Logging Incentive Systems

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Introduction

This publication describes formal incentive systems used for Pacific Northwest logging operations. It covers direct pay-for-production plans—sometimes called competitive logging programs, contractor-parity programs, productivity-sharing plans, bonus systems, or POD systems. (Incentives such as individual or supervisory incentives, year-end profit sharing, informal nonmonetary bonuses, safety bonuses, or quality bonuses are not covered.) The principles described here can be applied to cutting, hauling, yarding and loading, or road construction. They are applicable to the operations of independent contractors or large companies and to union or nonunion crews.

Why should incentive systems be used? What are the principles behind successful ones? This paper will answer those questions and describe the cost and wage behavior of five variations of incentive systems, demonstrating the calculations for and advantages or disadvantages of each. It will explain how to design and implement an incentive system as well as provide example forms.

Common Practices

Paying bonuses to cutters has been a common practice in logging for many years, each cutter being paid according to the volume he produced. This practice, called "busheling," is similar to the piece-rate bonus systems used in manufacturing. Occasionally informal systems based on loads per day have been set up for hauling operations. In rare cases, yarding and loading incentives have been offered to crews if they exceeded some base amount.

The informal systems used by many independent contractors are not as effective as they could be. Production goals are usually seat-of-the-pants estimates. Bonuses are often given at the whim of the owner, and the amount is typically not substantial. Most of these shortcomings can be overcome by formalizing a system. The change from an informal to a formal system is followed in many instances by a large increase in productivity.

A major increase in logging incentive systems occurred between 1982 and 1987 among large, unionized operations. One of the main reasons was to bring company crew costs in line with contract loggers' bids. A survey during this time of 146 mechanized logging operations in the western United States showed that 35 percent of the respondents used monetary incentive bonuses. Nearly two-thirds of the firms used production over a set goal as the basis for their incentive programs.

Production Gains

Why should a company use incentives, or a logging crew choose to go on an incentive system? Because cost per volume can be reduced while the worker takes home more pay. For the most part, company costs for crews on incentives are in line with contractor's bids, while the crews maintain or exceed their previous hourly take-home pay (in real earning power after adjustment for inflation). A company is in position for more competitive bids when sales are scarce and in a more profitable position when they are not. It is also easier for a company to attract and retain production-oriented workers.

How big are the gains? Production increases in the 20- to 30-percent range are the most common. In some situations, the increase may reach 50 percent. Incentive bonuses that are 20 percent of regular pay are common. At the same time, company direct costs drop approximately 10 percent. Indirect costs also decrease. The proportionate benefits of worker and company depend on the particular system that is used.

System Types

Five incentive systems (arbitrarily numbered from 1 to 5) will be demonstrated here. Each has advantages and disadvantages. Each has been used successfully in Pacific Northwest logging operations.

Three of the systems begin with calculation of a bonus pool. First, a crew is given a target, or standard, price per volume for the particular unit. The price is the competitive bid that might be readily obtained from a good private contractor. (This is generally controlled by the market.) The volume for the unit is multiplied by the price to obtain total price, or revenue. Standard costs for the unit are subtracted from this total to obtain the bonus pool.

Miscellaneous charges such as travel pay, move-in costs, and bonus-system administration are part of the standard costs charged against the total price, but the main costs are equipment, wages, and other personnel costs, which can be

called "labor overhead." Each piece of equipment has its own daily cost, which is multiplied by the days of use. Wages are based on hours worked multiplied by an hourly labor rate. Labor overhead is charged at a predetermined percentage of wages derived from current rates for such things as worker's compensation, unemployment taxes, and social security (FICA). Group insurance and retirement are sometimes included. There is a growing trend to exclude travel allowances, vacation pay, and holiday pay from this overhead. Systems of calculating and distributing the bonus pool vary.

Two of the bonus systems base the incentive on a percentage of the hourly wage and on the level of production rather than on a bonus pool. Productivity is usually measured in loads per day. The production goal can also be expressed in volume per man-hour, which automatically adjusts for crew size on a unit and encourages the crew leader to experiment with crew size and assignments for optimum efficiency. The 100-percent production level is defined as that needed to maintain a competitive price with standard company costs.

The following examples are based on actual harvest projects. For demonstration, workers' wages are set at $10.00 per hour, labor overhead at 45.8 percent. The projected competitive price for the unit, obtained by multiplying the estimated volume to be harvested by the price per cunit (100 ft^3), is the agreed-upon goal: $10.00 per cunit x 5,828.7 cunits = $58,287. From the estimated daily cost of operation, a daily production target in truck loads per day is calculated. Bonuses are based on the recorded volumes and costs at completion of the unit. The hypothetical crew averages 11 loads per day, finishing the unit in 1,744.8 man-hours. The example calculations are for 110-percent productivity. Numbers are rounded to the nearest dollar.

Bonus-Pool Systems

SYSTEM 1: 80-percent base-wage guarantee, 80-percent worker share of the bonus pool, no deduction of labor overhead from the worker bonus.

Wages (hours worked x 80% of wage)	$13,958
Labor overhead (45.8% of wage)	6,393
Equipment cost (daily cost x days of use)	27,549
Subtotal cost (wages + labor overhead + equipment cost)	47,900

Bonus pool (projected price of unit − subtotal cost)	10,387
Worker share (80%)	8,309
Total worker earnings (wages + bonus)	22,267
Average wage per hour (total earnings ÷ hours worked)	12.76
Company coverage of labor overhead (45.8% of bonus)	3,806
Company cost (subtotal cost + worker share + labor overhead)	60,015
Cost per cunit	10.30

Company cost equals 102.96 percent of the competitive price.

If the subtotal cost is greater than the projected price for the unit, no bonus is calculated, and the company absorbs the difference. This system does not subtract labor overhead from the bonus; rather labor overhead is absorbed by the company. In compensation, the company may be given a share of the bonus pool. (This varies from 0% to 67%, 20% being most common.) System 1 guarantees a base wage to protect the employee, usually 80% of the hourly rate before the system was established.

SYSTEM 2: 100-percent base-wage guarantee, 100-percent worker share of the bonus pool, overhead deducted from the worker bonus.

Wages (hours worked x 100% of wage)	$17,448
Labor overhead	7,991
Equipment cost	27,549
Subtotal cost	52,988
Bonus pool	5,299
Net worker bonus (bonus pool ÷ 1.458)	3,634
Total worker earnings (wages + net bonus)	21,082
Average wage per hour	12.08
Company cost (subtotal cost + gross bonus)	58,287
Cost per cunit	10.00

Company cost equals 100 percent of the competitive price.

System 2 divides the bonus pool by the predetermined rate of labor overhead, and the resulting amount is subtracted from the worker bonus. (See Appendix A for a complete bonus appraisal with System 2.) At productivity levels below 100 percent, wages have a guarantee of $10.00 per hour in this example. In some cases, the crew must pay back losses on previous units before a current bonus is given. For example, with 80-percent productivity, subtotal costs are $72,859, which is $14,572 above the competitive price. This $14,572 would be recovered from future bonus pools.

SYSTEM 3: 100–percent base–wage guarantee, 50–percent worker share (yarding crews) of the bonus pool, labor overhead deducted from the worker bonus. Wages, labor overhead, equipment cost, and subtotal cost are the same as in System 2.

Bonus pool	$5,299
Worker share (50%)	2,649
Net worker bonus (bonus share ÷ 1.458)	1,817
Total worker earnings	19,265
Average wage per hour	11.04
Company cost	55,637
Cost per cunit	9.55

Company cost equals 95.45 percent of the competitive price.

System 3 combines Systems 1 and 2. The bonus pool is shared by company and crew before the overhead percentage is subtracted from the worker share. This system is conservative, giving a smaller bonus to the crew than the other two variations and creating less motivation. It has the advantage of ensuring that company costs are covered and that the company receives a substantial share of bonuses.

Percentage Systems

SYSTEM 4: 100–percent base–wage guarantee, 1–percent increase in pay for 1–percent increase in production, no deduction of labor overhead from the worker bonus. Wages, labor overhead, equipment cost, and subtotal cost are the same as in System 2.

The goal is 10 loads per day; actual production, 11 loads per day.

Worker bonus (10% for 110% productivity)	$1,745
Total worker earnings	19,193
Average wage per hour	11.00
Company coverage of labor overhead	799
Company cost	55,532
Cost per cunit	9.53

Company cost equals 95.27 percent of the competitive price.

The production target is calculated by estimating the total price for the unit and the daily costs for labor and equipment, then by dividing the total price by daily cost to find the number of days for completing the unit. Dividing the total volume by the number of days will give the target for daily production; in this case it is 10 loads per day. If crew costs per day are higher than those of other crews, faster daily production will be required to be competitive. This system allows production to be estimated accurately on a weekly basis, so that incentive bonuses can be paid weekly. The company absorbs the extra cost for productivity levels below 100 percent. The results are similar to those of System 3, if the percentage of labor costs in the total price is the same as the share percentage in System 3.

SYSTEM 5: 100–percent base–wage guarantee, 1.5–percent increase in pay for each 1–percent decrease in cost, no labor overhead deducted from the worker bonus. Wages, labor overhead, equipment cost, and subtotal cost are the same as in System 2.

Percentage of cost decrease $\left(\dfrac{\text{competitive price} - \text{subtotal cost}}{\text{competitive price}} \right)$	9.09%
Worker bonus (0.0909 x 1.5 x regular wage)	$2,379
Total worker earnings	19,827
Average wage per hour	11.36
Company coverage of labor overhead	1,090
Company cost	56,457
Cost per cunit	9.69

Company cost equals 96.86 percent of the competitive price.

System 5 gives results similar to those of Systems 3 and 4.

Comparison of Results

A comparison of the five systems can be made on a hypothetical (but realistic) yarding situation. Productivity levels can be equated to loads per day. A 100–percent level might be 10 loads per day, a 70–percent level 7 loads per day, and a 120–percent level 12 loads per day. The base wage is a preincentive wage of $10.00 per hour and the competitive price is $10 per cunit.

Wage and Cost Behavior

Total earnings per hour for a worker under the five systems are nearly identical at the 100-percent performance level (Figure 1). Systems 2, 3, 4, and 5 guarantee the wage at production levels under 100 percent. System 1 guarantees an 80-percent base wage and provides a strong motivation for the worker to reach and surpass the 100-percent level in order to achieve preincentive wages. It also protects company cost per volume at levels of productivity below 100 percent (Figure 1). At levels above 100 percent, Systems 1 and 2 give hourly bonuses that are roughly double those of the other three systems.

When dollars per volume achieved by the company at various productivity levels are measured against the competitive bid (Figure 1), System 1 shows prices above bid at all levels of productivity below 90 percent. Systems 2, 3, 4, and 5 show rapid rises in cost when productivity drops below 100 percent.

At levels above 100 percent, costs of Systems 1 and 2 stay approximately the same while those of Systems 3, 4, and 5 drop.

In addition to the effects shown in Figure 1, a company has two other advantages at production levels over 100 percent. The costs used in the incentive calculations are direct costs of operating the logging system, but the company has additional fixed administrative overhead. More volume is therefore produced for the same fixed overhead. A company also has increased productive capacity; greater volume is produced with no increase in equipment or personnel.

Machine-Restricted Output

Highly mechanized operations do not have as great a potential for raising production as labor-intensive operations because part of the work cycle is controlled by machine speed, such as the regulated highway speed of trucks. A crew usually can't affect the machine-paced portion of the cycle, which limits the possible increase in productivity (Table 1).

For example, in yarding, the inhaul and outhaul speeds of machine travel are largely out of crew control. If inhaul-outhaul constitutes 50 percent of the work cycle, a crew can influence only one-half of the cycle. If a crew is able to improve that portion by 40 percent, productivity is increased only 20 percent.

Rough estimates of the proportions of different work cycles that are machine controlled are: felling 20 percent, yarding and loading 50 percent, road building 60 percent, and hauling 70 percent. Such estimates help to explain why past felling performances have yielded good bonuses and hauling performances poor bonuses.
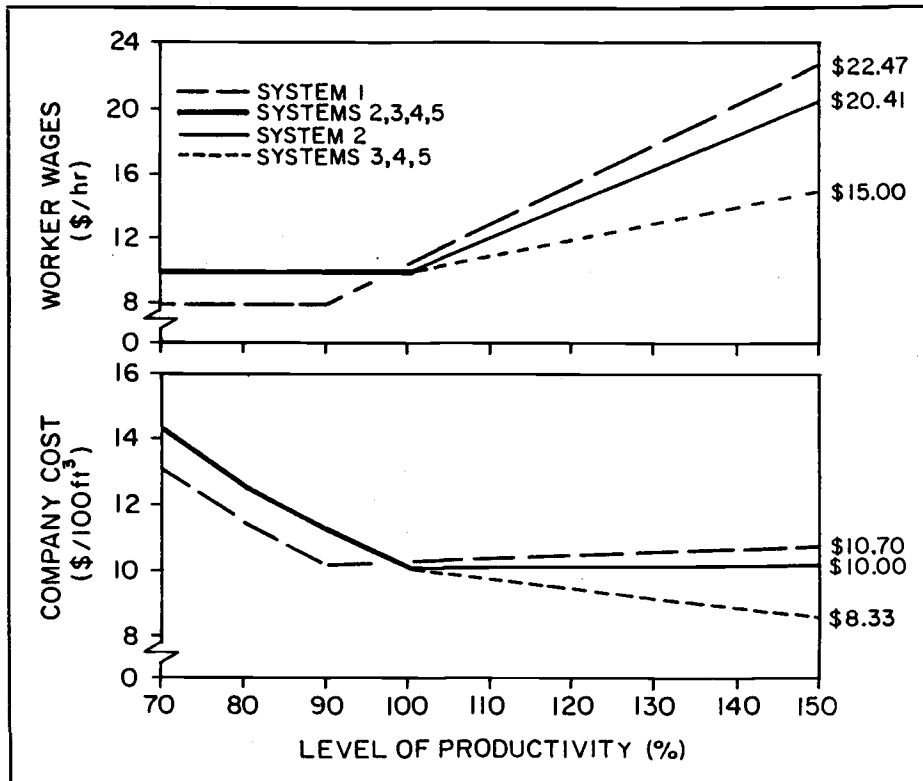

FIGURE 1.

WORKER WAGES AND COMPANY COSTS WITH FIVE INCENTIVE SYSTEMS. (PREINCENTIVE WAGE $10.00/HR; COMPETITIVE PRICE $10/CUNIT.)

TABLE 1.

PERCENTAGE OF BASE WAGE GIVEN IN BONUSES (SYSTEM 3) ON OPERATIONS MACHINE-CONTROLLED TO DIFFERING DEGREES.

Level of productivity (%) of nonmachine-controlled activities	Operation machine-controlled—				
	0%	25%	33%	50%	75%
150	50	37.5	33.5	25	12.5
140	40	30	26.1	20	10
130	30	22.5	20.1	15	7.5
120	20	15	13.4	10	5
110	10	7.5	6.7	5	2.5
100	0	0	0	0	0
90	-10	-7.5	-6.7	-5	-2.5
80	-20	-15	-13.4	-10	-5.0
70	-30	-22.5	-20.1	-15	-7.5

Effect of Logging Activity

Felling, yarding, hauling, and road construction activities are each affected differently by incentive systems because of the differing labor costs. This can best be demonstrated by comparing the bonuses earned under Systems 2 and 3.

With System 2, all logging activities receive 100 percent of the bonus pool. As can be seen in Figure 2, those activities with the smallest labor content (road construction and hauling) have the greatest earnings. With System 3, in which the bonus share is proportional to the labor content, all activities have the same bonus at each productivity level. Although this appears to be more equitable, it is not because the machine-paced activities such as hauling cannot achieve the same levels of productivity as labor-intensive activities such as felling. In practice, therefore, System 2 gives more equitable bonuses for the various activities.

Activities in System 2 have the same cost per unit at all productivity levels (Figure 2). System 3 would have lower costs at higher production levels, although attaining high levels in road construction and hauling would not be likely.

Advantages and Disadvantages of the Systems

Each of the incentive systems has advantages and disadvantages. The strong and weak points are summarized in Table 2. Systems 1 and 2 give generous bonuses while holding the cost per cunit equal for all productivity levels above 100 percent. By guaranteeing a base-rate wage of 80 percent, the cost per cunit at less than 100 percent productivity is also kept in control. The other three systems give bonuses roughly half the size of Systems 1 and 2 because the cost per cunit to the company drops as production levels exceed 100 percent. Unfortunately, the cost per cunit rises rapidly for production levels under 100 percent, but guaranteeing anything other than 100-percent base wage is not recommended because it

FIGURE 2.

WORKER WAGES AND COMPANY COSTS FOR DIFFERENT LOGGING ACTIVITIES UNDER BONUS SYSTEMS 2 AND 3.

TABLE 2.

FEATURES OF FIVE BONUS SYSTEMS.[a]

	System 1 80% wage base, 80% bonus– pool share	System 2 100% wage base, 100% bonus– pool share	System 3 Bonus–pool share by labor content (yarding 50%)	System 4 1% wage increase for 1% produc– tivity increase	System 5 1% wage increase for 1.5% cost decrease
Company cost					
Under 100% productivity	Moderate increase⁻	Large increase—	Large increase—	Large increase—	Large increase—
Over 100% productivity	Slight increase⁻	Constant⁺	Decrease⁺⁺	Decrease⁺⁺	Decrease⁺⁺
Equipment–cost coverage	Complete⁺	Complete⁺	Complete⁺	Indirect⁻	Complete⁺
Equipment–cost records	Needed⁻	Needed⁻	Needed⁻	Not critical⁺	Needed⁻
Wages					
Under 100% productivity	80% protected⁻	100% protected⁺	100% protected⁺	100% protected⁺	100% protected⁺
Over 100% productivity	Dramatic bonus⁺⁺	Dramatic bonus⁺⁺	Limited bonus⁻	Limited bonus⁻	Limited bonus⁻
Labor overhead	Company covered⁺	Worker covered⁻	Worker covered⁻	Company covered⁺	Company covered⁺
Bonus fluctuation	Not controlled—	Not controlled—	Not controlled⁻	Not controlled⁻	Not controlled⁻
Weekly bonus	Not given⁻	Not given⁻	Not given⁻	Given⁺	Not given⁻

[a] Symbols indicate advantages and disadvantages from the company standpoint on costs and the worker standpoint on the remaining features. ++ Major advantage; + Advantage; – Disadvantage; — Major disadvantage.

would further reduce the bonus potential of the crews.

Questions that both workers and managers should ask about a system are:

Does the company cost per volume increase at productivity levels below 100 percent?
Does the company cost per volume decrease at productivity levels above 100 percent?
Are worker earnings per hour guaranteed at productivity levels below 100 percent?
How substantial are opportunities for worker bonuses at productivity levels above 100 percent?
Are equipment costs and labor overhead fully recovered by the company at all productivity levels?
How critical are accurate cost records?
Is labor overhead paid from the bonus pool?
Does the system smooth wide fluctuations in bonuses caused by imprecise price setting?
Can bonuses be calculated and paid weekly?

System 1 gives the company a stable price at all production levels and gives workers the highest bonuses at production levels above 100 percent. Its weakness is that only 80 percent of worker wages are guaranteed.

System 2 is similar to System 1 at levels of productivity above 100 percent. At levels below 100 percent, the worker's wage is protected, resulting in large increases in company costs.

System 3 also protects wages below 100–percent productivity, causing high company costs. Employee bonuses are about half those of Systems 1 and 2. Company costs decrease at productivity levels above 100 percent, and equipment costs are fully recovered, but weekly bonuses are impractical.

System 4 is similar to System 3 with regard to wages, and company costs dropping at high levels of productivity. Weekly bonuses are possible, and the accuracy of record keeping is less crucial, but full recovery of equipment costs is not guaranteed.

System 5 is similar to System 3 in almost all respects, but it does not have the flexibility allowed by different share percentages.

In general, Systems 3, 4, and 5 are conservative; since there is less opportunity for a bonus, worker motivation may be insufficient to bring impressive jumps in productivity. All of the systems are subject to bonus fluctuations resulting from price setting. The choice among them depends on the business philosophy of the management. The company owner should choose a system that best suits the needs and goals of the organization and workers, thus benefiting both. With System 3, for example, a crew working at a 120–percent productivity level receives a bonus of 20.8 percent, while company cost is reduced 8.3 percent per cunit.

System Modifications

Some system disadvantages can be overcome with modifications, such as those designed to reduce the base wage or to smooth bonus fluctuations.

Reducing the Base Wage

The cost per cunit of System 1 at levels of productivity below 100 percent is a feature desirable for other systems. The base wage can also be reduced with System 2. With a base wage of 80 percent, the cost and wage curves of System 2 are unchanged at productivity levels above 100 percent, while at levels below 100 percent, they are almost identical to those of System 1. Unfortunately, the same is not true for Systems 3, 4, and 5, in which bonuses are greatly reduced with a reduced base wage. These systems already have conservative bonuses, roughly one-half those of Systems 1 and 2. The calculation method used in Systems 3, 4, and 5 would further reduce them. Therefore, base-wage reductions are not recommended for protecting company costs at productivity levels below 100 percent with Systems 3, 4, or 5.

Smoothing Bonus Fluctuations

No matter which system is used, a bonus ceiling will even the fluctuation in bonuses and will help compensate a company for past projects that exceeded target costs. To smooth wide fluctuations, bonuses may be limited to 50 percent (or another percentage), and the amount in excess of that may be banked in the individual worker's pool. On later projects in which bonuses are less than 50 percent, the money is then withdrawn and paid to the maximum percentage. At the end of each year, the worker is given the sum remaining in the account. If there is a debt, it is erased, and the next year begins at zero. Table 3 shows how this works. Note that the pool can be used to compensate the company for past losses only if a balance remains after the current full bonus is paid (Projects 7 and 8). When a debt exists, a bonus is paid only if there is a balance after the company is compensated (Projects 5 and 6).

A bonus ceiling can replace the policy of paying no bonus below 100-percent productivity. It can also replace the morale-destroying policy of having workers compensate a company for previous losses before a current bonus is given, and it counteracts problems caused by pricing errors.

TABLE 3.

WORKER BONUSES AND COMPANY COMPENSATION ON SUCCEEDING PROJECTS UNDER A BONUS-CEILING PLAN. BASE WAGE IS $10 PER HOUR, BONUS CEILING 50 PERCENT.

Project	Worker hours	Bonus earned, or debt acquired		Bonus paid		Payable to company	Deposit to or withdrawal from worker's pool	Pool balance
1	100	$8/hr	($800)	$5/hr*	($500)		+$300	$300
2	100	$3/hr	($300)	$5/hr*	($500)		−$200	$100
3	100	0		$1/hr	($100)		−$100	0
4	100	$8/hr	($800)	$5/hr*	($500)		+$300	$300
5	100	−$1/hr	(−$100)	$2/hr	($200)	$100	−$300	0
6	100	−$2/hr	(−$200)		0		−$200	−$200
7	100	$4/hr	($400)	$4/hr	($400)		0	−$200
8	100	$8/hr	($800)	$5/hr*	($500)	$200	$300	$100

* Maximum allowed

Implementing an Incentive System

Incentive systems require supervisory change. The logging superintendent and foreman will spend more time in planning and less in direct supervision, and the crew leader will make on-site decisions about methods and production, although major decisions will be agreed upon after meetings between crew leader, foreman, and superintendent. The crew leader may receive an

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increase in base wage of as much as 10 percent to reflect the added responsibility; therefore, time and money should be spent in developing the leader's supervisory and technical skills. Time must also be spent in helping the crew to solve production problems and to plan—skills not traditionally needed in foremen-dominated situations.

An incentive system also requires more record keeping, approximately 2 additional hours of clerical work per month for each worker on the system. Accurate records of production, cost, and individual employee payrolls are therefore essential. In most cases, the increased paperwork will be handled more efficiently with a personal computer. The incentive-system records should be integrated with other company payroll and production records.

Incentive-system administration should not be taken for granted. On the surface it may appear that all that is needed is establishment of a load-per-day target and payment of the crew when the target is exceeded. A properly run system is considerably more sophisticated than this. The benefit to both company and workers is directly proportional to how well targets are set and how well records are kept. The setting of the target (whether it is a production goal or a price goal) requires detailed analysis of conditions and costs on each unit to be undertaken.

How are the bonuses distributed? The base wages of individual crew members are established in the same manner as those for crews not in incentive programs; however, the bonuses are usually distributed at the same rate (in dollars per hour) to all crew members. This creates a spirit of teamwork, since all share equally. If some crew members have worked fewer hours on a project, their bonuses are prorated accordingly. Inclusion in the bonus pool of workers outside the incentive system has been tried by several companies with the rationale that mechanics, dispatchers, shop personnel, and office clerical staff contribute indirectly to productivity and should share in the rewards. In general this practice has lowered crew earnings and is not recommended.

Sources of Better Productivity

Managers may fear that incentives will encourage workers to work unsafely or hurriedly, disregard quality, abuse equipment, or cause problems for subsequent operations in the work cycle. Experience in the logging industry and in many other industries has shown these fears to be unfounded. Properly designed incentive systems remove potential problems; many have quality and safety bonuses in conjunction with productivity bonuses, and some have pay penalties for substandard safety or quality (see Appendix B, page 14). Workers know that high maintenance costs lower bonuses, because equipment costs are subtracted before a bonus pool is calculated, and that production stops during downtime, so they avoid many of the delays seen when there is no incentive. To prevent problems with subsequent operations (such as timber out-of-lead or poorly sorted decks), a foreman can monitor the operation.

If an incentive crew includes fallers, yarding crew, and truck drivers, they tend to work as an integrated group. When they have a vested interest in productivity, they ferret out much waste in the system. Improvements commonly seen are elimination of waiting delays, reduction of system delays, avoidance of suboptimal payloads, faster cycle times, proper equipment mix, and more planning to eliminate problems. Equipment servicing and maintenance is anticipated and performed off shift or during delays, and proper sorts and other quality-control measures are recognized. Crew size is more apt to be correct for an operation. Workers can and will perform any task (assuming they have proper training). They train one another and care for each other's safety.

All of these things occur at the same work pace as before. The work is "smarter, not faster." Many of these improvements can be immediately accomplished. Others, such as informing crews about equipment costs to aid them in making the best decisions, will require additional education by company managers. Of course, if total output of a company is limited by a quota, the incentive system is incapacitated. Management must make provisions to take advantage of any increased productive capacity.

The most obvious reason that incentive systems increase productivity is the direct reward a worker gets for ideas and effort. Participation helps the worker feel like a part owner in an operation; morale is increased because the job gives more independence and challenge than does a traditional work situation. In logging operations, incentive systems aid the building of an integrated, compatible crew by encouraging crew stability. The incentive system also fosters cooperation between management and labor; organizational and individual effort is spent on productivity rather than dispute.

Goal Setting and Record Keeping

In order to implement a successful system, a production target (price goal) must be set for each unit. This requires management time, resources, and perhaps training of the crew leader. Past research has shown that participation of the crew in setting the production target results in substantial increases in productivity. In fact, one reason for the dramatic productivity increases often accompanying an incentive system is the goal setting itself.

A brief agreement, drawn up and signed, that documents the incentive–system policies agreed upon by crew and company is highly recommended. It might include:

Safety policy
Quality policy
Equipment costs
Crew contract policies (rate setting, rate and production documentation, volume tracking and measurement, harvest description, cost accounting/payroll, bonus percentages, bonus upper limits, settlement timing, crew composition, settlement of contract rate disputes, out–of–work policy)
Establishment of covered pay–for–production groups (new groups, combined groups, modified group size)

Personnel practices (work assignments, overtime, transfers, vacations and holidays)
Seniority policy
Training policy
Hiring policy
Outside–work policy
Legal obligations
Insurance policy
Management and work interaction: operating committee, responsibilities, grievances, guarantees
Annual bonus based on length of service

See Appendix C for a sample agreement.

Accurate cost and production records must be maintained for feedback to crew and management. Typically, such vital information for decision making has been previously unavailable, so the feedback alone improves productivity. The crew usually receives three types of reports. The first documents the setting conditions and price. It contains an estimate of the total volume, the daily costs, the target production rate, and any special logging restrictions.

A second kind of report is a weekly progress statement summarizing the volume harvested, hours worked, and costs incurred to date by the crew. The third type is the final settlement detailing total costs and the bonus distribution to crew members (see Appendix A).

A company must have accurate records in order to estimate the daily cost of equipment. This is usually obtained by extrapolating from the estimated annual cost of operation the amount needed for the anticipated operation. Labor overhead is also estimated. Scaling tickets from log–truck hauls are often used for recording the production of a crew. An accurate record must be kept of each crew member's hours on each unit. Equipment used by a crew is assigned and charged on a daily basis. These figures are then used to calculate and prorate each crew member's bonus. Bonus calculations for all five systems at 70– to 150–percent production levels are shown in Appendix D.

Price Setting

Analyses of recent incentive projects show that some crews average larger bonuses than others and that even the same crew will earn very different bonuses from project to project. Much of this fluctuation is inherent in logging operations, but some can be avoided by consistent pricing. Setting the competitive price is a crucial step that should be performed by a person with experience in bidding and evaluating results. The price setter must know the competitive market and adjust for the difficulty of each project. The price (estimated for 100–percent productivity) represents the planned costs: the amount of money needed to cover labor and miscellaneous expenses and reasonable equipment charges. It does not include the owner's profit–and–risk margin nor other fixed overhead. The equipment cost will include depreciation, investment return, operating cost (fuel, lubrication, maintenance, tires), and supplies.

The price must be adjusted to reflect such things as the mix of equipment, environmental restrictions, slope, yarding distance, piece size, and volume per acre. Often, the logging superintendent, foreman, and crew leader will discuss the conditions of a unit before the price is set. Once set, no further negotiation of the price should occur. An inviolate price ensures the crew that if they do well, the bonus is theirs. On occasion the price will be set too low, and no bonus is possible, a risk that must be accepted. Since company costs per volume improve with

high bonuses, the company encourages them. Any company effort to curtail bonuses dooms a system to failure.

A decrease in competitive price year after year, called ratcheting, is a valid trend if the industry as a whole is improving. A crew can continue to make improvements on projects and to achieve bonuses. Some companies apply an annual 2-percent ratchet to production goals to account for technological advances in logging equipment.

A competitive price is difficult to establish because conditions on a unit may be more or less difficult than anticipated. Figure 3 shows the effect on wages and cost per volume of high and low price settings calculated under System 2. The example assumes that $68,773 is the correct unit

price. If the price is too high (standard too loose), a crew will easily undercut it and earn a bonus, about 15 percent too much if the price is 10 percent too high. If the price is too low (standard too tight), the opposite occurs.

An incorrect price also has a dramatic impact on company cost in dollars per volume (Figure 3), which suffers or benefits in direct proportion to the percentage the price is off the mark.

One company has set a policy of giving bonuses only at the 110-percent level of productivity and of exacting a penalty from performances under 90 percent. The base wage is given for performance in the 90- to 110-percent range. This eliminates some of the bonus variation that results from inaccurate price setting yet continues to motivate the crew.
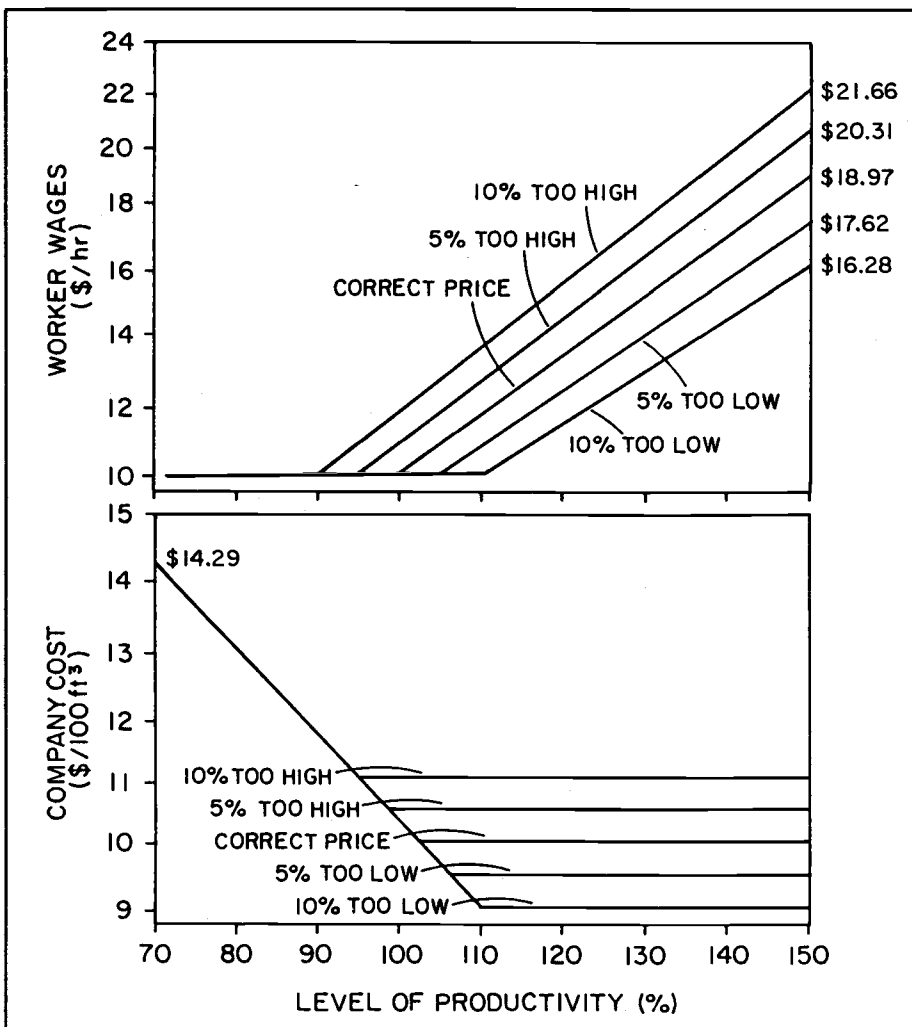
FIGURE 3.

WORKER WAGES AND COMPANY COSTS WITH DIFFERENT PRICE SETTINGS UNDER SYSTEM 2.

Adjusting to Additional Capacity

Productivity levels tend to be 20 to 30 percent higher with incentive systems. This means an additional logging capacity of 20 to 30 percent. Management must take responsibility for utilizing this added resource. The most desirable use of the capacity is to process more volume per year. The crew can then enjoy higher earnings during the season and the company can cover the fixed hourly cost for the scheduled hours. To accomplish this, management must acquire sufficient harvesting projects. For an independent contractor, this means bidding for and winning more sales.

If the volume harvested can't be increased, the company work forces and equipment can be reduced 20 to 30 percent. As turnover on logging crews is high, personnel reduction can be handled with normal attrition. Excess equipment can be gradually phased out, resulting in better equipment utilization.

A third approach is to harvest the same volume with the same work force but to reduce total hours worked. In effect, the workers' bonus becomes time, not money. Workers earn their previous wages in four days and have a fifth day off. The company in this instance does not benefit from better use of equipment.

If incentives become widespread, as appears likely, regional as well as company adjustments will have to be made. Under the first approach, the total volume harvested and market share would be increased. Under the second approach, the regional logging work force would shrink approximately 20 to 30 percent. Workers would have to transfer to other industries, and fewer new workers could enter the logging industry. The third approach, shorter work weeks, is unlikely on a regional basis as companies won't allow equipment to sit idle.

The point to note is that with incentive systems individual companies must make a major adjustment to accommodate additional production capacity. In the long run, the regional logging industry will see poorly performing businesses eliminated. Competitiveness of the region will be increased. Wood will be harvested and processed at lower cost.

Characteristics of a Sound Plan

The single most important characteristic of a sound incentive system is the worker's trust in company management, because the motivation to be productive rests on the confidence of fair reward. The system must have the backing of top management for continuity and stability; it must be simple, direct, and easily understandable; and

there must be regular, weekly feedback, with further explanations when necessary.

In general under an incentive system, a crew will nominate its own members, although the company may reserve the right to reassign individuals in order to assure smooth operations. The company will assist the crew in developing a compatible and productive team.

Crew size in a good system will be appropriate: for fallers, it could be as few as two people; for a highly mechanized and integrated yarding operation, it could be everyone from faller-buncher operators to truck drivers. The smaller the crew, the more individual effort will affect the bonus. (If a crew is too large, the worker loses the direct connection between effort and bonus.) The boundaries between incentive crews should not violate important work interactions. Some crews like to have fallers and truck drivers as part of the yarding incentive crew, but in most cases, felling, yarding, road construction, and hauling would be performed by separate crews. Smaller project size, which is possible in all cases except yarding, allows quicker calculation of bonuses.

Pay is prompt, calculated on a weekly basis. Advances, usually conservative, are made on projects still in progress. For instance, a crew may be paid 90 percent of the estimated volume processed. This provides a "kitty" for adjusting inaccuracies when the final wage and bonus settlement is made upon completion of the unit. (Bonuses are usually paid only on finished units.) Rapid computation and payment of bonuses is important. If more than a month elapses between completion of the work and payment of the bonus, much motivation is lost.

Bonus Performance on 151 Projects

Analysis of the bonus performance for 1 year of 16 different crews from 3 companies showed that approximately 200 labor hours per project were spent on road construction, road rocking, right-of-way felling, and hauling right-of-way timber. Felling projects averaged 689 hours each; yarding projects well over 1,000 hours. The range was from 1,373 hours for yarding to 2,471 hours for yarding, loading, and hauling, with some felling and bucking included.

The bonuses of the crews differed considerably. The better of two hauling crews averaged

$9.91 per hour more than the other. Between the best and worst of four felling crews there was $11.31 per hour difference in bonus, and between the best and worst of five yarding crews $3.61 per hour difference.

Earnings of the same crew also varied from project to project by an average $5.13 per hour (the range: $1.28 per hour for a felling crew on two projects to $11.86 per hour for a rocking crew on 11 projects). Roughly two-thirds of the projects for a given yarding crew deviated ±$3.39 from their average bonus earnings.

Effects of Incentive Systems

The use of crew incentives in logging operations in the western United States is an effective way to reduce costs and provide attractive wages. However, all such systems require a reliable method of setting the price, a good estimate of the daily costs of labor and equipment, and a method of tracking production output. The introduction of an incentive system requires a substantial initial investment of company managerial time as well as the goodwill and trust of workers.

Incentive systems affect the workers, the company, and the industry as a whole. Additional skills are needed in crew leadership, cost control, and equipment utilization. If the workers are production-oriented and the incentive system is well managed, the effects are mostly positive. The worker's job becomes more varied and planning and coordinating are self-managed. There are no limits imposed by job classifications. Take-home pay, though varied, is usually higher. Inefficient workers are either reassigned or terminated, and the total work force is smaller, but potentially more stable.

Incentive projects allow a company to reduce its first-level supervision. Managerial effort is turned toward long-range planning and problem solving. Price setting becomes critical, therefore cost records must be accurate and timely. Feedback on production, and other communication to crews, increases significantly. Handling of the extra production capacity requires extra planning, but the decrease in unit cost can be used either to increase profit or to reduce unit cost further.

In the industry as a whole, some noncompetitive firms will be eliminated. Because of the focus on productivity, both technological and business innovations will continually be introduced and adopted, and Pacific Northwest prices should be more competitive with those of other regions as logging-cost reductions are passed on.

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Appendix A: Bonus-Appraisal Sheet for Tractor Harvesting

The example is calculated with System 2. Labor overhead is based on 1985 figures.

Crew: nine
Equipment: three crawler tractors, one loader, one crew bus
Completion: 42 days
Volume (MBF): 4,230
Price per MBF: $44.59

Value of unit			$188,616
Costs:	Base wage + labor overhead (57%)	$1,189/day	49,937
	Equipment cost	2,223/day	93,366
	Crew transportation	45/day	1,890
	Rigging cost	77/day	3,232
	Safety–equipment cost	8/day	348
Total costs		$3,542/day	$148,773
Bonus pool (value of unit less total costs)			$39,843
Worker bonus net (39,843 ÷ 1.57)			25,378
Man–hours			3,402
Net bonus per hour			$7.46

Labor overhead item	% of wage	Base
Pension	5.0	Unlimited
Vacation	13.65	Unlimited
Holiday	6.6	Unlimited
FICA (employer share)	7.05	$39,600
State Unemployment	4.7	7,000
Federal Unemployment	0.8	7,000
Group Insurance	10.5	Unlimited
Worker's Compensation Insurance	8.7	Unlimited
	57.00	

Appendix B: Calculation Sheet for System 4 Standards and Bonuses

Month: _____ Job Name: _____ Incentive Area # _____ Logging Side # _____

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
Men																																
Hours																																
Man–Hrs																																

Incentive standard: _____ Cunits/man–hour

(WP) Week's production: _____ (Total volume delivered)

(TM) Total man–hours worked: _____ (Man–hours worked for week [from above])

Actual Production = $\dfrac{\text{(WP)}}{\text{(TM)}}$ _____ = _____ Cunits/man–hr

Productivity = $\dfrac{\text{Actual production}}{\text{Incentive–standard}}$ $\dfrac{\text{Cunits/man–hr}}{\text{Cunits/man–hr}}$ x 100 = _____ %

Production incentive: 82%   (Productivity _____ – 100) x 0.82 = _____

Quality incentive: 18%

Sorting	One missorted load	= 4% = .04
	Two missorted loads	= 2% = .02
	More than two missorted	= 0% = .00	_____

Unbucked ends	One unbucked end	= 4% = .04
	Two unbucked ends	= 2% = .02
	More than two unbucked ends	= 0% = .00	_____

Clean logging	Less than 10 ft^3/acre	= 8% = .08
	10–20 ft^3/acre left	= 4% = .04
	More than 20 ft^3/acre left	= 0% = .00	_____

Safety	No lost time (accident)	= 2% = .02
	Lost time (accident)	= 0% = .00	_____

TOTAL   _____

(Productivity _____ – 100) x (Quality total _____) = _____

TOTAL INCENTIVE:

TOTAL INCENTIVE, PRODUCTION PLUS QUALITY, TO BE PAID   _____%

Appendix C: An Incentive-Program Agreement

This example is not intended as a standard agreement but merely as an illustration of how administrative policies might be stated.

Date _____

This agreement shall become part of the labor agreement and shall supersede all previous yarding and loading agreements and practices inconsistent with this program.

A. Unit Prices

1. A unit (Harvest Plan) price is based on competitive prices as it would be offered to an outside contractor.

2. The price per MBF shall be established by the company. After consultation with the hooktender and before logging of a unit, the company will furnish the hooktender a "Harvest-Plan Cost and Bonus-Appraisal Data Sheet."

B. Crew Makeup

1. The company shall designate the crew leader (hooktender).

2. The company shall determine the maximum number of crew members to fit the unit being logged.

3. Upon date of ratification, all jobs except hooktender in the competitive logging program will be considered as new jobs for bidding purposes, and the job bid procedure of the working agreement will be used to fill any opening. Employees who enter the program at its inception may exercise, at any time up to the 30th workday, their plant seniority as though they were affected by a job elimination.

C. Bonus Payment

1. On the following pay period, fifty percent (50%) of the estimated bonus payable shall be paid when fifty percent (50%) of the unit's volume has been removed, and one hundred percent (100%) of any remaining bonus owed shall be payable upon completion of the unit.

2. Should a unit remain inactive (partially logged) for more than two (2) months, the bonus shall be calculated upon the percent-

age of volume removed, and, if owed, a bonus shall be paid up to eighty percent (80%) of the estimated bonus payable for the unit. When the unit is reactivated, the same crew shall be assigned, and one-hundred percent (100%) of any remaining bonus owed shall be payable upon completion of the unit.

3. Bonus payable to the crew shall be distributed between the crew members according to actual hours worked by each crew member, as reported by the hooktender.

D. Advanced Wages

1. Advanced wages in the form of a guaranteed base rate shall be paid on regular pay periods.

2. The base rate will equal seventy-five percent (75%) of the hourly rate for an individual's classification in effect on _____.

E. Hours of Labor

1. A normal work day is defined as an eight-(8) hour period.

2. Authorized overtime will be paid on the guaranteed base rate for hours worked in excess of eight (8) in a day and forty (40) in a week.

3. All crews will be required to check in at the woods office when going to work and to check out at the woods office when leaving the work site. If mutually agreed, alternative sites may be designated.

F. Vacation, Holidays, Jury Duty, and Funeral Leave

These items shall be paid at the guaranteed base rate.

G. Work Assignments

Each crew member shall have the responsibility and right to perform all tasks necessary to accomplish crew goals in a safe and reasonable manner.

H. Quality Control

The company shall determine quality standards and audit to assure compliance. A volume penalty for damaged logs, limby logs, missorts, and substandard utilization on the unit shall be assessed against any crew bonus earned.

I. Harvest Plan Compliance

The Forest Practices Act will be adhered to at all times and any violation made by a crew shall be corrected in the time specified by the Forest-Practices inspector. If violations require payment by the company of a fine, such amount will be assessed against any crew bonus earned.

The hooktender will accompany the woods superintendent during a Forest Practices inspection.

J. Safety and Fire Regulations

1. The Company shall remain responsible for providing and enforcing these programs.

2. The crew will be expected to comply with all applicable company, state, and federal regulations.

K. Discipline

The company's right to discipline shall not be diminished by this agreement.

L. Implementation

The program shall be implemented as soon as practical following ratification by the Union.

M. Duration

Either party reserves the right to terminate this Agreement thirty (30) days after giving written notice of intention to terminate.

During the thirty- (30) day period, the parties will meet in an effort to resolve any problems giving rise to the notice.

Upon termination by either party, this agreement shall have no affect on yarding and loading agreements and practices that existed prior to its inception.

Signed this _____ day of _____:

WORKER REPRESENTATIVES

By: _____
_____
_____
_____
_____
_____

COMPANY REPRESENTATIVES

By: _____
_____

System 1: 80% of bonus pool to workers, 80% base-wage guarantee, 45.8% labor overhead covered by company for bonus.

Productivity level (%)	70	80	90	95	100	105	110	115	120	130	140	150
Hours to complete unit	2,743	2,400	2,133	2,021	1,920	1,829	1,745	1,670	1,600	1,477	1,371	1,280
Price of unit	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287
Wages	21,935	19,193	17,060	16,163	15,354	14,624	13,958	13,352	12,796	11,811	10,967	10,236
Labor overhead	10,046	8,790	7,814	7,402	7,032	6,697	6,393	6,115	5,860	5,409	5,023	4,688
Equipment cost	43,291	37,880	33,671	31,899	30,305	28,861	27,549	26,351	25,253	23,311	21,646	20,203
Subtotal cost	75,272	65,863	58,545	55,464	52,691	50,182	47,900	45,818	43,909	40,531	37,636	35,127
Bonus pool				2,823	5,596	8,105	10,387	12,469	14,378	17,756	20,651	23,160
Worker share				2,258	4,477	6,484	8,309	9,975	11,502	14,205	16,521	18,528
Worker bonus				2,258	4,477	6,484	8,309	9,975	11,502	14,205	16,521	18,528
Bonus labor overhead				1,034	2,050	2,970	3,806	4,569	5,268	6,506	7,566	8,486
Total wage + bonus	21,935	19,193	17,060	18,421	19,831	21,108	22,267	23,327	24,298	26,016	27,488	28,764
Per hour wage + bonus	8.00	8.00	8.00	9.11	10.33	11.54	12.76	13.97	15.19	17.61	20.04	22.47
Company cost/cunit	12.91	11.30	10.04	10.08	10.16	10.23	10.30	10.36	10.41	10.51	10.59	10.66

System 2: 100% of bonus pool to workers, 100% base-wage guarantee, 45.8% labor overhead deducted from bonus.

Productivity level (%)	70	80	90	95	100	105	110	115	120	130	140	150
Hours to complete unit	2,743	2,400	2,133	2,021	1,920	1,829	1,745	1,670	1,600	1,477	1,371	1,280
Price of unit	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287
Wages	27,419	23,991	21,326	20,203	19,193	18,279	17,448	16,690	15,994	14,764	13,709	12,795
Labor overhead	12,558	10,988	9,767	9,253	8,790	8,372	7,991	7,644	7,325	6,762	6,279	5,860
Equipment cost	43,291	37,880	33,671	31,899	30,304	28,861	27,549	26,351	25,254	23,310	21,646	20,203
Subtotal cost	83,268	72,859	64,764	61,355	58,287	55,512	52,988	50,685	48,573	44,836	41,634	38,858
Bonus pool						2,775	5,299	7,602	9,714	13,451	16,653	19,429
Worker share						2,775	5,299	7,602	9,714	13,451	16,653	19,429
Bonus labor overhead						872	1,664	2,388	3,052	4,225	5,231	6,103
Worker bonus						1,903	3,634	5,214	6,663	9,225	11,422	13,326
Total wage + bonus	27,419	23,991	21,326	20,203	19,193	20,182	21,082	21,904	22,657	23,989	25,131	26,121
Per hour wage + bonus	10.00	10.00	10.00	10.00	10.00	11.04	12.08	13.12	14.16	16.24	18.32	20.41
Company cost/cunit	14.29	12.50	11.11	10.53	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

System 3: 50% of bonus pool to workers, 100% base–wage guarantee, 45.8% labor overhead deducted from bonus.

Productivity level (%)	70	80	90	95	100	105	110	115	120	130	140	150
Hours to complete unit	2,743	2,400	2,133	2,021	1,920	1,829	1,745	1,670	1,600	1,477	1,371	1,280
Price of unit	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287
Wages	27,419	23,991	21,326	20,203	19,193	18,279	17,448	16,690	15,994	14,764	13,709	12,795
Labor overhead	12,558	10,988	9,767	9,253	8,790	8,372	7,991	7,644	7,325	6,762	6,279	5,860
Equipment cost	43,291	37,880	33,671	31,899	30,304	28,861	27,549	26,351	25,254	23,310	21,646	20,203
Subtotal cost	83,268	72,859	64,764	61,355	58,287	55,512	52,988	50,685	48,573	44,836	41,634	38,858
Bonus pool						2,775	5,299	7,602	9,714	13,451	16,653	19,429
Worker share						1,388	2,649	3,801	4,857	6,725	8,327	9,714
Bonus labor overhead						436	832	1,194	1,526	2,113	2,616	3,051
Worker bonus						952	1,817	2,607	3,332	4,613	5,711	6,663
Total wage + bonus	27,419	23,991	21,326	20,203	19,193	19,231	19,265	19,297	19,326	19,377	19,420	19,458
Per hour wage + bonus	10.00	10.00	10.00	10.00	10.00	10.52	11.04	11.56	12.08	13.12	14.16	15.20
Company cost/cunit	14.29	12.50	11.11	10.53	10.00	9.76	9.55	9.35	9.17	8.85	8.57	8.33

System 4: 1% wage increase for 1% productivity increase, 100% base–wage guarantee, 45.8% labor overhead covered by company for bonus.

Productivity level (%)	70	80	90	95	100	105	110	115	120	130	140	150
Hours to complete unit	2,743	2,400	2,133	2,021	1,920	1,829	1,745	1,670	1,600	1,477	1,371	1,280
Price of unit	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287
Wages	27,419	23,991	21,326	20,203	19,193	18,279	17,448	16,690	15,994	14,764	13,709	12,795
Labor overhead	12,558	10,988	9,767	9,253	8,790	8,372	7,991	7,644	7,325	6,762	6,279	5,860
Equipment cost	43,291	37,880	33,671	31,899	30,304	28,861	27,549	26,351	25,254	23,310	21,646	20,203
Subtotal cost	83,268	72,859	64,764	61,355	58,287	55,512	52,988	50,685	48,573	44,836	41,634	38,858
Bonus percentage						5%	10%	15%	20%	30%	40%	50%
Worker bonus						$914	$1,745	$2,503	$3,199	$4,429	$5,484	$6,398
Bonus labor overhead						419	799	1,147	1,465	2,029	2,512	2,930
Total wage + bonus	27,419	23,991	21,326	20,203	19,193	19,193	19,193	19,193	19,193	19,193	19,193	19,193
Per hour wage + bonus	10.00	10.00	10.00	10.00	10.00	10.50	11.00	11.50	12.00	13.00	13.99	14.99
Company cost/cunit	14.29	12.50	11.11	10.53	10.00	9.75	9.53	9.32	9.13	8.80	8.52	8.27

System 5: 1.5% wage increase for 1% cost decrease, 100% base-wage guarantee, 45.8% labor overhead covered by company for bonus.

	70	80	90	95	100	105	110	115	120	130	140	150
Productivity level (%)	70	80	90	95	100	105	110	115	120	130	140	150
Hours to complete unit	2,743	2,400	2,133	2,021	1,920	1,829	1,745	1,670	1,600	1,477	1,371	1,280
Price of unit	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287	$58,287
Wages	27,419	23,991	21,326	20,203	19,193	18,279	17,448	16,690	15,994	14,764	13,709	12,795
Labor overhead	12,558	10,988	9,767	9,253	8,790	8,372	7,991	7,644	7,325	6,762	6,279	5,860
Equipment cost	43,291	37,880	33,671	31,899	30,304	28,861	27,549	26,351	25,254	23,310	21,646	20,203
Subtotal cost	83,268	72,859	64,764	61,355	58,287	55,512	52,988	50,685	48,573	44,836	41,634	38,858
Cost decrease percentage						4.76%	9.09%	13.04%	16.67%	23.08%	28.57%	33.33%
Worker bonus						$1,306	$2,379	$3,265	$3,999	$5,110	$5,876	$6,398
Bonus labor overhead						598	1,090	1,495	1,831	2,341	2,691	2,930
Total wage + bonus	27,419	23,991	21,326	20,203	19,193	19,585	19,827	19,955	19,993	19,874	19,585	19,193
Per hour wage + bonus	10.00	10.00	10.00	10.00	10.00	10.71	11.36	11.95	12.50	13.46	14.28	14.99
Company cost/cunit	14.29	12.50	11.11	10.53	10.00	9.85	9.69	9.51	9.33	8.97	8.61	8.27

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The use of crew incentives in logging operations in the western United States is an effective way to reduce costs and provide attractive wages. However, such systems require a reliable method of setting the price, a good estimate of the daily costs of labor and equipment, and a method of tracking production output. The introduction of an incentive system requires a substantial initial investment of company managerial time as well as the goodwill and trust of workers. The cost and wage behaviors, as well as the advantages and disadvantages, of five incentive systems are described in this paper. Calculations for the systems are demonstrated. The principles described can be applied to cutting, hauling, yarding and loading, or road construction. They are applicable to the operations of independent contractors or large companies and to union or nonunion crews.