ALTEN TECHNOLOGY

SUCCESSFUL PRODUCT DEVELOPMENT SERIES

Part 1—Costs and Profit Impact of Product Development: Cost of Personnel

by Mark Henault
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10875 N Dover St #500
Westminster, CO 80021

ALTEN

INTRODUCTION

MARK HENAULT
Chief Technology Officer
ALTEN Technology
mark.henault@alten.com

> We look at products as significant corporate assets, and ROA is a key financial measure of a company's financial health.

Research and product development (PD) are strategic investments in producing future profits for a firm. A major challenge is identifying the cost associated with your effort with the benefits realized. Most product development firms are quick to account for the cost of engineers, design and prototyping, and parts and manufacturing, but they often underestimate the cost of labor.

ALTEN Technology has developed a series of white papers that investigate the costs and profit impact as well as their overall effect on the return on assets (ROA) of product development—the PD-ROA. Furthermore, we will review the cost impacts of PD, look at the causes of reduced team productivity, and review what work should be outsourced as part of your successful product development plan.

In the first paper in this series, we examine the true cost of personnel and its effects on your PD-ROA. We have chosen ROA rather than the more common measure of return on investment (ROI) because we look at products as significant corporate assets, and ROA is a key financial measure of a company's financial health.

Any accountant will tell you expenses are not as straightforward as they may seem. A common example of oversimplifying costs is calculating the expense of operating a car by looking at the miles per gallon rating. By simply considering the cost of gas, one would quickly conclude that a 30 MPG car costs $0.10/mile to operate with gas at $3 per gallon. This is not the true cost of operating a car; even the conservative IRS allows a $0.50/mile cost deduction as the average cost estimate across all cars in all states. Additional factors such as buying the car, providing maintenance, and purchasing insurance should also be considered. The actual cost of operating a car includes all these factors.

The same can be said of engineering personnel costs—what it costs to actually employ personnel is more complicated than you may think. Understanding the true annual cost of your personnel is crucial to understanding your ROA. This is where we will focus our attention: the PD-ROA of personnel.

THE GREATEST COST

The most important cost in product engineering: Your people.

The greatest and most often underestimated cost in PD is the total cost of the people involved. The cost of equipment and supplies in PD is relatively straightforward. The people side of the equation is more complex than that, but when assessed properly, it helps to determine your true profits.

STANDARD COSTS OF PERSONNEL

The actual costs to operate your car are more complex than simply considering gas and mileage. Likewise, salary and benefits are not the only expenses involved in employing your personnel. Consider an example of a mid-level mechanical engineer (ME) or electrical engineer (EE) who earns $80,000/year or $38.46/hour. First, look at the basics: salary and benefits.

TABLE 1. SALARY

SALARY: BASE SALARY, VACATION, SICK TIME, ETC.	
Description	**Amount**
Annual Salary	$80,000
Available hours per year	2,080
Base salary per year	$38.46
- Less vacation/sick/personal hours	160
- Less holiday hours	80
- Less training hours	60
Net productive hours	1,780
Salary productive hourly costs	**$44.94**

Benefits such as health care and life insurance vary depending on what coverage the employer provides. Employees can choose some benefits and waive others, so the cost fluctuates between individuals as well. In this example, a mid-level mechanical engineer has chosen to participate in all the benefits the employer provided. This engineer has chosen a specific amount of coverage that shows fixed deductions from his or her paycheck each year. These employer cost contributions represent an average amount for an employee who earns a base salary of $80,000 and selects all of the employer benefits offered.

Table 1 highlights the fact that full-time employees generally do not provide more than 1,780 "productive" hours per year on projects. Although they're paid for 2,080 hours of work, your employees are truly only able to contribute 1,780 hours of productive work after considering vacations, personal or sick time, holidays, and training hours. We use this number of 1,780 net productive hours when calculating the true cost of personnel, which we consider the productive hourly cost.

TABLE 2. BENEFITS

BENEFITS		
Description	**% of Yearly Cost**	**Cost Added Per Productive Hour**
FICA	6.2%	$2.79
Medicare	1.45%	$0.65
State unemployment	$500	$0.28
Federal unemployment	$300	$0.17
Healthcare	$9,000	$5.06
Dental	$1,800	$1.01
Vision	$250	$0.14
LTD	$600	$0.34
STD	$800	$0.45
Life Insurance	$100	$0.06
Benefits hourly cost		**$10.94**

Then, combining the salary productive hourly cost from Table 1 with the total benefits hourly cost from Table 2, we reach a new productive hourly cost of $55.88.

Many firms stop here when calculating personnel costs and develop a simple planning number for the cost of all new employees as ranging between 1.25 and 1.5 times the employee's salary:

Multiplication factor for personnel =
productive hourly cost/base salary per hour
$55.88/$38.46 =
1.45

This simple multiplication factor of 1.45 times the employee's salary is typically used by companies to calculate the cost of that employee. However, numerous other cost allocations will surprise you when considering every expense to describe the true cost of personnel, leading to a much larger multiplication factor.

MORE INTRICATE COSTS OF PERSONNEL

Like our car operating cost example, many other factors must be considered with the cost of personnel.

Combining the costs from Tables 1 and 2 with Tables 3 and 4 will help us determine a more accurate productive hourly cost that allows us to calculate the true cost of personnel.

Still using our example of a mid-level mechanical engineer (ME) or electrical engineer (EE) who earns $80,000 per year or $44.94 per productive hour, we next look at overhead and management costs in a company with 250 employees.

TABLE 3. OVERHEAD AND MANAGEMENT

OVERHEAD AND MANAGEMENT		
Description	**Annual cost**	**Cost added per productive hour**
Facilities		
Desk, chair, phone equipment ($4k spread over 5 years)	$800	$0.45
Office space (avg. $22/sq. ft./year, 250 sq. ft./employee)—includes common areas and bathrooms	$5,500	$3.09
Building maintenance, utilities, security, equipment taxes (avg. $5/sq. ft./year)	$1,250	$0.70
IT		
Computer ($4k cost to replace every 3 years, CAD system)	$1,333	$0.75
CAD/analysis software ($4k per year with maintenance)	$4,000	$2.25
IT staff (40:1 ratio, @75k salary and 25% benefits cost)	$93,750	$1.32
HR/Payroll		
HR staff (50:1 ratio, @$65k salary and 30% benefits cost)	$84,500	$0.95
Payroll staff (50:1 ratio, @$50k salary and 30% benefits cost)	$65,00	$0.73
Sales & Marketing		
CMO (250:1 ratio, @$200k salary, 25% benefits, and 30% bonus)	$325,000	$0.73
Director of Sales (250:1 ratio, @$200k salary, 25% benefits, and 30% bonus)	$325,000	$0.73
Sales staff (30:1 ratio x @$150k salary, 25% benefits, and 30% bonus)	$243,750	$4.56
Marketing budget	$1,000,000	$2.25
Sales related costs (e.g., travel, entertainment, meals)	$400,000	$0.90
Quality		
QMS system manager (250:1 ratio, @$150k salary, 25% benefits, and 20% bonus)	$225,000	$0.51
CORPORATE OVERHEAD		
BOD stipends, benefits, travel, etc. (5 members @$50k each per year, over 250 employees)	$250,000	$0.56
Senior management time (50:1 ratio, @200k salary, 25% benefits, and 30% bonus)	$325,000	$3.65
Project management (8:1 ratio, @$125k salary, 25% benefits, and 20% bonus)	$187,500	$13.17
Admin staff (50:1 ratio, @$50k salary and 30% benefits)	$65,000	$$0.73
CEO (250:1 ratio, @$300k salary, 20% benefits, and 30% bonus)	$468,000	$1.05
CFO (250:1 ratio, @$200k salary, 25% benefits, and 30% bonus)	$325,000	$0.73
Corporate office overhead (avg. $25/sq. ft./year, 20,000 sq. ft.)—houses 40	$500,000	$1.12
Corporate office building maintenance, utilities, etc. ($6/sq. ft./year, 20,000 sq. ft.)—houses 40	$120,000	$0.27
Overhead and management hourly cost		**$41.20**

Additional indirect labor costs also add to the productive hourly cost, including waiting time between projects, meetings, brainstorming, recruiting costs, and company training.

TABLE 4. INDIRECT LABOR COSTS

INDIRECT LABOR COSTS		
Description	**Estimated Percentage**	**Cost Added Per Productive Hour**
Downtime spent waiting between projects (5–15% of yearly available time) (or work on low value added tasks)	Use 10% of base salary	$4.49
Unproductive meetings (range 5–15%)	Use 10% of base salary	$4.49
Working outside skill set/ training (5–15% less efficient than correctly skilled talent)	Use 10% of base salary	$4.49
Re-creating the wheel (1-10% less efficient)	Use 10% of base salary	$2.25
Designing down wrong path, rework (1–10%)	Use 10% of base salary	$2.25
Indirect labor hourly cost		**$17.98**

TRUE COST OF PERSONNEL—PRODUCTIVE HOURLY COST AND MULTIPLICATION FACTOR

Many firms stop at salary and benefits when considering the cost of their personnel, leading them to a multiplier factor of 1.45 times the employee's base salary for calculating the cost of that employee. As Tables 3 and 4 highlight, when accounting for more intricate costs such as management and indirect labor costs, a single employee's productive hourly cost jumps significantly.

By appropriately considering all costs associated with personnel, the productive hourly cost in this example increases from $55.88 (as noted on page three) to $115.06.

TABLE 5. TRUE PRODUCTIVE HOURLY COST

TRUE PRODUCTIVE HOURLY COST	
Description	**Amount**
Salary hourly cost (Table 1)	$44.94
Benefits hourly cost (Table 2)	$10.94
Overhead and management hourly costs (Table 3)	$41.40
Indirect labor hourly cost (Table 4)	$17.98
Productive hourly costs	**$115.06**

The new, combined, and accurate cost and multiplier factor of an employee is shown below.

TABLE 6. TRUE MULTIPLIER FACTOR

Description	Amount
Productive hourly cost	$115.06
Total annual cost (productive hours of 1,780 x productive hourly cost of $115.06)	$204,801.58
Overall multiplier (total annual cost of $204,801.58 / annual salary of $80,000)	2.6

As you can see, our final multiplier is 2.6, not the 1.45 many organizations use. Also, the list of common overhead, management, and indirect labor costs is not exhaustive. Dozens more items can affect the true cost of adding an employee, including the hidden costs of retaining employees by providing them with adequate resources to stay abreast of new technologies, updating manufacturing processes, and dealing with the hidden costs of employee turnover. These factors are often overlooked when calculating your PD-ROA.

Some of the expenses can be excluded from this calculation if your company assumes these costs would be incurred whether you add additional employees or not, such as CEO salary, marketing, and the cost of furniture.

This question generally comes up when trying to decide whether to hire or outsource for the additional resources your company requires. The driving point here is not to overlook even the little details. **Effective product development companies consider all of these seemingly small elements when calculating their ROA.**

We take things a step further when considering the multiplication factor. If you look at Appendix A, you will see the multiplication factor applied to three typical engineering positions—designer/junior engineer, mid-level ME/EE, and senior ME/EE. Based on the average overhead burdens, the true annual cost based on their base salary works out to the following:

	Base Salary	Burdened Cost	Multiplier
Designer/ junior engineer	$65,000	$182,654.08	2.8
Mid-level ME/EE	$80,000	$204,801.58	2.6
Senior ME/EE	$125,000	$271,244.08	2.2

The multiplier drops as the base salary increases. This change is made because the majority of the personnel costs are relatively the same for all employees (they require the same space, computers, benefits, etc.). Once you get to the senior ME/EE level and above, however, many companies will also have additional employee benefits that are not included in this paper, such as retirement plans or bonuses, which will increase the multiplier beyond these calculations.

ACTION STEP

Take a moment to determine your true cost of personnel and its effects on your product development-return on assets (PD-ROA). Using the equation provided on the following page, calculate your own engineering costs to gain better insight so you can maximize your PD-ROA.

CONCLUSION

The cost of personnel can be calculated in many ways. This paper is meant to show you what it costs to get 1,780 productive hours of work per year, per full-time employee. Incorporate the equation below into your engineering cost calculations, and you'll better understand the true cost of your personnel.

Productive hourly cost (PHC) =
(hourly base salary + hourly benefits + hourly overhead + hourly indirect labor)

Multiplication factor for personnel =
PHC/(base annual salary/productive hours available yearly)

Successful product development requires planning and considering all costs, including your personnel. In doing so, you will have a better understanding of your product development-return on assets (PD-ROA). Once you hire a full-time employee, you also have the employee's cost, supervision, and HR to manage year-round.

When considering all factors associated with personnel and your product development efforts, you have to ask yourself whether your product development efforts are truly yielding the ROA that will drive profits. If the answer is no or you are unsure, it's time to consider the following:

a) Examine your products to determine your revenue and market share more accurately, or
b) Outsource to a product development firm.

We will cover those considerations in the second paper in this series from ALTEN Technology: "Costs and Profit Impact of Product Development: Product Revenue."