

Part Five

Measurements for Management

Responsibility Centers and Performance Measurement

Peoria Engine Plant (A)

Scocill Inc: Nutone Housing Group

Polysar Limited

The Balanced Scorecard—Measures That Drive Performance (HBR)

Alliant Health System: A Vision of Total Quality

Analog Devices: The Half-Life System

Texas Eastman Company

Responsibility Centers and Performance Measurement

Management control depends on measurement. Effective measurement of operations and performance requires assignment and acceptance of responsibility for performance. Performance measurements should meet three criteria: they should be timely, informing when action can be taken; they should be seen as fair; and they should be congruent with the goals of the organization. Goal congruence assures that an improved measure of performance means that the organization is nearer to achieving one or more of its objectives.

Measurements are used by managers for two reasons. First, measurements inform management about performance in the past, and they help managers answer questions about how they and the organization is performing. Second, they affect future behaviors by informing and motivating managers in the present and future.

Financial control of responsibility centers is achieved by measuring the dimensions of financial performance that managers can affect or control. Most responsibility centers can be classified by their focus on costs or expenses, margin or profit, or return on investment. Ideally, the financial measure should include any revenue or cost that managers can affect, even though they may not have complete control over revenues, expenses, or investments.

Cost Centers and Expense Centers

When only the resources consumed in a responsibility center can be measured, it can be classified as a **cost center** or an **expense center**. Performance is measured by a financial measure of the resources used. Control is achieved by com-

paring performance to a reference point, which may be a standard, budget, or prior period expenditure. Service centers, such as an accounting department, are often managed as expense centers because it is easy to measure the cost of providing the service but hard to measure the benefit or value of the output of the center.

A report for an expense center is shown in Exhibit 1. Actual expenses are compared to a budgeted amount. Control depends on the effective establishment of a reference point to which the actual expenses can be compared. Even then, however, no measure of the effectiveness or efficiency of the expense center can be made, because the report does not show how well the accounting department performed, how good its services were, or how much more efficiently the department could have performed the service it provided.

FINANCIAL PERFORMANCE CENTERS

When both the inputs and the outputs of a responsibility center can be measured, a **financial performance center** or **profit center** can be created. As with cost centers, control is achieved by comparing actual margin or profit to an expected or budgeted margin or profit. Detail in the financial measurements provides information on problems and need for management attention and action.

Several possible performance reports for a financial performance center are shown in Exhibit 2. The appropriate bottom line measure depends on the extent to which costs or expenses are controllable or can be influenced by a manager. The broader a manager's responsibility, the more costs and expense are likely to be relevant. If a financial performance center supplies or is supplied by another in the same organization, a mechanism for determining **transfer prices** must be established as well. Some organizations go beyond income or profit as it is usually measured in accounting for financial performance centers by adding a charge to the conventional expenses for the assets or resources that managers use to generate revenue and income. This **residual income** approach is thought to avoid some problems which can be encountered when an investment center is measured by return on investment.

Investment Centers

A manager of an **investment center** is held responsible for not only the inputs and outputs of that center, but also for the amount of investment used to produce the outputs. A proper measure of margin or profit needs to be selected, and the investment supporting the center needs to be measured. Investments can be measured by using their original cost, book value, current value, or replacement value. Control is best achieved by comparing expected return on investment to that achieved.

Two problems sometimes arise when investment centers are created. First, managers may be motivated to sell or dispose of assets that would have future utility to the organization, if doing so would give the appearance of improved financial performance. Second, managers may be reluctant to make new investments that would provide a return above the organization's cost of capital but below the current rate of return. Each of these two potential problems is illustrated in **Exhibit 3**.

Matching Performance Measures with Strategy

Because measurements motivate and affect behavior of managers, care must be taken to be sure that the performance measures support the organization's strategy. An organization committed to superior service may find treating responsibility centers that interface with clients or customers as expense centers undermines their strategy. Or an organization committed to being technological leaders may find that changing a profit center manager for research and development cost leads to less effective research and development. The most effective organizations use a carefully selected mix of financial performance measures and continually evaluate their effectiveness.

EXHIBIT 1

Example of a Performance Measurement Report for an Expense Center

	Budget	Actual	Variance
Salaries	\$3,070	\$3,070	\$ 0
Overtime	<u>0</u>	<u>206</u>	<u>(206)</u>
Total	\$3,070	\$3,276	(\$206)

EXHIBIT 2

Profit Concepts for Financial Performance Centers

Summary of Activities in the Retail division, July (thousands of dollars)

Revenue	\$1,000
Direct division expenses	
Variable	700
Nonvariable controllable	100
Nonvariable noncontrollable	50
Indirect division expenses:	
Allocated corporate overhead	60
Required earnings rate	10%

Income Statements

Retail division, July (thousands of dollars)	Division Contribution Margin	Division Controllable Income	Division Direct Income	Division Net Income	Division Residual Income
Revenue	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Less: Direct division variable expenses	<u>700</u>	700	700	700	700
Division contribution margin	\$ 300				
Nonvariable controllable expense		<u>100</u>	100	100	100
Division controllable income		\$ 200			
Nonvariable noncontrollable expenses			<u>50</u>	50	50
Division direct income			\$ 150		
Indirect division expenses				<u>60</u>	60
Division net income				<u>\$ 90</u>	
Capital charge (10%) on investment of \$1,100	<u>110</u>	<u>110</u>	<u>110</u>		<u>110</u>
Residual income	<u>\$ 190</u>	<u>\$ 90</u>	<u>\$ 40</u>		<u>(\$ 20)</u>

EXHIBIT 3

Examples of Performance Measures for Investment Centers

Measuring Investment for the Retail Division (thousands of dollars)

	Cost	Accumulated Depreciation	Replacement Value
Fixed assets:			
Land and buildings	\$ 500	\$ 200	\$ 900
Store fixtures	100	25	150
Total	\$ 600	\$ 225	\$1,050
Current assets:			
Cash	\$ 50		\$ 50
Receivables (net)	200		200
Inventories	250		275
	<u>\$1,100</u>		<u>\$1,575</u>
Investments:			
Gross historical		\$1,100	
Historical cost net of accumulated depreciation		875	
Replacement value		1,575	

Return on investment:

$$\frac{\text{Income}}{\text{Investment}} = \text{Return on investment}$$

$$\frac{\text{Division net income}}{\text{Gross historical cost}} = \frac{\$90}{\$1,100} = 8.2\%$$

Residual income reports income as absolute dollar amount after a capital charge, or return, expected of all divisions. (See example in Part II.) In most cases it encourages investments which are profitable (return more than capital charge rate) but below current rate of return.

Example:

Wholesale division current earns \$300,000 on investment of \$1,500,000 and has a rate of return of 20%. An investment of \$500,000 can be made which will raise income \$75,000.

	Return on investment	Residual income (capital charge = 10%)
Without investment	20%	\$150
After new investment	18.75%	\$175

Peoria Engine Plant (A)

Labor and Overhead represent 20% of our costs but we spend 90% of our perspiration monitoring and attempting to control them. Perhaps we have too much emphasis on what we traditionally have believed are our most controllable costs.

Lee Thomas, Supervisor of Operations Analysis
Peoria Engine Plant, Worldwide Motors

THE PEORIA ENGINE PLANT

The Peoria Engine Plant (PEP) was one of six engine suppliers in the North American division of Worldwide Motors. PEP was an old plant on a three-square-mile area of land shared with several other Worldwide Motors plants. The main production facility of PEP was in a building more than one mile long and one-half mile wide.

The inside of PEP appeared to a first-time visitor like a lively amusement park. Newly cast engines, produced in a nearby facility, moved on a complicated conveyor system. The conveyor moved the engines like a giant roller-coaster, to various production processes on the plant floor and vertically between the plant floor and the in-process storage area on the upper floor. The automated and semiautomated machinery working on the engines at each production process resembled rows of carnival games. At the final stage,

Professors Robert S. Kaplan and Amy Patricia Sweeney prepared this case. The case is an updated version of Worldwide Motor Company (190-069), written by Professor John Dearden.

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newly completed engines were started, hot-tested, and run in a continuously circling carousel for several minutes before being shipped to Worldwide Motors assembly plants throughout the United States.

During the first half of 1992, PEP produced about 2,500 engines per day, an annual rate in excess of 600,000 engines (423 engines per hourly employee per year). Annual sales were approximately \$1.33 billion per year. Cost of goods sold were about \$1.2 billion per year, of which about \$960 million was direct material, \$60 million direct labor, and \$180 million manufacturing overhead. Most materials were purchased from other divisions of Worldwide Motors, and virtually all sales were made to Worldwide assembly divisions.

PEP produced two basic engines:

- (1) a 5.9 liter engine used in trucks, and
- (2) a 3.6 liter model used in a popular car model.

Sales for the car and truck models using the PEP engines were currently strong, and the plant was working overtime to keep up with demand. Under terms of the union agreement, hourly employees were guaranteed pay for 80% of a 40-hour work week. Supervisors could send workers home if they were not needed during the shift and could call in workers early, or have them work later, if they were needed to meet extra production demands. Bob Jones, PEP controller, remarked:

Direct labor is treated as 100% variable by our system, but this is probably not completely accurate. You can't get below one person to monitor machines. Direct labor is really a step function since volume may have to drop by 20% before we can start to see some real labor savings.

PLANT ORGANIZATION

The line organization of Peoria Engine Plant consisted of a plant manager, an assistant plant manager, superintendents for each of the three production areas, and managers of five staff departments. (See **Exhibit 1** for an organization chart.) Nine production departments were defined within the three production areas. Department superintendents were responsible for the direct and indirect labor, direct materials, tools and supplies, and maintenance materials used within their departments. Departments were further subdivided into manufacturing sectors. (See **Exhibit 2** for a listing of the manufacturing departments within each area.)

INFORMATION AND COST SYSTEMS

The Peoria Engine Plant had recently completed installation of a new Materials Management System (MMS). MMS replaced numerous stand-alone and

antiquated local materials management systems, and provided a common integrated system that could be used in all of Worldwide's North American plants. The major functions of MMS are displayed in **Appendix 1**.

PEP's finance group maintained a plant ledger containing a company-wide chart of accounts. (See **Exhibit 3** for a description of the plant ledger.) Actual direct labor and indirect labor hours were recorded each day for payroll purposes. These were multiplied by actual wage rates and debited to departmental labor cost accounts. Supplies, tools, and maintenance materials were charged to the requesting department as they were withdrawn from the appropriate inventories. Scrap was recorded on the basis of "scrap tickets" that were prepared each time a part was scrapped.

During the second half of each year, PEP's finance group developed an expense budget for the following year for every account in the plant ledger. The budget base for individual accounts was the prior year's budget. This budget base was adjusted for expected changes in volume, mix, and product design for the upcoming year. The adjusted expense budget for each account was then decreased to reflect a targeted annual improvement factor. The annual improvement factor represented the implementation of one of Worldwide Motor's basic strategies: to maintain a competitive cost advantage.¹

DAILY REPORTING

Shop floor supervisors, at the end of each shift, entered the quantity of every part produced. The supervisors grumbled about the extra work required for data entry into MMS, feeling that data recording should be done by accounting people, not production supervisors. The manufacturing people also did not trust the new computerized system for reporting on operations. They felt that computers were vulnerable to shutdowns due to power interruptions and failures.

The finance staff used MMS to prepare a daily performance report on direct labor usage. (See **Exhibit 4**.) In this report, Actual Hours represented the direct labor hours worked and recorded the previous day (this quantity was also sent to the payroll system). The Budgeted Work Standard (BWS) labor hours was the quantity of direct labor hours authorized for the actual parts produced that day. The system calculated the daily BWS labor hours for an area by:

- (1) multiplying the quantity produced of each part by the part's standard direct labor hours; and

¹ **Appendix 2** provides a complete description of Worldwide Motor's budgeting process including the derivation and application of the annual improvement factor.

- (2) summing the quantity calculated in Step (1) across all the parts produced in the area that day.

The variances (total and percentage) between actual and BWS hours were calculated and reported in the daily performance report (Exhibit 4). The last column in the report displayed the week-to-date (W-T-D) percentage labor usage variance (the sum of the daily variances).

A similar report (see Exhibit 5) was prepared daily for the indirect labor worked at the plant. Indirect labor included people who performed maintenance, cleaning, materials handling, and inspection. The report showed the actual hours worked by indirect labor in each department and compared this quantity to the daily authorized indirect labor hours (labeled as BWS Hours in Exhibit 5). The authorized indirect labor hours were calculated as a percentage of the department's Budgeted Work Standard Direct Labor Hours. The authorized indirect labor hours percentage differed for each department.

The daily direct and indirect labor reports were available on the computer at the beginning of each day, with hard copies also printed daily. Supervisors, department superintendents, and managers could access their performance reports for the previous day from terminals on the plant floor.

Hal Green, superintendent for the largest production department at PEP, described the various factors that influenced daily labor variances:

Sometimes, we have shortages of parts to work on because previous departments have produced less than scheduled. If I learn of these shortages early enough, I can send people home midway through a shift, but then I have to bring the next day's shift in early to make up for the shortfall from the previous day.

Some days, we lose time because of machine breakdowns and repairs, or because not all the output we produced met quality standards. Other days, more people show up to work than expected. I can loan some people to other departments, but occasionally I send excess people home. Days when fewer people show up than I need to run the machines, I have to take salaried people and put them on the line.

Green did not feel that the daily direct labor performance report gave him much useful information:

I can't wait until the next day to find out what my supervisors are doing with their labor force. I get a report hourly on the production output and labor hours worked from each section in my area. [Exhibits 6 and 7 are copies of Green's hand-written reports on hourly production and labor hours worked.] I hold my general supervisors responsible for the actual and overtime hours worked in their departments, as shown in the Daily Report on Time [Exhibit 7].

Green expressed similar doubts about the daily indirect labor report:

I probably "manage" the report more than I manage by the report. I generally maintain indirect labor below authorized levels by not replacing people who

are on vacation or absent. I try to downsize the indirect labor force gradually, perhaps 1% every few weeks. My maintenance foreman, however, does watch the daily report closely to make sure that we are only charged for what we actually used.

Bill Walker, an area superintendent in the same production zone as Green, commented on his explanations of variances in the daily labor performance reports.:

There are lots of reasons why direct labor could be overspent. With just-in-time production, we're now more vulnerable to parts shortages. Other times, machines become idled because the powerplant shut down so that a new production line could be installed. But, problems are not always due to external events. Machines break down because of mistakes in loading materials. We can also produce more scrap than expected so that we have to work extra hours to reach our production targets.

Even in the best of circumstances, however, some of the labor standards have become difficult to meet because of all the performance tasks that have been rolled in. We'll only be making the engines we're currently producing for a few more years so management is reluctant to make significant capital investments for this line. Without new capital, additional productivity improvements may not be possible.

Walker reflected on the information he would like to have to manage his department:

The information I would look at daily are the number of pieces produced, machine up-time, quality and a comparison of the actual direct labor hours with the Budgeted Work Standard hours authorized.

Bob Jones, PEP controller, questioned the value of the short-term reports:

If managers respond too closely to hourly or daily fluctuations, they may introduce more variation into the process and increase variances further. Also, the daily variance reports generate lots of excuses about the lack of funds for improvement programs. It may not be that useful to show costs to shop-floor people. I agree with Bill that the key drivers of plant performance are quality and machine up-time.

WEEKLY REPORTING

Each Friday, senior plant management met with the superintendents to review the cost performance of the past week. Bob Jones explained that the agenda for the 90 minute meeting was set by the finance staff. Key issues were identified, and responsibility for each issue was assigned to individuals.

Lee Thomas and his Operations Analysis staff prepared and distributed weekly cost performance reports in advance of the meetings. **Exhibit 8** shows

a weekly performance report for the entire plant. Comparable reports were prepared for each production department. Graphs were included to highlight trends in Total Manufacturing Expense.² The variances in the weekly reports represented the difference between actual and authorized dollars for each account. Authorized direct labor dollars were calculated by multiplying the weekly BWS labor hours by a moving average wage rate.³ The authorized dollars for each variable overhead account were calculated by multiplying the BWS labor hours by an authorization rate for that account.⁴

Lee Thomas described how he used the reports at the weekly meetings:

Susan Johnson [Plant Manager] wants people talking about future plans for problem solving, not explaining their past performance. So, at the weekly meeting, I might point to the negative 485 variance for indirect labor [see MTD column in Exhibit 8] and ask the superintendents how are we going to get under budget for the rest of June, July, and August? Do we need to review authorized levels of indirect people? Should we attempt to reduce weekend overtime or cut back on overtime during the week.

Bill Walker, Department 4's superintendent, cited several examples of explainable variances that might show up on his department's cost performance report:

Sometimes I get hit with things beyond my control, like the time a truck driver fell asleep at a truck stop with a load of parts. Another time a husband and wife driving team had an argument and abandoned a truck full of parts. Both times, with no parts to work on, I had to send the assembly line home.

Walker admitted that the weekly cost reports did direct his attention to potential problems but added that they also caused him to juggle resources. He explained that if a machine needed to be refurbished, he would buy parts over four weeks to smooth the purchases so he would not be in the red in any given week. Walker felt that some superintendents might allow their machines to run at less than 'high performance' rather than purchase all the needed parts at once and have a cost overrun in their weekly performance report.

Hal Green, Department 7's superintendent, commented on his use of the weekly cost reports:

² Total Manufacturing Expense is reported in the last row of the first panel of numbers in Exhibit 8, labeled TOT MFG EXP.

³ The moving average wage rate was calculated by dividing the sum of the three prior weeks' actual direct labor dollars by actual direct labor hours.

⁴ The authorization rates for individual overhead accounts were developed in the annual budgeting process. (See Appendix 2.)

I don't use the weekly cost charts. I look at them to become familiar with them and to think about how I can explain them to upper management. Basically these reports are for upper management not for me.

Susan Johnson expressed her preference for weekly reports over daily reports:

I don't think it's useful for me to react to short-term blips. But, if the blips form a trend, I notice. With trends I can identify a big improvement or shortfall and ask questions about why it happened. Not all the inquiries are negative. If I see an improving trend, I want to know what the superintendent is doing and whether we can try his approach elsewhere.

Weekly direct labor usage graphs. (See **Exhibit 9**.) for each area were also displayed and discussed. Actual and BWS hours were graphed along with the planned hours. Planned hours were based on forecasted volume projections made during the budget process. Management recognized that the direct labor usage plots could look very different depending on whether the plant was operating with excess capacity or using overtime.

The weekly meeting also reviewed weekly scrap reports for each area. (See **Exhibit 10**.) The scrap rate was calculated as the dollars of scrap per engine produced. Green commented that he wanted his departmental supervisors to pay attention to the weekly fluctuations in scrap:

I send information on scrap down to each supervisor. Formerly, I had only a single individual acting as the champion of scrap. This person focused on the top five scrap issues. Now, all nine supervisors in my department must work on the top three scrap items in their respective departments. We have reduced scrap by 10% to 20% a year for the last four years.

Today, our main source of scrap is caused by outside suppliers. I want supervisors to identify which particular suppliers are causing problems and I want supervisors to talk directly to them. Problems with internal suppliers I try to handle privately. I am willing to take a beating in one weekly meeting from an internal supply problem, but then the supplier had better clean up his act.

To realize the 7% improvement target over last year's budget, each department superintendent developed Cost-Reduction Plans (CRP's). The CRP's identified specific plans of action to achieve cost savings. Weekly reports tracked the progress of these plans. (See **Exhibit 11**.) The reports displayed: the approved plan of action, the planned date of implementation, the actual date of implementation, the Facilities and Tooling (F&T) expenditure necessary to implement the plan of action, and the savings expected in each major cost category as a result of the plan. When superintendents failed to meet the planned date of implementation, the weekly meeting discussed the reasons for the delay.

MONTHLY REPORTING

Each month, all North American plants of Worldwide Motors prepared a summary report Direct Labor and Manufacturing Overhead Budget Performance Report. (See **Exhibit 12.**) The report was reviewed by central finance staff at corporate headquarters. The report had extensive variance analysis to compare actual costs in 26 labor and overhead categories to both the calendarized budget (the annual budget, divided into 12 monthly components) and the authorized budget (the costs authorized based on actual volume and mix of production). The report also summarized information on actual production and project spending. Everyone at the plant believed that this report was mainly for corporate's benefit. Senior plant management received a weekly version and hence already knew about the information that would appear in the monthly labor and overhead report.

The finance staff produced several other monthly reports:

- (1) A monthly productivity report (see **Exhibit 13**) showed the number of engines produced per person.⁵ PEP had productivity objectives for its two engines:

Engine Type	Engines per Person
3.6 liter	2.50
5.9 liter	1.95

Recent productivity was slightly below these targets. PEP managers knew that comparable Japanese plants were producing about 3.0 engines per person but believed that PEP was still cost competitive with the Japanese plants because its facility was mostly depreciated. In addition to the report on engine productivity, separate productivity measurements were made monthly for each major engine component. The efficiency (% actual to capacity) of the three largest bottleneck operations was also tracked monthly to highlight opportunities for capital spending or operating improvements to increase plant throughput.

- (2) A Salary Manpower Budget Performance summary (see **Exhibit 14**) identified the number of salaried people in each function, the budgeted number, and the objective for the end of the calendar year. Bob Jones watched closely whether the current actual number of salaried people was converging to the December 31 objective.

⁵ This number was obtained by dividing the number of completed engines of each type by the number of fulltime-equivalent direct and indirect labor workers (overtime hours were converted into the equivalent additional workers). Workers in the Powerhouse, Training, and Project Launch were excluded from the calculation.

- (3) A Monthly and Year-to-Date Scrap Report summarized the weekly information already seen by the management team and supervisors.

The plant also received a report from corporate that showed the cost per engine set produced in each of Worldwide's ten North American engine plants. This report was used internally to compare PEP's performance with the production of similar engines in other facilities. No data were provided to benchmark comparable costs for domestic and international competitors.

Bill Walker commented that the monthly summaries gave him a better perspective on his cost and productivity performance than the weekly or daily reports:

I look at costs first; budgets are secondary and sometimes arbitrary, deriving from conditions that occurred more than two years ago or from arbitrary assignment of performance tasks. Over the long run, I can make substitutions that increase costs in one category, leading to reported variances, but that lower overall costs. For example, I shifted to a coolant that was 3 times more expensive than what we had been using, but the new coolant lasted about 10 times as long. The labor savings from less frequent changes amounted to \$36,000 over two years. So, I personally set priorities on reducing costs rather than meeting budgets. If I am effective in lowering costs, the actuals will eventually fall within the budget.

Don Banas, supervisor of accounting, concurred that the emphasis at PEP was changing:

Business meetings used to focus exclusively on short-term variations. Recently, however, the participants have been looking at the longer-term trends.

Hal Green also preferred the longer-term perspective:

The information that's most useful to me is the historical trends of actuals versus actuals. I watch the monthly reports for the trends on engines per person, actual hours worked, and the productivity/efficiency numbers. The outcomes from my work as a superintendent can take one to two years to realize. I have to maneuver within the system to get people the equipment they need. I try to get one year ahead of the improvement targets, but I'm beginning to fall behind now because money for capital improvements is scarce with the line phasing out.

Susan Johnson, plant manager, watched the report that compared PEP's engine costs with those of the other Worldwide Motors plants:

I compare the components in the cost-per-engine set report. I look at supplies, tools, maintenance materials, and scrap. The departmental superintendents look at these as well and call their colleagues at other plants if they see large discrepancies.

Lee Thomas was sympathetic to the concerns voiced by the operating people but defended the budgeting system:

We may spend too much time classifying costs and not enough on reducing them. We could put more emphasis on actual costs, especially by improving our presentations on cost trends. But I still believe that budgets and reporting on budgets is necessary. The cost classifications give us insights about the underlying cost elements, where problems are, and where priorities for cost improvement should be placed.

Susan Johnson believed that senior managers of Worldwide Motors emphasized the Labor and Overhead budget mainly because they believed that these cost components were the most controllable:

Materials are very critical in overall costs. But plant people find it tough to control these costs since purchasing people have almost complete responsibility for materials acquisition.

Achieving 7% controllable cost improvements in a mature product line is not easy. The emphasis on labor and overhead efficiencies may be causing us to over-spend on capital. For example, we're installing automatic loaders in some departments to replace labor and overhead support. The superintendents pushed hard for the investment so that they could reach their labor and overhead targets. But the promised benefits will only be realized for the few years remaining in the engine line's life. Also, as new lines are installed, the managers are reluctant to sign-up for "stretch" efficiency objectives since they know that whatever objective they agree to will be tightened even further in future years. By underestimating achievable operating rates, we may be investing in greater capacity than is actually needed.

EXHIBIT 1
Peoria Engine Plant
Organizational Chart

