried to break out of the master agreement negotiated by the CPG. But the effect of the union provisions was to generalize and reinforce the trend toward adoption of preparation machinery, which was also impelled by wartime labor shortages, high wages, increased product demand, decreasing seasonality, and the internal logic of technical innovation. The union contract provisions for centralization of hiring, seniority, minimum piece-rate earnings, regularization of work shifts, as well as the union role in obtaining coverage under unemployment insurance, undoubtedly also contributed to the mechanization wave of the 1940s.

By 1947 hand work in preparation had been all but eliminated from California canneries, and many canneries were well along the way toward implementing mechanically integrated, continuous-flow production processes in preparation. The 1947 contract still permitted the use of incentive wage rates in addition to minimum hourly wages to increase internal competition for workers operating individual, disconnected machines. Wedded to a postwar unionized work force that was relatively stable and high-wage, cannery management continued to pursue technical change throughout the 1950s, and by the end of that decade few jobs amenable to the application of individual incentives

⁵² California CIO Council, *Economic Material on California Cannery Industry* (San Francisco, Calif., 1946), I-C-5—I-C-9.

⁵³ Howell, “California Cannery Unions,” 49–59; Kenneth Cameron, “Association Bargaining in the California Canning Industry” (M.A. thesis, University of California, 1949), 132–66.

remained in cannery preparation work. Since the late 1950s, incentive wage systems, while still allowed by the union contracts, have been used only in rare instances, such as when machine production cannot accommodate unique or defective produce and turn-of-the-century hand techniques must be employed.⁵⁴

CONCLUSION

This case study has focused on a primarily low-wage, female, highly seasonal occupation in order to highlight important aspects of incentive wages that are often ignored in studies that focus on incentive wages in high-wage craft occupations.⁵⁵ It was found that the piece-rate system was initially useful to the employer in enhancing external competition by expanding the pool of qualified labor for preparation work. As the process of industrial development unfolded, large corporate enterprises as well as labor unions became important institutions in the industry. Most notably, however, the technology of the production process required a more stable, attached work force with a relatively narrow dispersion of productivity characteristics. As a result of these developments, the simple, individual piece-rate system became progressively dysfunctional as a mechanism for enhancing external competition. During the initial phase of mechanization, however, the simple piece-rate system remained useful to the employer as a device to foster internal competition in clustered jobs and to monitor the production process in serially sequenced jobs. As the labor process became technically integrated, group piece rates and hourly wages augmented by incentive premiums proved more functional, both in stimulating group competition and in monitoring sections of the work process. Finally, with the development of fully integrated, continuous-flow production technology, incentive wage systems were almost totally eliminated from the California canning industry.

The union position toward piece rates in the canning industry was typically antagonistic. Early union contracts, however, were designed more to constrain and regulate than to abolish the piece-rate system, and no evidence exists that the union opposed the short-lived use of premium incentive wages. On the other hand, the various constraints that union contracts did impose on the hiring and wage system contributed to the acceleration of mechanization and, indirectly, to the abolition of the piece-rate system.

⁵⁴ California Canning Industry Automation-Mechanization Commission, *Report on In-Plant Studies* (Sacramento, Calif., 1963).

⁵⁵ Jack Steiber, *Steel Industry Wage Structure* (Cambridge, Mass., 1959); Ronald Schatz, *The Electrical Workers: A History of Labor at General Electric and Westinghouse, 1923-1960* (Urbana, Ill., 1983).

Generalization from a single case study to the historical behavior of incentive wage systems is obviously risky. Indeed, one lesson of the research on the California canning industry is that the history of incentive wages needs to be viewed in the context of the technical, market, and industrial relations characteristics of each industry. Nevertheless, we think that this case study is suggestive of the broad patterns of historical evolution that one might expect to find in regard to incentive wage systems. As a Chandlerian pattern of industrial development occurs, we would expect that incentive systems first become dysfunctional in terms of fostering external competition and only later in terms of their internal competition and monitoring functions. We would expect to witness a relative decline in simple, individual piece-rate systems and a relative increase in group piece rates and premium or bonus systems.⁵⁶

While the data are unfortunately sparse, some other studies do support this prediction. Roughly comparable surveys of the overall prevalence of incentive wage systems in manufacturing industries were conducted by the National Industrial Conference Board for the years 1924, 1935, and 1939. These data do not suggest an overall decline of incentive systems during these years, but they do show a decrease in the proportion of piece-rate systems and an increase in the proportion of premium and bonus systems. In 1924, for example, 83 percent of all incentive systems were piece-rate systems and only 17 percent were premium or bonus systems. By 1939, the proportion of piece-rate systems had decreased to 60 percent, and the proportion of premium and bonus systems had risen to 40 percent. In addition, the 1939 survey found that, out of a subsample of 313 manufacturing firms, five firms switched over from individual piece-rate systems between 1929 and 1939, and ten firms started new premium or bonus systems in those years.⁵⁷ While this evidence cannot be considered conclusive, it is, at least, consistent with our case study.

Comparable data on the general prevalence of incentive systems over the longer term are even more scarce. Again, however, available data are consistent with the historical pattern observed in our case study. The general prevalence of incentive systems in the pre-Second World War studies cited above ranges from 44 to 62 percent of the work force. In three postwar surveys, conducted from 1945 to 1970, the incidence of incentive systems ranges from a high of 30 percent in

⁵⁶ Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Mass., 1977).

⁵⁷ Conference Board, *Financial Incentives*, 16–22; National Industrial Conference Board, *Some Problems in Wage Incentive Administration* (New York, 1940), 8–11.

1945 and consistently declines to a low of 14 percent in 1970. Also, the average proportion of simple piece-rate systems in surveys done in the decade of the 1960s, about 40 percent of all incentive systems, is lower than the proportions found in the 1924–39 period, when they averaged about 65 percent.⁵⁸

The apparent anomaly in all the historical data on incentive wages is the 1890 study, which shows an overall prevalence of incentive wages of only 18 percent. There are two possible explanations for this result, both of which are probably relevant. The 1890 study may systematically understate the prevalence of incentive systems. A number of factors, connected with the data-collecting methodology of the 1890 census, support this theory. The other possibility is that the prevalence of incentive systems did, in fact, increase between 1890 and the 1920s and then decreased thereafter, especially after the Second World War. Such a pattern is consistent with the rise of early mechanized factory production and the growth in the popularity of scientific management in the late nineteenth and early twentieth century and with the subsequent pattern of industrial development described in this paper.

We would not expect every industry to experience this same general pattern in the chronological evolution of incentive wage systems, even if the data on the overall prevalence of incentive systems were much more conclusive than it is. For example, in some high-wage industries with craft traditions, the prevalence of incentive wages may have been perpetuated because of labor union pressure despite a technological evolution making the system dysfunctional from the viewpoint of management. Moreover, industrial and technological evolution proceeds unevenly. Outside the United States and beyond large-scale manufacturing industries, conditions may be found today that would favor the existence of the kind of piece-rate system that flourished in California canning in the early part of the twentieth century. Agricultural harvest labor and low-wage manufacturing industries that employ large proportions of immigrant labor in California today are two examples. This very diversity leads us to believe that long-term historical studies of specific industries that carefully take into account market structure and conditions, the technology of the production system, and the industrial relations environment can increase our understanding of the nature and role of wage payment systems in a modern industrial economy.

⁵⁸ Joseph M. Sherman, "Incentive Pay in American Industry," *Monthly Labor Review* 45 (Nov. 1947): 535–38; Earl L. Lewis, "Extent of Incentive Pay in Manufacturing," *ibid.* 83 (May 1960): 460–63; John Howell Cox, "Time and Incentive Pay Practices in Urban Areas," *ibid.* 94 (Dec. 1971): 53–55.