

**CONSTRUCTION PROJECT MANAGEMENT
WITH AN EMPHASIS ON PROJECT CONTROL :
A CASE STUDY**

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PREFACE

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LIST OF ABBREVIATIONS

WBS	: Work Breakdown Structure
CPM	: Critical Path Method
TQM	: Total Quality Management
PPC	: Percent Plan Complete
R&D	: Research and development
HR	: Human Resources
IPS	: Integrated Production Scheduler
JIT	: Just in Time
WP	: Work Package
CIO	: Chief Information Officer
PM	: Project Manager
US GAAP	: United States Generally Accepted Accounting Principles
I	: Impact
P	: Probability
Pot	: Potential
C	: Costs
POC	: Percentage of Completion
ETC	: Estimate to Complete
EVA	: Economic Value Added
ACWP	: Actual Cost of Work Performed
KPI	: Key Performance Indicator
BCWS	: Budgeted Cost of Work Scheduled
BCWP	: Budgeted Cost of Work Performed
CV	: Cost Variance
SV	: Schedule Variance
CPI	: Cost Performance Index
BAC	: Budgeted Cost of Completion
SPI	: Schedule Performance Index
CPM	: Time Expected
EOT	: Earliest Occurance Time
QM	: Quality Management
PQM	: Project Quality Manager

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CONSTRUCTION PROJECT MANAGEMENT WITH AN EMPHASIS ON PROJECT CONTROL : A CASE STUDY

SUMMARY

In this study construction project management approach of a German company with emphasis on project controlling is analysed since project control is the pivotal activity that ties all project management techniques together and is exercised in this company by showing great emphasis especially on risk management, cost controlling, resource controlling, schedule controlling, and quality controlling. Project controlling is seen in the company as a significant tool for handling projects successfully where the success of the project is measured in terms of profits and customer satisfaction. Despite the fact that the selected company has a well established project controlling system some problems occur like overestimating the construction costs, running behind schedule, failing in maintaining good project and client / contractor relations, in documenting meetings properly, failing in controlling meetings and using overtime. As a company using generally a traditional project management approach it can overcome these problems by integrating contemporary approaches.

PROJE KONTROLÜ AĞIRLIKLİ İNŞAAT PROJE YÖNETİMİ: BİR VAKA ANALİZİ

ÖZET

Proje kontrolünün tüm proje yönetimi tekniklerini birleştiren en önemli aktivite olmasından ve özellikle risk yönetimi, maliyet, kaynak, termin ve kalite kontrolü konularına çok önem verilmesinden ötürü bu tezde proje kontrolü ağırlıklı bir Alman firmasının inşaat proje yönetimi yaklaşımı incelenmiştir. Söz konusu firma içerisinde proje kontrolü, projenin karlılık ve müşteri memnuniyeti açısından başarısının belirlenerek projelerin idare edildiği önemli bir araç olarak ele alınmaktadır. İncelenen şirketin oldukça iyi kurulmuş bir proje kontrolü sistemi olmasına rağmen inşaat maliyetlerindeki abartılı öngörüler, terminlerde gecikmeler, proje/ müşteri/ yüklenici ilişkilerini iyi seviyede muhafaza etmede sorunlar, toplantı yönetimi ve dökümantasyonu eksiklikleri ve mesai yönetiminde bazı sorunların yaşandığı ortaya çıkmıştır. Ağırlıklı olarak geleneksel bir proje yönetimi yaklaşımı izleyen firma çağdaş yaklaşımları uygulamaya başlayarak bu sorunları aşabilecektir.

1 Introduction

1.1 Objectives of the Study

Project control is the an activity of crucial importance that joins all Project management techniques. Planning and organizing are certainly important in leading us toward meeting our Project goals, but effective Project control is definitely necessary. We might be a little bit off- target on planning and organizing and escape the unpleasant consequences, but we can't be successful even a little bit in control.

The project management system of the German company shows great emphasis on project controlling. As a 100% German company it holds project controlling as a significant tool for handling projects successfully. The success of a project is measured in terms of profits and customer satisfaction.

This is why I chose a German company to analyse.

2 Literature review

There are several approaches that can be taken to managing construction project activities.

Regardless of the approach used, careful consideration needs to be given to clarify project objectives, goals, and importantly, the roles and responsibilities of all participants and stakeholders.

2.1 Evaluative construction project control approaches

2.1.1 Cost Control

During the execution of a project, procedures for project control and record keeping become essential tools to managers and other participants in the construction process. These tools serve the dual purpose of recording the financial transactions that occur as well as giving managers an indication of the progress and problems associated with a project. The problems of project control are summed up in an old definition of a project as "any collection of vaguely related activities that are ninety percent complete, over budget and late." (Zoll, 1979) The task of project control systems is to give a fair indication of the existence and the extent of such problems.

Interpretation of project accounts is generally not straightforward until a project is completed, and then it is too late to influence project management. Even after completion of a project, the accounting results may be confusing. Hence, managers need to know how to interpret accounting information for the purpose of project management.

The limited objective of project control deserves emphasis. Project control procedures are primarily intended to identify deviations from the project plan rather than to suggest possible areas for cost savings. This characteristic reflects the advanced stage at which project control becomes important. The time at which

major cost savings can be achieved is during planning and design for the project. During the actual construction, changes are likely to delay the project and lead to inordinate cost increases. As a result, the focus of project control is on fulfilling the original design plans or indicating deviations from these plans, rather than on searching for significant improvements and cost savings. It is only when a rescue operation is required that major changes will normally occur in the construction plan.

Finally, the issues associated with integration of information will require some discussion. Project management activities and functional concerns are intimately linked, yet the techniques used in many instances do not facilitate comprehensive or integrated consideration of project activities. For example, schedule information and cost accounts are usually kept separately. As a result, project managers themselves must synthesize a comprehensive view from the different reports on the project plus their own field observations. In particular, managers are often forced to infer the cost impacts of schedule changes, rather than being provided with aids for this process. Communication or integration of various types of information can serve a number of useful purposes, although it does require special attention in the establishment of project control procedures.

For cost control on a project, the construction plan and the associated cash flow estimates can provide the baseline reference for subsequent project monitoring and control. For schedules, progress on individual activities and the achievement of milestone completions can be compared with the project schedule to monitor the progress of activities. Contract and job specifications provide the criteria by which to assess and assure the required quality of construction. The final or detailed cost estimate provides a baseline for the assessment of financial performance during the project. To the extent that costs are within the detailed cost estimate, then the project is thought to be under financial control. Overruns in particular cost categories signal the possibility of problems and give an indication of exactly what problems are being encountered. Expense oriented construction planning and control focuses upon the categories included in the final cost estimation. This focus is particularly relevant for projects with few activities and considerable repetition such as grading and paving roadways.

For control and monitoring purposes, the original detailed cost estimate is typically converted to a project budget, and the project budget is used subsequently as a guide for management. Specific items in the detailed cost estimate become job cost elements. Expenses incurred during the course of a project are recorded in specific

job cost accounts to be compared with the original cost estimates in each category. Thus, individual job cost accounts generally represent the basic unit for cost control. Alternatively, job cost accounts may be disaggregated or divided into work elements which are related both to particular scheduled activities and to particular cost accounts.

In addition to cost amounts, information on material quantities and labor inputs within each job account is also typically retained in the project budget. With this information, actual materials usage and labor employed can be compared to the expected requirements. As a result, cost overruns or savings on particular items can be identified as due to changes in unit prices, labor productivity or in the amount of material consumed.

The number of cost accounts associated with a particular project can vary considerably. For constructors, on the order of four hundred separate cost accounts might be used on a small project. (Halpin, 1985) These accounts record all the transactions associated with a project. Thus, separate accounts might exist for different types of materials, equipment use, payroll, project office, etc. Both physical and non-physical resources are represented, including overhead items such as computer use or interest charges. In developing or implementing a system of cost accounts, an appropriate numbering or coding system is essential to facilitate communication of information and proper aggregation of cost information. Particular cost accounts are used to indicate the expenditures associated with specific projects and to indicate the expenditures on particular items throughout an organization. These are examples of different perspectives on the same information, in which the same information may be summarized in different ways for specific purposes. Thus, more than one aggregation of the cost information and more than one application program can use a particular cost account. Separate identifiers of the type of cost account and the specific project must be provided for project cost accounts or for financial transactions. As a result, a standard set of cost codes such as the masterformat codes may be adopted to identify cost accounts along with project identifiers and extensions to indicate organization or job specific needs. Similarly the use of databases or, at a minimum, inter-communicating applications programs facilitate access to cost information. (American Society of Civil Engineers, 1985)

Converting a final cost estimate into a project budget compatible with an organization's cost accounts is not always a straightforward task. Cost estimates are generally disaggregated into appropriate functional or resource based project

categories. For example, labor and material quantities might be included for each of several physical components of a project. For cost accounting purposes, labor and material quantities are aggregated by type no matter for which physical component they are employed. For example, particular types of workers or materials might be used on numerous different physical components of a facility. Moreover, the categories of cost accounts established within an organization may bear little resemblance to the quantities included in a final cost estimate. This is particularly true when final cost estimates are prepared in accordance with an external reporting requirement rather than in view of the existing cost accounts within an organization.

One particular problem in forming a project budget in terms of cost accounts is the treatment of contingency amounts. These allowances are included in project cost estimates to accommodate unforeseen events and the resulting costs. However, in advance of project completion, the source of contingency expenses is not known. Realistically, a budget accounting item for contingency allowance should be established whenever a contingency amount was included in the final cost estimate.

A second problem in forming a project budget is the treatment of inflation. Typically, final cost estimates are formed in terms of real dollars and an item reflecting inflation costs is added on as a percentage or lump sum. This inflation allowance would then be allocated to individual cost items in relation to the actual expected inflation over the period for which costs will be incurred.

For the purpose of project management and control, it is not sufficient to consider only the past record of costs and revenues incurred in a project. Good managers should focus upon future revenues, future costs and technical problems. For this purpose, traditional financial accounting schemes are not adequate to reflect the dynamic nature of a project. Accounts typically focus on recording routine costs and past expenditures associated with activities. (Lucas and Morrison, 1981)

Generally, past expenditures represent *sunk costs* that cannot be altered in the future and may or may not be relevant in the future. For example, after the completion of some activity, it may be discovered that some quality flaw renders the work useless. Unfortunately, the resources expended on the flawed construction will generally be *sunk* and cannot be recovered for re-construction (although it may be possible to change the burden of who pays for these resources by financial withholding or charges; owners will typically attempt to have constructors or designers pay for changes due to quality flaws). Since financial accounts are

historical in nature, some means of forecasting or projecting the future course of a project is essential for management control. In this section, some methods for cost control and simple forecasts are described.

For project control, managers would focus particular attention on items indicating substantial deviation from budgeted amounts. In particular, the cost overruns in the labor and in the "other expense category would be worthy of attention by a project manager next step would be to look in greater detail at the various components of these categories. Overruns in cost might be due to lower than expected productivity, higher than expected wage rates, higher than expected material costs, or other factors. Even further, low productivity might be caused by inadequate training, lack of required resources such as equipment or tools, or inordinate amounts of re-work to correct quality problems. Review of a job status report is only the first step in project control.

Estimates are used to identify the actual progress and status of a expense category. Estimates might be made from simple linear extrapolations of the productivity or cost of the work to date on each project item. Algebraically, a linear estimation formula is generally one of two forms. Using a linear extrapolation of costs, the forecast total cost, C_f , is:

$$C_f = c_t / p_t \quad 2.1$$

where C_t is the cost incurred to time t and p_t is the proportion of the activity completed at time t .

Alternatively, the use of measured unit cost amounts can be used for forecasting total cost. The basic formula for forecasting cost from unit costs is:

$$C_f = W c_t \quad 2.2$$

where C_f is the forecast total cost, W is the total units of work, and c_t is the average cost per unit of work experienced up to time t .

More elaborate forecasting systems might recognize peculiar problems associated with work on particular items and modify these simple proportional cost estimates. For example, if productivity is improving as workers and managers become more familiar with the project activities, the estimate of total costs for an item might be revised downward. In this case, the estimating equation would become:

$$C_f = C_t + (W - W_t)c_t$$

2.3

where forecast total cost, C_f , is the sum of cost incurred to date, C_t , and the cost resulting from the remaining work $(W - W_t)$ multiplied by the expected cost per unit time period for the remainder of the activity, c_t .

In addition to changes in productivities, other components of the estimating formula can be adjusted or more detailed estimates substituted. For example, the change in unit prices due to new labor contracts or material supplier's prices might be reflected in estimating future expenditures. In essence, the same problems encountered in preparing the detailed cost estimate are faced in the process of preparing exposure estimates, although the number and extent of uncertainties in the project environment decline as work progresses. The only exception to this rule is the danger of quality problems in completed work which would require re-construction.

Each of the estimating methods described above require current information on the state of work accomplishment for particular activities. There are several possible methods to develop such estimates, including : (Riggs, 1986)

- Units of work completed

For easily measured quantities the actual proportion of completed work amounts can be measured. For example, the linear feet of piping installed can be compared to the required amount of piping to estimate the percentage of piping work completed.

- Incremental milestones

Particular activities can be sub-divided or "decomposed" into a series of milestones, and the milestones can be used to indicate the percentage of work complete based on historical averages. For example, the work effort involved with installation of standard piping might be divided into four milestones:

- Spool in place: 20% of work and 20% of cumulative work.
- Ends welded: 40% of work and 60% of cumulative work.
- Hangars and Trim Complete: 30% of work and 90% of cumulative work.
- Hydrotested and Complete: 10% of work and 100% of cumulative work.

Thus, a pipe section for which the ends have been welded would be reported as 60% complete.

- Opinion

Subjective judgments of the percentage complete can be prepared by inspectors, supervisors or project managers themselves. Clearly, this estimated technique can be biased by optimism, pessimism or inaccurate observations. Knowledgeable estimators and adequate field observations are required to obtain sufficient accuracy with this method.

- Cost ratio

The cost incurred to date can also be used to estimate the work progress. This method provides no independent information on the actual percentage complete or any possible errors in the activity budget: the cost forecast will always be the budgeted amount. Consequently, managers must use the estimated costs to complete an activity derived from the cost ratio method with extreme caution.

Systematic application of these different estimating methods to the various project activities enables calculation of the percentage complete or the productivity estimates used in preparing job status reports.

In some cases, automated data acquisition for work accomplishments might be instituted. For example, transponders might be moved to the new work limits after each day's activity and the new locations automatically computed and compared with project plans. These measurements of actual progress should be stored in a central database and then processed for updating the project schedule.

Accounting information is generally used for three distinct purposes:

- Internal reporting to project managers for day-to-day planning, monitoring and control.
- Internal reporting to managers for aiding strategic planning.
- External reporting to owners, government, regulators and other outside parties.

External reports are constrained to particular forms and procedures by contractual reporting requirements or by generally accepted accounting practices. Preparation of such external reports is referred to as financial accounting. In contrast, cost or

managerial accounting is intended to aid internal managers in their responsibilities of planning, monitoring and control.

Project costs are always included in the system of financial accounts associated with an organization. At the heart of this system, all expense transactions are recorded in a general ledger. The general ledger of accounts forms the basis for management reports on particular projects as well as the financial accounts for an entire organization. Other components of a financial accounting system include:

- The accounts payable journal is intended to provide records of bills received from vendors, material suppliers, subcontractors and other outside parties. Invoices of charges are recorded in this system as are checks issued in payment. Charges to individual cost accounts are relayed or posted to the General Ledger.
- Accounts receivable journals provide the opposite function to that of accounts payable. In this journal, billings to clients are recorded as well as receipts. Revenues received are relayed to the general ledger.
- Job cost ledgers summarize the charges associated with particular projects, arranged in the various cost accounts used for the project budget.
- Inventory records are maintained to identify the amount of materials available at any time.

In traditional bookkeeping systems, day to day transactions are first recorded in journals. With double-entry bookkeeping, each transaction is recorded as both a debit and a credit to particular accounts in the ledger. For example, payment of a supplier's bill represents a debit or increase to a project cost account and a credit or reduction to the company's cash account. Periodically, the transaction information is summarized and transferred to ledger accounts. This process is called posting, and may be done instantaneously or daily in computerized systems. (Coombs and Palmer, 1977)

In reviewing accounting information, the concepts of flows and stocks should be kept in mind. Daily transactions typically reflect flows of dollar amounts entering or leaving the organization. Similarly, use or receipt of particular materials represent flows from or to inventory. An account balance represents the stock or cumulative amount of funds resulting from these daily flows. Information on both flows and

stocks are needed to give an accurate view of an organization's state. In addition, forecasts of future changes are needed for effective management.

Information from the general ledger is assembled for the organization's financial reports, including balance sheets and income statements for each period. These reports are the basic products of the financial accounting process and are often used to assess the performance of an organization. The balance sheet reflects the effects of income flows during the year on the overall worth of the organization.

In the context of private construction firms, particular problems arise in the treatment of uncompleted contracts in financial reports. Under the "completed-contract" method, income is only reported for completed projects. Work on projects underway is only reported on the balance sheet, representing an asset if contract billings exceed costs or a liability if costs exceed billings. When a project is completed, the total net profit (or loss) is reported in the final period as income. Under the "percentage-of-completion" method, actual costs are reported on the income statement plus a proportion of all project revenues (or billings) equal to the proportion of work completed during the period. The proportion of work completed is computed as the ratio of costs incurred to date and the total estimated cost of the project.

The "percentage-of-completion" method of reporting period earnings has the advantage of representing the actual estimated earnings in each period. As a result, the income stream and resulting profits are less susceptible to precipitate swings on the completion of a project as can occur with the "completed contract method" of calculating income. However, the "percentage-of-completion" has the disadvantage of relying upon estimates which can be manipulated to obscure the actual position of a company or which are difficult to reproduce by outside observers. There are also subtleties such as the deferral of all calculated income from a project until a minimum threshold of the project is completed. As a result, interpretation of the income statement and balance sheet of a private organization is not always straightforward. Finally, there are tax disadvantages from using the "percentage-of-completion" method since corporate taxes on expected profits may become due during the project rather than being deferred until the project completion. (Wall Street Journal, 1986)

It should be apparent that the "percentage-of-completion" accounting provides only a rough estimate of the actual profit or status of a project. Also, the "completed

contract" method of accounting is entirely retrospective and provides no guidance for management. This is only one example of the types of allocations that are introduced to correspond to generally accepted accounting practices, yet may not further the cause of good project management. Another common example is the use of equipment depreciation schedules to allocate equipment purchase costs. Allocations of costs or revenues to particular periods within a project may cause severe changes in particular indicators, but have no real meaning for good management or profit over the entire course of a project. As Johnson and Kaplan argue: (Johnson and Kaplan, 1987)

Today's management accounting information, driven by the procedures and cycle of the organization's financial reporting system, is too late, too aggregated and too distorted to be relevant for managers' planning and control decisions....

Management accounting reports are of little help to operating managers as they attempt to reduce costs and improve productivity. Frequently, the reports decrease productivity because they require operating managers to spend time attempting to understand and explain reported variances that have little to do with the economic and technological reality of their operations...

The management accounting system also fails to provide accurate product costs. Cost are distributed to products by simplistic and arbitrary measures, usually direct labor based, that do not represent the demands made by each product on the firm's resources.

As a result, complementary procedures to those used in traditional financial accounting are required to accomplish effective project control, as described in the preceding and following sections. While financial statements provide consistent and essential information on the condition of an entire organization, they need considerable interpretation and supplementation to be useful for project management.

Project managers also are involved with assessment of the overall status of the project, including the status of activities, financing, payments and receipts. These various items comprise the project and financing cash flows described in earlier chapters. These components include costs incurred (as described above), billings and receipts for billings to owners (for contractors), payable amounts to suppliers and contractors, financing plan cash flows (for bonds or other financial instruments), etc.

The job status reports provide a primary tool for project cost control. Different reports with varying amounts of detail and item reports would be prepared for different individuals involved in a project. Reports to upper management would be summaries, reports to particular staff individuals would emphasize their responsibilities (eg. purchasing, payroll, etc.), and detailed reports would be provided to the individual project managers. Of course, these schedule and cost reports would have to be tempered by the actual accomplishments and problems occurring in the field. For example, if work already completed is of sub-standard quality, these reports would not reveal such a problem. Even though the reports indicated a project on time and on budget, the possibility of re-work or inadequate facility performance due to quality problems would quickly reverse that rosy situation.

2.1.2 Schedule Control

In addition to cost control, project managers must also give considerable attention to monitoring schedules. Construction typically involves a deadline for work completion, so contractual agreements will force attention to schedules. More generally, delays in construction represent additional costs due to late facility occupancy or other factors. Just as costs incurred are compared to budgeted costs, actual activity durations may be compared to expected durations. In this process, forecasting the time to complete particular activities may be required.

The methods used for forecasting completion times of activities are directly analogous to those used for cost forecasting. For example, a typical estimating formula might be:

$$D_t = W h_t \quad 2.4$$

where D_t is the forecast duration, W is the amount of work, and h_t is the observed productivity to time t . As with cost control, it is important to devise efficient and cost effective methods for gathering information on actual project accomplishments.

Once estimates of work complete and time expended on particular activities is available, deviations from the original duration estimate can be estimated.

In evaluating schedule progress, it is important to bear in mind that some activities possess float or scheduling leeway, whereas delays in activities on the critical path

will cause project delays. In particular, the delay in planned progress at time t may be soaked up in activities' float (thereby causing no overall delay in the project completion) or may cause a project delay. As a result of this ambiguity, it is preferable to update the project schedule to devise an accurate portrayal of the schedule adherence. After applying a scheduling algorithm, a new project schedule can be obtained.

Scheduling and project planning is an activity that continues throughout the lifetime of a project. As changes or discrepancies between the plan and the realization occur, the project schedule and cost estimates should be modified and new schedules devised. Too often, the schedule is devised once by a planner in the central office, and then revisions or modifications are done incompletely or only sporadically. The result is the lack of effective project monitoring and the possibility of eventual chaos on the project site.

On "fast track" projects, initial construction activities are begun even before the facility design is finalized. In this case, special attention must be placed on the coordinated scheduling of design and construction activities. Even in projects for which the design is finalized before construction begins, change orders representing changes in the "final" design are often issued to incorporate changes desired by the owner.

Periodic updating of future activity durations and budgets is especially important to avoid excessive optimism in projects experiencing problems. If one type of activity experiences delays on a project, then related activities are also likely to be delayed unless managerial changes are made. Construction projects normally involve numerous activities which are closely related due to the use of similar materials, equipment, workers or site characteristics. Expected cost changes should also be propagated throughout a project plan. In essence, duration and cost estimates for future activities should be revised in light of the actual experience on the job. Without this updating, project schedules slip more and more as time progresses. To perform this type of updating, project managers need access to original estimates and estimating assumptions.

Unfortunately, most project cost control and scheduling systems do not provide many aids for such updating. What is required is a means of identifying discrepancies, diagnosing the cause, forecasting the effect, and propagating this effect to all related activities. While these steps can be undertaken manually,

computers aids to support interactive updating or even automatic updating would be helpful. (Lewitt and Kunz, 1985)

Beyond the direct updating of activity durations and cost estimates, project managers should have mechanisms available for evaluating any type of schedule change. Updating activity duration estimations, changing scheduled start times, modifying the estimates of resources required for each activity, and even changing the project network logic (by inserting new activities or other changes) should all be easily accomplished. In effect, scheduling aids should be directly available to project managers. (Kromer, 1984) Fortunately, local computers are commonly available on site for this purpose.

Actual projects involve a complex inter-relationship between time and cost. As projects proceed, delays influence costs and budgetary problems may in turn require adjustments to activity schedules.

Unanticipated events might result in increases in both time and cost to complete an activity. For example, excavation problems may easily lead to much lower than anticipated productivity on activities requiring digging.

While project managers implicitly recognize the inter-play between time and cost on projects, it is rare to find effective project control systems which include both elements. Usually, project costs and schedules are recorded and reported by separate application programs. Project managers must then perform the tedious task of relating the two sets of information.

The difficulty of integrating schedule and cost information stems primarily from the level of detail required for effective integration. Usually, a single project activity will involve numerous cost account categories. For example, an activity for the preparation of a foundation would involve laborers, cement workers, concrete forms, concrete, reinforcement, transportation of materials and other resources. Even a more disaggregated activity definition such as erection of foundation forms would involve numerous resources such as forms, nails, carpenters, laborers, and material transportation. Again, different cost accounts would normally be used to record these various resources. Similarly, numerous activities might involve expenses associated with particular cost accounts. For example, a particular material such as standard piping might be used in numerous different schedule activities. To integrate cost and schedule information, the disaggregated charges for specific activities and specific cost accounts must be the basis of analysis.

A straightforward means of relating time and cost information is to define individual work elements representing the resources in a particular cost category associated with a particular project activity. Work elements would represent an element in a two-dimensional matrix of activities and cost accounts. A numbering or identifying system for work elements would include both the relevant cost account and the associated activity. In some cases, it might also be desirable to identify work elements by the responsible organization or individual. In this case, a three dimensional representation of work elements is required, with the third dimension corresponding to responsible individuals. (Neil, 1983)

Until data collection is better automated, the use of work elements to control activities in large projects is likely to be difficult to implement. However, certain segments of project activities can profit tremendously from this type of organization. In particular, material requirements can be tracked in this fashion. Materials involve only a subset of all cost accounts and project activities, so the burden of data collection and control is much smaller than for an entire system. Moreover, the benefits from integration of schedule and cost information are particularly noticeable in materials control since delivery schedules are directly affected and bulk order discounts might be identified. Consequently, materials control systems can reasonably encompass a "work element" accounting system.

In the absence of a work element accounting system, costs associated with particular activities are usually estimated by summing expenses in all cost accounts directly related to an activity plus a proportion of expenses in cost accounts used jointly by two or more activities. The basis of cost allocation would typically be the level of effort or resource required by the different activities. For example, costs associated with supervision might be allocated to different concreting activities on the basis of the amount of work in the different activities. With these allocations, cost estimates for particular work activities can be obtained. (Mueller, 1986)

2.1.3 Quality control

Control is redefined when the work in projects is understood as making and keeping commitments. By control, the ability to make things happen as intended is meant. Projects that look good on the cost and schedule report are not necessarily under control by this definition. Too often people choose and do work to make their accounts look good rather than keep their promise to deliver what is needed downstream. This sort of thing can be traced to a lack of accountability.

Accountability arises when a person makes a promise and accountability vanishes when they don't have the freedom to say, "No." Telling people to get their numbers up destroys accountability to others in the line of work. (Howell and Macomber, 2005)

Quality control and safety represent increasingly important concerns for project managers. Defects or failures in constructed facilities can result in very large costs. Even with minor defects, re-construction may be required and facility operations impaired. Increased costs and delays are the result. In the worst case, failures may cause personal injuries or fatalities. Accidents during the construction process can similarly result in personal injuries and large costs. Indirect costs of insurance, inspection and regulation are increasing rapidly due to these increased direct costs. Good project managers try to ensure that the job is done right the first time and that no major accidents occur on the project.

As with cost control, the most important decisions regarding the quality of a completed facility are made during the design and planning stages rather than during construction. It is during these preliminary stages that component configurations, material specifications and functional performance are decided. Quality control during construction consists largely of insuring conformance to these original design and planning decisions.

While conformance to existing design decisions is the primary focus of quality control, there are exceptions to this rule. First, unforeseen circumstances, incorrect design decisions or changes desired by an owner in the facility function may require re-evaluation of design decisions during the course of construction. While these changes may be motivated by the concern for quality, they represent occasions for re-design with all the attendant objectives and constraints. As a second case, some designs rely upon informed and appropriate decision making during the construction process itself. Since such decisions are based on better information concerning actual site conditions, the facility design may be more cost effective as a result.

With the attention to conformance as the measure of quality during the construction process, the specification of quality requirements in the design and contract documentation becomes extremely important. Quality requirements should be clear and verifiable, so that all parties in the project can understand the requirements for conformance.

Safety during the construction project is also influenced in large part by decisions made during the planning and design process. Some designs or construction plans are inherently difficult and dangerous to implement, whereas other, comparable plans may considerably reduce the possibility of accidents. For example, clear separation of traffic from construction zones during roadway rehabilitation can greatly reduce the possibility of accidental collisions. Beyond these design decisions, safety largely depends upon education, vigilance and cooperation during the construction process. Workers should be constantly alert to the possibilities of accidents and avoid taken unnecessary risks. (Fox and Cornell, 1984)

A variety of different organizations are possible for quality and safety control during construction. One common model is to have a group responsible for quality assurance and another group primarily responsible for safety within an organization. In large organizations, departments dedicated to quality assurance and to safety might assign specific individuals to assume responsibility for these functions on particular projects. For smaller projects, the project manager or an assistant might assume these and other responsibilities. In either case, insuring safe and quality construction is a concern of the project manager in overall charge of the project in addition to the concerns of personnel, cost, time and other management issues.

Inspectors and quality assurance personnel will be involved in a project to represent a variety of different organizations. Each of the parties directly concerned with the project may have their own quality and safety inspectors, including the owner, the engineer/architect, and the various constructor firms. These inspectors may be contractors from specialized quality assurance organizations. In addition to on-site inspections, samples of materials will commonly be tested by specialized laboratories to insure compliance. Inspectors to insure compliance with regulatory requirements will also be involved. Common examples are inspectors for the local government's building department, for environmental agencies, and for occupational health and safety agencies.

Inspectors routinely conduct site visits of work places in conjunction with approved state inspection agencies. Inspectors are required by law to issue citations for all standard violations observed. Safety standards prescribe a variety of mechanical safeguards and procedures. In cases of extreme non-compliance with standards, inspectors can stop work on a project. However, only a small fraction of construction sites are visited by inspectors and most construction site accidents are not caused

by violations of existing standards. As a result, safety is largely the responsibility of the managers on site rather than that of public inspectors.

While the multitude of participants involved in the construction process require the services of inspectors, it cannot be emphasized too strongly that inspectors are only a formal check on quality control. Quality control should be a primary objective for all the members of a project team. Managers should take responsibility for maintaining and improving quality control. Employee participation in quality control should be sought and rewarded, including the introduction of new ideas. Most important of all, quality improvement can serve as a catalyst for improved productivity. By suggesting new work methods, by avoiding rework, and by avoiding long term problems, good quality control can pay for itself. Owners should promote good quality control and seek out contractors who maintain such standards. (Brock and Sutcliffe, 1986)

In addition to the various organizational bodies involved in quality control, issues of quality control arise in virtually all the functional areas of construction activities. For example, insuring accurate and useful information is an important part of maintaining quality performance. Other aspects of quality control include document control (including changes during the construction process), procurement, field inspection and testing, and final checkout of the facility.

Specifications of work quality are an important feature of facility designs. Specifications of required quality and components represent part of the necessary documentation to describe a facility. Typically, this documentation includes any special provisions of the facility design as well as references to generally accepted specifications to be used during construction.

Quality control in construction typically involves insuring compliance with minimum standards of material and workmanship in order to insure the performance of the facility according to the design. For the purpose of insuring compliance, random samples and statistical methods are commonly used as the basis for accepting or rejecting work completed and batches of materials. Rejection of a batch is based on non-conformance or violation of the relevant design specifications.

An implicit assumption in these traditional quality control practices is the notion of an acceptable quality level which is a allowable fraction of defective items. Materials obtained from suppliers or work performed by an organization is inspected and passed as acceptable if the estimated defective percentage is within the acceptable

quality level. Problems with materials or goods are corrected after delivery of the product. (Parker and Oglesby, 1972)

In contrast to this traditional approach of quality control is the goal of total quality control. In this system, no defective items are allowed anywhere in the construction process. While the zero defects goal can never be permanently obtained, it provides a goal so that an organization is never satisfied with its quality control program even if defects are reduced by substantial amounts year after year. This concept and approach to quality control was first developed in manufacturing firms in Japan and Europe, but has since spread to many construction companies. The best known formal certification for quality improvement is the International Organization for Standardization's ISO 9002 standard. ISO 9002 emphasizes good documentation, quality goals and a series of cycles of planning, implementation and review.

Total quality control is a commitment to quality expressed in all parts of an organization and typically involves many elements. Design reviews to insure safe and effective construction procedures are a major element. Other elements include extensive training for personnel, shifting the responsibility for detecting defects from quality control inspectors to workers, and continually maintaining equipment. Worker involvement in improved quality control is often formalized in quality circles in which groups of workers meet regularly to make suggestions for quality improvement. Material suppliers are also required to insure zero defects in delivered goods. Initially, all materials from a supplier are inspected and batches of goods with any defective items are returned. Suppliers with good records can be certified and not subject to complete inspection subsequently.

The traditional microeconomic view of quality control is that there is an "optimum" proportion of defective items. Trying to achieve greater quality than this optimum would substantially increase costs of inspection and reduce worker productivity. However, many companies have found that commitment to total quality control has substantial economic benefits that had been unappreciated in traditional approaches. Expenses associated with inventory, rework, scrap and warranties were reduced. Worker enthusiasm and commitment improved. Customers often appreciated higher quality work and would pay a premium for good quality. As a result, improved quality control became a competitive advantage.

Of course, total quality control is difficult to apply, particular in construction. The unique nature of each facility, the variability in the workforce, the multitude of

subcontractors and the cost of making necessary investments in education and procedures make programs of total quality control in construction difficult. Nevertheless, a commitment to improved quality even without endorsing the goal of zero defects can pay real dividends to organizations.

An ideal quality control program might test all materials and work on a particular facility. For example, non-destructive techniques such as x-ray inspection of welds can be used throughout a facility. An on-site inspector can witness the appropriateness and adequacy of construction methods at all times. Even better, individual craftsmen can perform continuing inspection of materials and their own work. Exhaustive or 100% testing of all materials and work by inspectors can be exceedingly expensive, however. In many instances, testing requires the destruction of a material sample, so exhaustive testing is not even possible. As a result, small samples are used to establish the basis of accepting or rejecting a particular work item or shipment of materials. Statistical methods are used to interpret the results of test on a small sample to reach a conclusion concerning the acceptability of an entire lot or batch of materials or work products. (Ritz, 1994)

The use of statistics is essential in interpreting the results of testing on a small sample. Without adequate interpretation, small sample testing results can be quite misleading. As an example, suppose that there are ten defective pieces of material in a lot of one hundred. In taking a sample of five pieces, the inspector might not find any defective pieces or might have all sample pieces defective. Drawing a direct inference that none or all pieces in the population are defective on the basis of these samples would be incorrect. Due to this random nature of the sample selection process, testing results can vary substantially. It is only with statistical methods that issues such as the chance of different levels of defective items in the full lot can be fully analyzed from a small sample test.

There are two types of statistical sampling which are commonly used for the purpose of quality control in batches of work or materials:

- The acceptance or rejection of a lot is based on the number of defective (bad) or nondefective (good) items in the sample. This is referred to as sampling by attributes.

- Instead of using defective and nondefective classifications for an item, a quantitative quality measure or the value of a measured variable is used as a quality indicator. This testing procedure is referred to as sampling by variables.

Whatever sampling plan is used in testing, it is always assumed that the samples are representative of the entire population under consideration. Samples are expected to be chosen randomly so that each member of the population is equally likely to be chosen. Convenient sampling plans such as sampling every twentieth piece, choosing a sample every two hours, or picking the top piece on a delivery truck may be adequate to insure a random sample if pieces are randomly mixed in a stack or in use. However, some convenient sampling plans can be inappropriate. For example, checking only easily accessible joints in a building component is inappropriate since joints that are hard to reach may be more likely to have erection or fabrication problems.

Another assumption implicit in statistical quality control procedures is that the quality of materials or work is expected to vary from one piece to another. This is certainly true in the field of construction. While a designer may assume that all concrete is exactly the same in a building, the variations in material properties, manufacturing, handling, pouring, and temperature during setting insure that concrete is actually heterogeneous in quality. Reducing such variations to a minimum is one aspect of quality construction. Insuring that the materials actually placed achieve some minimum quality level with respect to average properties or fraction of defectives is the task of quality control. (International Organization for Standardization, 1981)

3 The PM process in the German company with emphasis on controlling

3.1 A general view of the PM process the company

The company runs its internal construction activities through its department called “Real estate management” in all countries including Turkey. The department has the “Development and sales” division to exercise and manage the construction projects. The organization chart of the division is as shown in the figure 3.1.

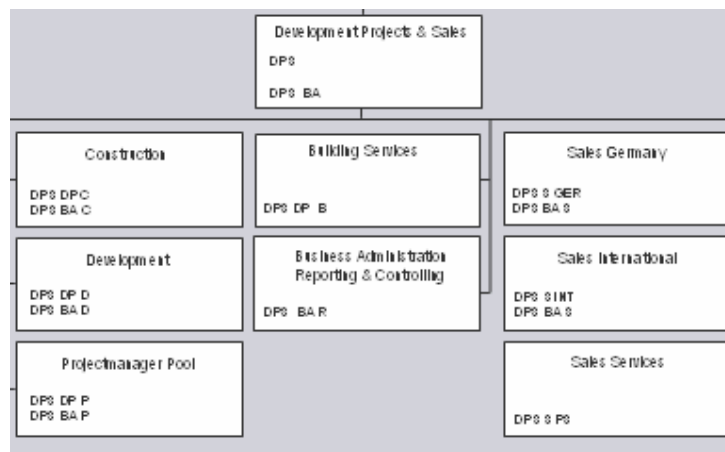


Figure 3.1 The organization chart of the division “Development and sales”

According to the company view a project is a unique, complex undertaking with the following characteristics:

- has clear objectives
- is limited on time, quality and budget
- is delimited from other activities and
- requires project Organization

In the company all construction PM activities are carried out by the Real Estate departments which uses the following ways of working.

Project management provides an overview of the processes and documents and ensures a proper, systematic, and structured approach to projects. It is based on existing the Company's business processes.

The core elements are as follows:

- The system structure is drawn up by the project manager and represents the entire project in a clear and concise manner with the internal and external interfaces, including all the requirements for the project and their limitations and effects. It is also used to provide information quickly to third parties about the interrelations. The system structure is the base for clarifying requirements, provides initial information to identify (risk potential, interfaces (personal, technical) and alternative solutions) and is a well-established method for analysis.
- The project structure is based on the system structure. It presents the project organisation which is appropriate and cost effective for the project, and the responsibilities of the individual internal and external partners for specific work packages in a transporter manner. It also regulates the interfaces within the project. Project management is based on the double verification principle for both commercial and technical issues.

The Work Breakdown Structure (WBS) is the complete structured representation of a project, divided into levels and work packages, includes important relations between the elements of the Project and is the basis for efficient planning and controlling of the Project.

The Work Breakdown Structure enables us to recognize duplications and gaps in the planning, shows the potential for standardization and provides the basis for schedule, resource, and procurement planning.

A WBS is a deliverable-oriented grouping of project components that organizes and defines the total scope of work. It is often used to develop or confirm a common understanding of project scope. Each item in the WBS can provide a structure for hierarchical summation of costs and resources. (The Company's Construction Project management standards, 2006)

The item at the lowest level may be referred to as Work Packages as shown in the figure 3.2

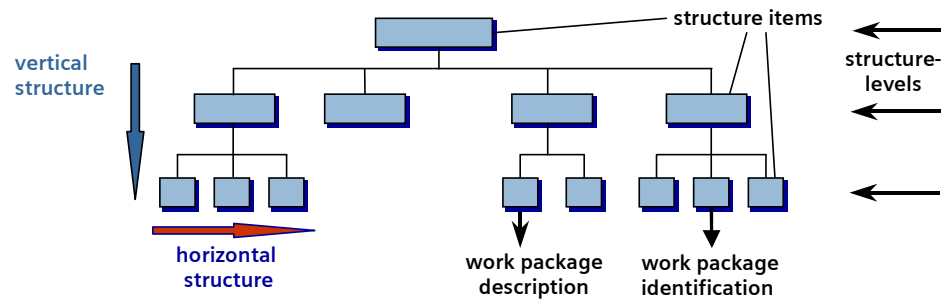


Figure 3.2 Work breakdown structure

Work Package (WP) has the following characteristics:

- compact amount of work, demarcated from other WPs
- clear, measurable result
- an individual is named as being responsible
- object of planning and controlling

Work Package is the unit to be controlled in the project.

A clear and detailed description of the work packages is necessary, that you can delegate and purchase efficiently single tasks of the Project. (The Company's Construction Project management standards, 2006)

- Quality management includes active planning and sustainable methods for ensuring quality throughout the Project. It is based on a systematic, transparent and proactive procedure linked with ongoing control of the project specific measures for quality assurance with the emphasis on prevention.
- Risk management ensures early detection of problems, prompt action to avoid, prevent or minimize any events or circumstances which may endanger the project objectives. Risk management includes both preventative and corrective measures.

- Schedule management, systematic schedule planning and ongoing follow-up work with actual target comparisons should ensure the project is handed over on time and that corrective measures are implemented if any delays occur. Milestone planning subdivides the project into meaningful segments with mandatory results.
- Cost management, systematic cost planning and ongoing follow up work with actual/target comparisons, should ensure the project is kept within budget and that corrective measures are implemented if any changes occur. Cost follow up work enables the project manager to make a statement at any time as to the anticipated total costs.
- Change management, is the qualified handling of all contractual changes to the Project.

3.2 Processes and Roles

3.2.1 Processes

In order to achieve the objective it is essential that the processes relevant for project handling be defined in a uniform fashion and integrated into the The Company's Process House.

This creates a basis for implementing process improvements into practice throughout the company, through the application of uniform procedures, methods and roles in project handling.



Figure 3.3 Project phase model

The generic project phase model shown in the figure 3.3 was devised as a first but crucial step involving precise milestones. It forms the basis for further detailing and introduces a uniform processing language.

The representation of a complex handling process as a linear phase model entails the seemingly insuperable, system-inherent problem that the real process passes through the described phases several times. The process representation with its

milestones is still valid, however – for each component as well as for the system – and is thus a valuable tool.

The individual process operations are staggered in a practical fashion, on the basis of the integrated project schedule; hence this linear process approach also makes sense for projects business.

To record the completion of a process step, each milestone is accorded mandatory results. This provides the basis for introducing Key Performance Indicators, allowing the quality of project processing as well as ontime performance to be measured. Certain activities typical of projects business cannot be illustrated in a phase model.

These “enablers” are summarized separately and will be subsequently anchored in the Reference Process House with The Company’s CIO. (The Company’s Construction Project management standards, 2006)

In the figures 3.4 and 3. 5 project start and planning are shown.

Serial processes	PM@SRE - Construction Project Management Development Projects & Sales - PM@SRE - Toolbox		
	Organization	Quality Management	Cost Management
Process Overview			
Objectives/Core Elements			
1. Project Triggers			
2. KDP			
3. Feasibility Study			
4. Decision Paper			
5. CEC Decision			
6. Project Start			
7. Planning			
8. Construction Award			
9. Construction			
10. Acceptance			
11. Project End			
12. Guarantee			
Contact: Rolf Klotzsche			
	- Formulate the construction investment: spatial data, structure of the building → <u>tenant specification</u>, User requirements costs, schedule, qualities - Inventory - Ownership structure - Construction law situation, environmental analysis - Pollution, infrastructure, preparation - Conclude → <u>PM agreement</u> - Set up → <u>system structure</u> - Set up → <u>project structure/organization</u>: Select award strategy (Investor/general contractor/main contractor or single contractor) - Determine organization: PM (Technical/Commercial), double verification principle - Internal resources (HQ/Region), users, external parties - Kick-off with project team - Define and set up → <u>Reporting</u>	→ <u>Building Configurator</u> → <u>Siemens Cross Selling</u> Contract Management - Conclude → <u>LoI/tenancy agreement</u> - Select external project members: → <u>Scope</u>, commission in stages, remuneration, schedules → <u>Competition</u> (Investor/general contractor, or architect/planning engineer) - for Investor ⇒ Set up reward folder - for general contractor ⇒ - Functional specification for lump sum pricing - Purchase as per → <u>Purchasing Guidelines</u>: ⇒ Involve LS and Purchasing - Negotiate and conclude contracts → <u>Template contracts</u> (planning, project management, consultants) ⇒ → <u>Compliance Check</u> (> €0'5)	- Check costs - Draw up and sign off the budget - Set up cost controlling - Finance planning → <u>Requirements planning</u> - Approval → <u>BBA</u> (> €0'250) (binding tenancy agreement in existence) → <u>Opportunities/Risk Analysis</u> Schedule Management - Set up → <u>management schedule</u> - Define Go/No Go milestones - Set up regular meetings (steering committee, board, contractors' jour fixe)

Figure 3.4 Phase Project Start

Phase Project Start requires the following milestones/mandatory results:

- Construction project is clearly defined (Spatial data, user requirements, quality)
- Tenant specification and LoI/ tenancy agreement to be on hand

- Overall budget is defined
- Framework schedule is defined
- Project organization is set up

PM@SRE - Construction Project Management Development Projects & Sales - PM@SRE - Toolbox			
Back to Livelink eng / de SRE			
Serial processes	Organization	Quality Management	Cost Management
Process Overview			
Objectives/Core Elements	• Basic evaluation	• → Building Configurator • → Siemens Cross Selling • → Corporate Architecture • → WPM • Carry out quality checks on the individual planning results • Check building application • Check tender for accuracy and completeness • Life cycle cost analysis, involve technical building management	• → Release cost estimates • → Release cost calculation • Actual/target comparison with feasibility study • Evidence of savings potential • Budget split SRE/user • → Continual cost control • Corrective actions • → Requirements planning • Payment authorisation
1. Project Triggers	• Subsurface investigation, pollution report, preserving evidence		
2. KDP	• Terrain survey, survey		
3. Feasibility Study	• Obtain right to build where appropriate		
4. Decision Paper	• Building preliminary request where appropriate		
5. CEC Decision	• → Construction specification • → Tenancy specification		
6. Project Start	• Release space allocation plan		
7. Planning	• Ongoing synchronization with users		
8. Construction Award	• Release design planning • Release approval planning		
9. Construction	• Draw up building application • Implement Siemens planning tool (such as Simaris design) • Release execution planning • Launch health and safety coordination	Contract Management • Select award strategy (main contractor / single contractor*) • for main contractor => Functional specification with main details and/or dimensions specification	• → Change management: Cost and schedule influences from user changes release/approve with user documentation • → Opportunities/Risk Analysis and Management
10. Acceptance			
11. Project End			
12. Guarantee			
Contact: Rolf Klotzsche			
			Schedule Management • Release management schedule

Figure 3.5 Project Phase Planning

A second essential aspect in the standardization of projects business is the uniform definition of project roles and functions. Depending on the project's complexity, various roles may be filled by only one resource.

3.2.2 Roles in project processing

Project Manager, Commercial Project Manager, Technical Project Manager, Senior Site Manager, Commercial Site Manager, Contract Manager, Risk Manager, Scheduler, Work Coordinator, Quality Manager, Claim Manager, Project Purchaser, Dispatch Logistics Coordinator, Administrator are direct project roles. Various roles may be combined; the two-head principle should be maintained.

Business Manager, Service Contact, Sales Project Manager, Bid Project Manager are connecting roles.

In addition to classic direct project roles, the essential connecting roles have also been defined, in order to mirror the essential interactions in project processing.

Task descriptions are developed for each role.

The Project Manager (PM) is an entrepreneur for the time being and is the responsible Manager to achieve all agreed upon project goals (individual, project specific PM-Goal agreement)

The Project Manager organizes and ensures the achievement of the technical and financial project goals. A Delegation of responsibilities (internal or external) does not limit his responsibilities. He sets the directives regarding scope and Quality, schedule and costs. This ensures that the fundamentals of the The Company's PM systematic are also valid for suppliers (e.g. Milestones and mandatory results). (Yaman, 2006)

The main tasks of the Project Manager: (Yaman, 2006)

- Representing the project to the customer as well as to partners
- As sold cost calculation (with the Bid Project Manager)
- Planning of the Project
- Setup of the project team and definition of split of responsibilities
- Eventually definition of goal achievement plans with the

work Coordinators

- Internal project controlling (schedule, costs, quality)
- Coordination and supervision of interface clarification
between organizations

- Decisions on purchase strategy in alliance with purchasing
- Developing of remedies in case of plan deviations
- Regularly project reports
- Execution of milestone review meetings
- Execution of project status meetings
- Contract management

- Risk Management
- Claim management
- Change-order and Configuration management
- Create of a final project report

The project manager is empowered by the business manager to achieve his task. This is documented in the project incentive agreement e.g.:

- Right of co-determination of personnel selection
- Project specific split of responsibilities for the core team

3.3 Principles of Project Organization

- A project has only one Project Manager;
 - s/he is fully responsible for commercial and technical aspects
 - s/he is given full authority.
- The Project Manager is supported by the Business Manager as shown in the figure 3.6, and the project objectives are mutually agreed.
- Not later than the project start a clear project organization with personnel attached tasks and competencies is existing.
- Projects have a defined start and an end. Projects are cleared up at the phases-model with individual milestones.
- Institutionalized, structured project status meetings are a duty.

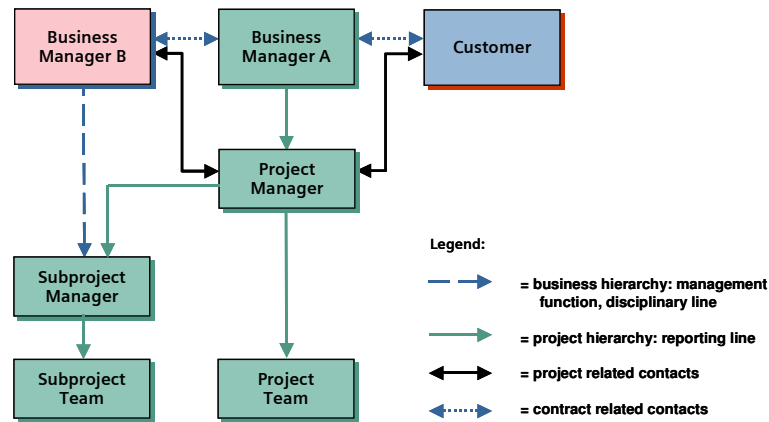


Figure 3.6 Project organization scheme

3.4 The role and importance of the Controlling Process

Project control is the pivotal activity that ties all Project management techniques together as mentioned in the " Objectives of the study ".

It is the work of constraining, coordinating, and regulating action in accordance with plans to meet specific objectives (The company has set its objectives of safely building a quality project, on time, and within budget).

Project control function is the mechanism that keeps the work of the project on target to meet the goals.

Controlling the construction plans and activities extends over the life of the project, and it is the most vital of the three total construction project management steps (planning, organizing and controlling).

The controlling function in the company monitors the quality of all phases of the work, to meet the universal goal of building the project as specified: Monitor time by checking the physical progress against the schedule and monitor costs through a cost control system based on the project budget. The project reporting system regularly informs key project players as to the status of project activities and results of the project control systems in detail.

Basically, the control process cycle shown in the figure 3.7 starts in the upper right corner measuring the actual performance, which is then compared against the planned performance. If there is any deviation, we analyse the causes. We formulate corrective actions and implement them to correct the variance, then repeat

the cycle by measuring the revised performance and comparing it to standard. The process is repeated until the variance is “ tuned out ” . (Genç, 2006)

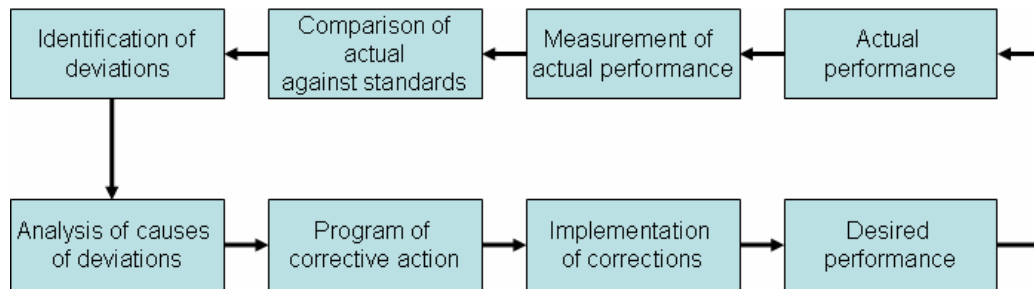


Figure 3.7 The Control Process cycle

So far we can say that the The Company’s Project controlling approach shows great similarity to general controlling approaches. Except for the project management system the company shows great emphasis on project controlling based on also Risk Management, besides in Cost Controlling, Resource Controlling, Schedule Controlling ,and Quality Controlling. Cost controlling is a very carefully handled part of controlling. Therefore a great number of financial controllers are employed in the company.

The Company’s project controlling is a significant tool for handling projects successfully. The success of a project is measured in terms of profits and customer satisfaction.

- Which key variables must be recorded in the context of Project Cost Controlling so as to permit a reliable forecast of the profits at the end of the project?
- How risks can be determined at the right time and minimized by taking appropriate action?
- How can Project Cost Controlling, which includes project reporting, be integrated uniformly and systematically in the business processes of the Groups? These questions are the key topics in the Project Cost Controlling module. Project Cost Controlling is sufficiently regulated in all groups. The standard variables for Project Cost Controlling related to the business management data and risk management are based on corporate finance specifications for all groups according to US GAAP (US Generally Accepted Accounting Principles).

All key variables of The Company’s project controlling related to financial and nonfinancial aspects are:

- Risk Management
- Cost controlling
- Resource controlling (Equipment and material controlling)
- Schedule controlling
- Quality controlling

3.5 The controlling process

3.5.1 Risk Management

3.5.1.1 Definition of Risk from The Company's point of view

General : Possibility of being affected by a negative event. Project based: The potential for damaging factors, which are anticipated in the planning. Additional negative events which are not foreseen in the planning and calculation.(The Company's AG Construction Project management standards, 2006)

3.5.1.2 Types of Risk

In the figure 3.8 th types of risks in the company are shown.

Risks	Handling
Tender risk	accept / charge
Price / Cost risk	form of contract
Planning, engineering and implementation risk	accept
Transport risk	effect insurance
Erection risk	effect insurance
Currency risk	effect insurance / form of contract
Delcredere risk	information / bond
Guarantee risk	accept
Warranty risk	effect insurance / legislation / form of contract
Delay risk	form of contract

Figure 3.8 Types of risks

3.5.1.3 Objectives of Risk Management

Through effective risk management it is possible to fend off all events and circumstances which can endanger the project success, and to minimize the impact of the risk, should it occur risk management includes preventive measures i.e. to improve transparency of risks and corrective measures i.e. to create standards. (The Company's Construction Project management standards, 2006)

3.5.1.4 Time for Risk Management

Risks occur and appear usually during the Project Implementation Phase. They are caused and established usually in the acquisition- and planning phases. Risk Management is a permanent process during the whole project life cycle and should start as soon as possible. (The Company's Construction Project management standards, 2006)

3.5.1.5 Distribution of Risks

In the figure 3.9 the risk distribution scheme is shown.

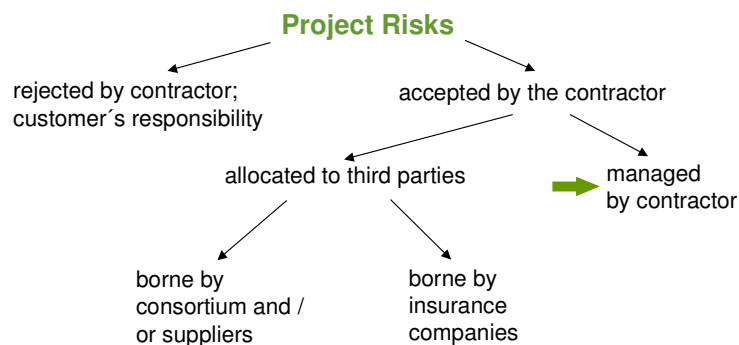


Figure 3.9 Risk distribution scheme

3.5.1.6 Risk and Measure Evaluation Example

In the figure 3.10 an example of risk and measure is shown.

type of risk	before taking measures			measure	C	after taking measures		
	I	P	Pot			I _M	P _M	Pot _M
scheduling delay by unknown subcontr.	10000	50	5000	permanent milestone trend analysis (MTA)	200	10000	20	2000
acceptance problems of technical modifications	1000	70	700	prepared discussion and a protocol to be signed	100	1000	20	200

I = Impact (€); P = Probability (%); Pot = Potential (€); C = Costs (€)

$$\text{Pot} = \text{Impact} \times \text{Probability}$$

Figure 3.10 Risk and measure evaluation example

3.5.2 Cost control

3.5.2.1 Goals of Cost Controlling

Setting the project objectives with regard to time, costs and deliverables triangle, comparing the actual status of the project to the planned objectives, taking corrective actions in case of deviations are the main objectives of cost controlling process in Siemens.

3.5.2.2 Cost controlling approach

The idea of integrated project controlling shows that project management practices and methods should be aligned with the framework set by the The Company's project controlling requirements. Beyond that, integrated project controlling also requires that all people involved in project controlling understand their roles and the need for communication.

The Company's cost controlling requirements should ensure proper construction accounting and reporting. The requirements set the framework for project management practices and methods that are necessary for cost controlling within the company.

The Company's cost controlling approach shows similarity to general cost controlling approaches as shown in the cost control flow diagram in the figure 3.11.

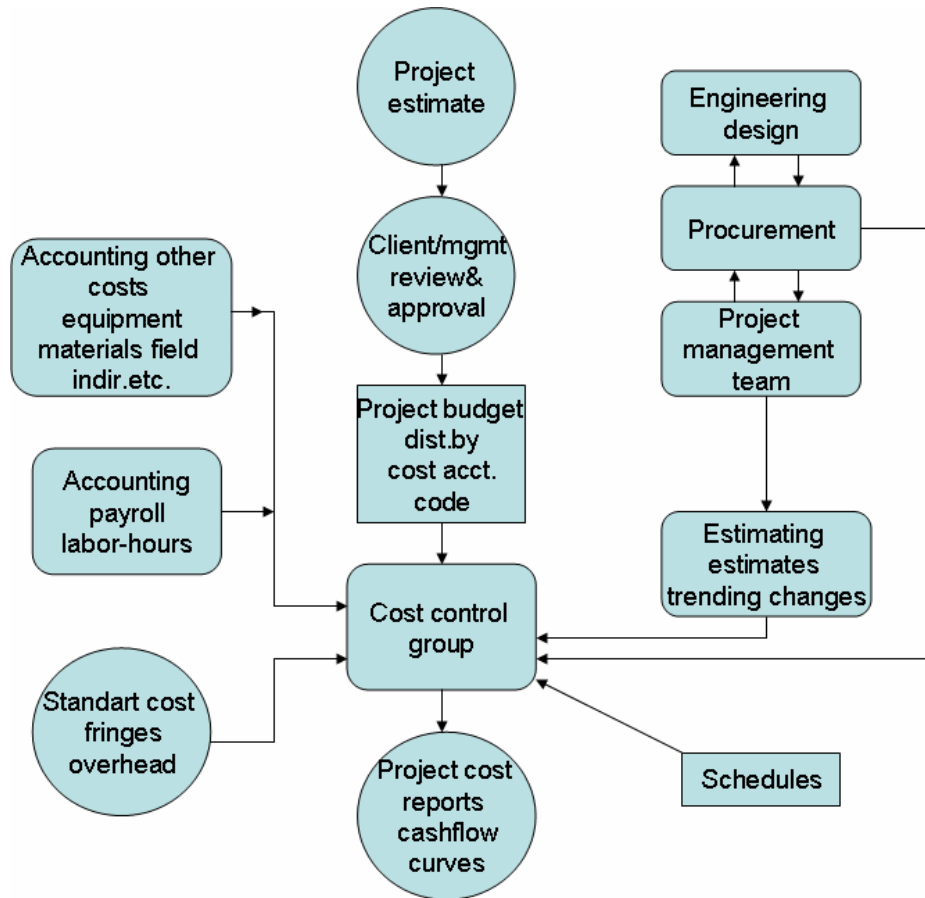


Figure 3.11 Cost control flow diagram

The process starts with the Project estimate passing through client and management reviews before it is converted into the Project budget. The budget is the basic Money plan for the Project and it becomes the baseline for the cost control system.

On the left side of the diagram, the normal staff departments are shown that feed routine construction costs and expenditures into the cost control center on a regular basis. On the right side the design, procurement, construction and estimating functions feeding commitments, project change orders, and estimating data into the cost control center are shown. At the lower side it is shown that the schedule is regularly issued on the cost control group so that it can evaluate the effects of schedule changes on project costs.

At least monthly, the cost control center issues the project cost report and cashflow curves. The idea behind the flow diagram is to have the large volume of routine data

flowing in standardized normal channels to ensure that nothing affecting construction cost is overlooked. Missing data can result in inaccurate reports, which led to loss of control of the project money plan. This in turn will result in unmet expectations for finishing the project under budget.

Effective project management approaches have to offer practices and methods that ensure proper project management, including the management of scope, resources, and schedule. At the same time, they have to fulfill the cost controlling requirements. Earned value and critical path method represent two approaches. (The Company's Construction Project management standards, 2006)

3.5.2.3 Project data path to financial statements

The project data path to financial statements demonstrates how financial and performance data is reported from the project level to the company, division, group, and corporate level.

An illustration of the project data path to the financial statements is below.

The project profile is a part of the project data path to financial statements as shown in the figure 3.12. It is an official document that forms a communication link between data collection and accounting on the project level and the financial statements on the business entity level.

Project profile and project list data is used for management reporting that provides the basis for project performance analysis.

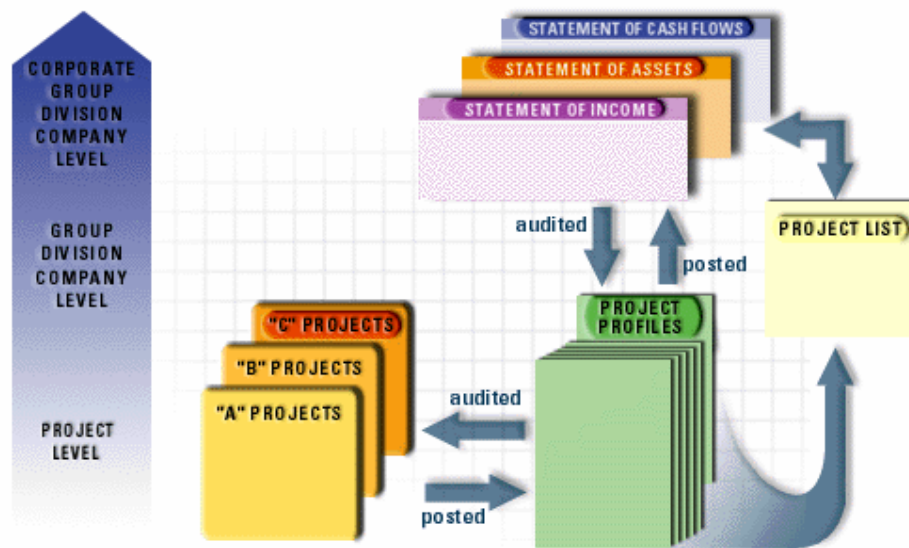


Figure 3.12 Project data path illustration

The project profile is an official document forming the key communication link between projects and financial statements. A variety of project data is reported in that. (The Company's Construction Project management standards, 2006)

The project list gives a high-level overview of the business entity's project-based business as shown in the figure 3.13. It includes project profile data for each project.

PROJECT LIST												
Project #	Business Unit (GF)	Project Name	Project End Date		POC Cost		Estimated Total Cost		POC Revenue		Estimated Total Revenue	
			Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual

Figure 3.13 Project list example

3.5.2.4 Project Profile

The project profile is an official document that forms the key communication link between data collection and accounting on the project level and the financial statements on the business entity level. The project profile is thus part of the project data path to corporate financial statements.

The project manager and his team prepare the project profile. It contains general, qualitative as well as financial information about the project.

The financial information is provided in a template and reports budgeted, actual, and forecasted data. (Genç, 2006)

Project profiles provide information needed for project controlling and are thus the link between individual projects and corporate financial reporting as shown in the figure 3.14.



Figure 3.14 Link between individual projects and corporate financial reporting

An example of the project profile template is given in the figure 3.15.

In the one direction, they are documents that help posting project data to the corporate financial statements.

In the other direction, the project profile is the starting point for audit of project data which ensures a true and fair picture of project progress and the compliance of data to US GAAP reporting requirements.

Beyond that, the project profile includes data that can be used by the business management to analyze project performance.

The extract of the project profile shows quantitative project data, including POC data posted to the statement of income, project cost information, project data reflected in the statement of assets as well as project data related to project capital employed.

Finance Information	Current Quarter		Accumulated		Total Project	
	Budget	Actual	Budget	Actual	Budget	Forecast
Statement of income:						
POC revenues						
POC (%) (see details below)						
POC cost 1)						
POC gross margin						
Cost information:						
Cost in excess of POC cost						
Actual cost incurred 2)						
Estimated total cost						x,xxx 3)
Estimate to complete (ETC)						
ETC variance						
Statement of assets / Capital employed:						
Cash balance						
Progress billings						
Excess cost						
Excess billings						
Accruals (losses on sales contracts, for delay, warranty after project closing)						
Capital charge 4)						
EVA contribution						

POC	Current Quarter
POC (%)	
POC cost	
Actual estimated total cost 5)	

- 1) For the earned value method, POC cost = Actual cost of work performed (ACWP)
- 2) Actual cost incurred = POC cost + Cost excess of POC cost
- 3) Forecast = Actual estimated total cost
- 4) Capital charge = Working capital x Cost of capital
- 5) Actual estimated total cost:
 = POC cost + ETC (cost to cost method)
 = ACWP + ETC (earned value method)

Figure 3.15 Project profile template example

Project profile data is posted to the financial statements of the business entity. Format and names of financial statements may vary depending on whether they are used for internal or external purposes, but all variations of financial statements are based on the same financial information. They differ only as far as the level of detail in the presentation and the frequency of being prepared (quarterly or monthly) is concerned. (Genç, 2006)

3.5.2.5 Integrated Cost Controlling

A cost controlling approach can only be as effective as the project management data that is provided.

The Company's cost controlling requirements establish a framework for project management data reporting. Within this framework, alternative project management practices can be used. Project management practices should provide information that gives a true and fair picture of the project progress (the percentage of completion) and can be used for controlling purposes. The scheme of interrelation between project management practices and cost controlling requirements is shown in the figure 3.16.

Project management practices should allow the project manager to plan the project appropriately concerning time and resource requirements, and execute the project in time and within budget.

The illustration below shows how current project management practices and cost controlling requirements are interrelated. The compliance of project management to the cost controlling requirements ensures that proper construction accounting and reporting is taking place.

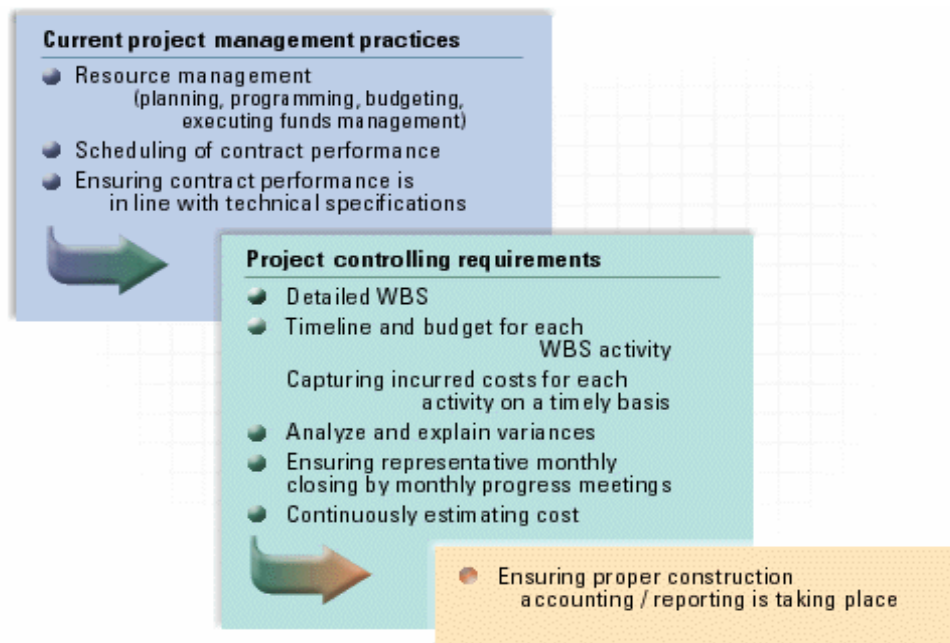


Figure 3.16 Scheme of interrelation between project management practices and cost controlling requirements

Current project management practices include the following areas: resource management, scheduling of contract performance, and ensuring that contract performance is in line with technical specifications. These practices which should be viewed within the framework of the cost controlling requirements. (The Company's Construction Project management standards, 2006)

3.5.2.6 Roles within cost controlling

There are a variety of people involved in the project cost controlling process:

- Project manager
- Project assistant
- Controller
- Accountant
- Business entity executives

The project manager and his team must provide finance with the information necessary to account for and report the results of the project in the business entity's financial statements. It is important that each party in this process understands their role. The key roles are discussed below. Different business entities may have different names for each role; however, each business entity will have staff with these characteristics.

Project manager is responsible for the project's success from the commercial and technical side, for determining the appropriate method of cost controlling, is most knowledgeable of project progress, and therefore in best position to report on project POC, estimate to complete (ETC), project profile, and is accountable for profitability of Project.

Project assistant performs day to day tasks as delegated from project manager and prepares POC, ETC, and project profile with input from the project manager.

Controller supervises operations of accounting staff and reports to business entity's executives.

Accountant is responsible for day to day accounting transactions and uses data from project profiles to prepare financial statements.

Business entity executives are at varying levels of business entity and are responsible for performance of division or business unit.

It is important that all people who are involved with the project business should understand their role and communicate with each another.

Proper construction accounting and reporting is only possible if all of the above mentioned requirements are in place. (Genç, 2006)

3.5.2.7 Cost controlling requirements

The financial data that underlies project business has a major impact on the business performance of the company worldwide and on most of its groups and divisions. Financial data generated by project business is shown explicitly in the financial statements. Management decisions and shareholders' investment decisions are based on this data. Therefore project controlling requirements are needed to ensure that project-related financial data is accurate and represents a true and fair reflection of the business.

The Company's cost controlling requirements serve as a framework to current project management practice. It is not important which specific project management approach or method is used. Cost controlling requirements have to be fulfilled to ensure that proper construction accounting/reporting is taking place.

In major project business, accounting and reporting is based on percentage of completion data. The Company's cost controlling requirements help to generate valid POC data. There are two main reasons why valid POC data is needed:

- To be compliant with requirements under US GAAP
- To ensure that project and business management decisions are based on valid financial data

Costs incurred on a project must be captured and allocated correctly. This should be done on a timely basis to make sure that project reality is reflected in the percentage of completion (POC) calculation.

The proper allocation of actual cost incurred and calculation of POC cost form an essential element of a valid POC calculation. Two major rules should be kept in mind:

- Actual costs incurred must be assigned to an appropriate project task.
- Actual costs incurred that are not reflecting project progress must be excluded from the calculation of POC cost.

Actual cost incurred that are not related to project progress must be inventoried and recognized at the time the corresponding assets are utilized or when the corresponding work is performed.

The second essential element for a valid POC calculation is a continuous estimation of costs.

The following is an example of costs related to project progress and costs not related to project progress as shown in the figure 3.17.

In this example, only the actual costs incurred for task 1 and task 2 are related to project progress and would be added to the POC cost. The actual cost incurred for task 3 (for example cost of materials to be used in future) are not project progress-related and therefore would be excluded from the POC calculation at this point in time.

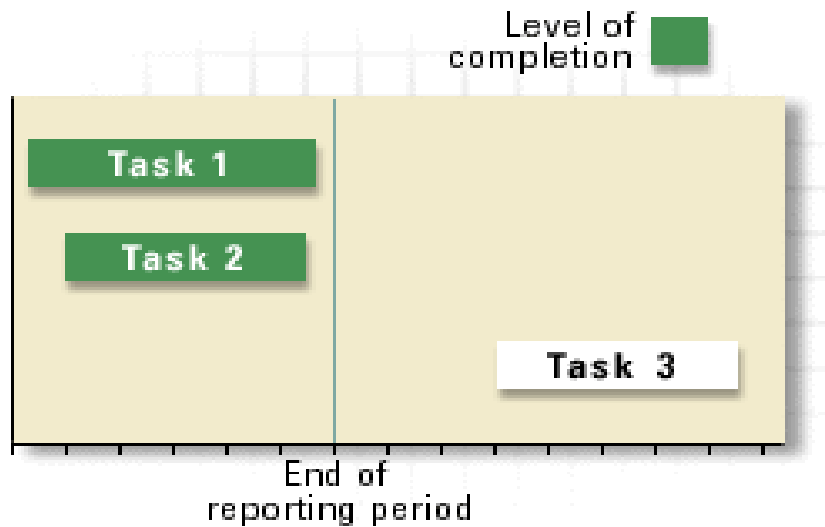


Figure 3.17 POC costs example

It should be made clear that the POC related figures in the quarterly reports reflect only progress related costs. In order to ensure that this occurs in practice, it has been shown to be useful to incorporate the discussion about capturing, categorizing, and allocating costs into monthly progress meetings.

Continuous recalculation is essential to the accuracy of the percentage of completion (POC) calculation. Only by continuously adjusting for the actual cost incurred, continuously recalculating the actual estimated total cost, and continuously

keeping total estimated revenue up to date is it possible to reflect the project's progress in the POC calculation.

While it is obvious that actual costs incurred and total estimated revenue impact the financial results and therefore should be tracked on an ongoing basis, a common mistake is to underestimate the importance of the estimate to complete (ETC). Under POC accounting, the estimate to complete impacts the financial results directly as it impacts the POC figure.

Investors and executive management make important decisions based on this data. Because of this, changes in the estimate to complete should be reflected in the POC calculation as soon as they are known. If the ETC is inaccurate and does not correspond to actual estimated total cost, proper decisions cannot be made or will be based on biased data.

Another essential for a valid POC calculation is a proper allocation of actual costs incurred and the proper calculation of POC cost.

To be able to allocate actual cost incurred on the project correctly and continuously estimate cost to complete, a process and method is needed that can help differentiate different types of costs and promote continuous recalculation. The process and method must reflect project scope, schedule, and cost in order to achieve this goal. One method that can be effectively used to do this is the work breakdown structure.

Control accounts are the focal point for the integration of scope, cost, and schedule in the WBS. Control accounts represent the adequate level of controlling detail for a specific project responsible person. All data that is more detailed than those at the control account level is aggregated bottom up for controlling purposes.

The WBS breaks down the control account level into more detail. The sufficient level of detail is determined by several factors:

- The lowest level of the WBS should be able to appropriately reflect project progress
- The structure of the WBS should be consistent. Tasks on the same level should be comparable in budget and schedule

- Significant pieces of work (for example work done by subcontractors, significant material purchases, or critical pieces of work) should be segregated

Once the project's scope has been established, the next step is to decompose the project. Decomposition is the process of subdividing the project's deliverables into distinctly manageable components. There are four major steps to be performed when decomposing a project

Note that this process of building the WBS is iterative; the project manager and his team may proceed through the first two steps of the process, and then find that they can break down the work packages and/or tasks further. The final WBS should support the financial controlling of the project in any aspects as described in the Siemens cost controlling requirements. The project manager and his team should re-evaluate the decomposition if any change orders are received to ensure that they have accounted for any new deliverables included in the change order.

Once the work breakdown structure (WBS) is done and sufficiently detailed, the next step is to allocate labor and material resources to the various work packages and tasks identified and coordinate the scheduling. This again emphasizes the importance of the WBS. Because the schedule and budget are tied to the activities in the WBS, any errors or omissions in the WBS will be magnified as the project progresses.

As soon as the available resources for the work packages and tasks are defined, scheduling can occur. Scheduling is the process of establishing begin and end dates. Every work package and every task should have a defined begin date and a defined end date. This is followed by establishing the logical dependencies of the work packages.

One technique of scheduling is the critical path. The focus of this method is to identify those tasks which have to occur on the schedule defined in order to accomplish the total project on time. There are other tasks which build up to the tasks on the critical path, so there is a priority to all tasks closely tied to the critical path tasks. The project manager can then allocate resources with a priority to these tasks.

No matter which scheduling methods are employed, the schedule must be documented in a clear manner to be useful. Many project managers use a chart

which graphically indicates the timeline for each task. One commonly used chart is called a Gantt chart.

The project schedule is a dynamic document, which must be revisited periodically and adjusted if any tasks along the way were not performed as scheduled.

Every work package and every task in a WBS needs its separate budget. A common error is to attempt to budget the project only at a high level. But without looking at each task in detail and determining its actual and budgeted cost proper financial controlling is not possible. Normally budgets are built from the bottom to the top and not vice versa.

As with all of the steps discussed thus far, the process of budgeting is not finite. The budget must be updated if there are any changes to the project scope or any other budget relevant issues occur.

Prior to and throughout the lifetime of a project, it is essential that risks, revenues, and cost are monitored constantly. Variances have to be analyzed and explained, with material deviations needing immediate action.

During a performance analysis, key performance indicators (KPI), as defined by management beforehand, are used to determine variances. KPIs are normally tracked and monitored over time to identify continuous trends. Under percentage of completion (POC) accounting, KPIs based on POC data are very useful because POC data directly links to the financial performance measurement of the group, division, and - the project. A POC based performance analysis defines where we are, where we are going and helps to define areas for further investigation. In these areas, the project management needs to dig deeper in a second step to find root causes and enable decision making.

The variance of actuals against budgets is used when checking for compliance with internal or external rules and regulations (for example US GAAP). Usually it looks at the figures over several periods of time.

The project profile or project list is normally the starting point for checking the variance of actuals against budget. Variance analysis is for example performed for ETC variance or actual estimated total cost.

After finding an error in the project data, it is important to check the materiality of the variance. Only material variances should be recalculated to determine the impact on the POC figure and on the financial statements and drive actions.

Project profile and project list are discussed in more detail elsewhere.

For the calculation of the POC figure it is essential that the underlying data reflect a true and fair view of the projects reality. The key to this requirement is to show the project's progress properly. But no project management tool or method will be effective if used improperly. Therefore, the project manager has to make sure that progress is tracked continuously and that the monthly closing of project data is representative.

In practice it is valuable to have a formal process in place to monitor and analyze the project's POC data. This should be done in monthly progress meetings. The benefit of this is twofold.

First, as a business entity, The company has to report quarterly to the financial community. Second, the company management has to report business results internally in quarterly review meetings. Holding monthly meetings that focus on representative monthly closing of POC data can help avoid unexpected corrections and ensure that shareholders and executive management have accurate information.

It is very important for the project manager to know where the project stands and where it is heading financially. Monthly meetings help ensure that the POC relevant data is representative and can be used for performance analysis on a regular basis .(The Company's Construction Project management standards, 2006)

3.5.2.8 Effective project management approaches

The project manager is responsible for selecting appropriate methods to be used to manage and control a project. But a project management approach has to be compliant to the project controlling requirements of the respective reporting entity, such as the business unit or the operating company.

The project controlling requirements on the business unit or company level are derived from the The Company's corporate project controlling requirements. The Groups and divisions have to translate project controlling requirements into definitive guidelines for the projects in the area of their responsibility.

An effective project management approach has to provide the basis to properly monitor project progress. Project management practices must ensure cost controlling requirements.

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An effective project management approach has to provide the basis to properly monitor project progress. Project management practices must ensure project controlling requirements.

The earned value method and the critical path method among others are project management approaches that have been used to fulfill the controlling requirements and to monitor project progress in The company.

The earned value method is an approach to measuring project progress by assigning each project deliverable a value. The value given to each deliverable, or its subsidiary work packages, is its budgeted costs.

The value is earned only when tasks are complete. Until that point, no value is earned, even though some work has already been performed on the task. Therefore a detailed WBS is required in order to monitor project progress as accurately as possible. (Yaman, 2006)

The earned value method provides an objective measure of project performance by:

- Providing a basis for accurately and realistically forecasting estimated total costs
- Providing a reliable basis for computing project progress, and thus providing accurate POC data
- Identifying cost and schedule over-runs early enough to allow the project manager and his team to address the issue before it compounds.

- Alerting project management to problem areas without requiring that every work package be monitored constantly. If the control account is within the thresholds prescribed by the project manager and his team, there is no need to investigate each work package.

The budgeted estimated total cost is the original budget for the entire project work to be done.

The budgeted estimated total cost is set during the cost budgeting process during the project's planning phase.

First, the costs of all project tasks are estimated and summed up for an estimate of the project's budgeted estimated total costs. Management must then sign off the cost estimations.

After the sign-off, budgets are fixed and are used as the basis for establishing incentives.

Budgeted estimated total cost is used as the basis for comparison to actual estimated total cost. Variances from budgeted estimated total cost can be used in both performance and financial analysis.

The budgeted cost of work scheduled (BCWS) provides a snapshot in time of how much work is planned to be completed at a specific date. It represents the sum of the value of all tasks to be completed at that date.

BCWS increases over time. All tasks are planned to be completed at the planned end of the project. At this point BCWS should be identical to the budgeted estimated total cost of the entire project.

BCWS is set in the cost budgeting process during the planning phase. The BCWS-curve shown in the figure 3.18 is the baseline. (The Company's Construction Project management standards, 2006)

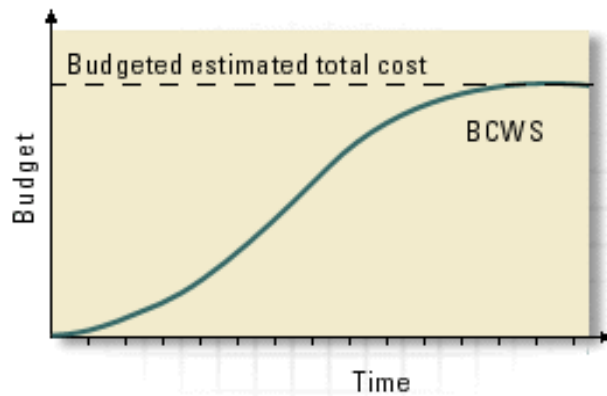


Figure 3.18 BCWS curve

The budgeted cost of work performed (BCWP) tracks the value of completed tasks. BCWP is determined by first identifying all of the tasks that are completed at a specific point in time, then summing the corresponding budgeted costs for each task.

BCWP increases over time as does the budgeted cost of work scheduled (BCWS). If the BCWP is bigger than the BCWS, then the project has delivered value faster than scheduled. If the BCWP is smaller than the BCWS, then the project is behind schedule.

The actual cost of work performed (ACWP) is the amount of costs spent to complete a task. ACWP records the costs only after a task has been completed; it does not record the costs incurred by the tasks that are still in progress. ACWP is accumulated for all tasks completed at a specific point in time.

By comparing ACWP with the budgeted cost of work performed (BCWP) it is possible to define, in general, whether completed tasks cost more or less than budgeted.

Cost variance (CV) is the difference between the costs of tasks that should be completed at a specific point in time (earned value or budgeted cost of work performed, BCWP) and the costs of tasks that are actually completed (actual cost of work performed, ACWP). Cost variance is calculated as follows:

$$CV = BCWP - ACWP \quad 3.1$$

If CV is higher than 0, the costs of tasks completed is lower than budgeted. Project work has been more efficient than originally planned.

If CV is below 0, the costs of tasks completed is higher than budgeted. Project work has been less efficient than originally planned. A negative CV, as shown in the graph below, can be caused, for example, by higher than budgeted material costs. To avoid negative CVs in the future, it may be advisable to review the purchasing process for systematic cost management issues. In the example, both CV and schedule variance (SV) are negative. CV is calculated as follows:

$$ACWP = 60.000\text{€} \quad 3.2$$

$$BCWP = 40.000\text{€} \quad 3.3$$

$$CV = 40.000\text{€} - 60.000\text{€} = - 20.000\text{€} \quad 3.4$$

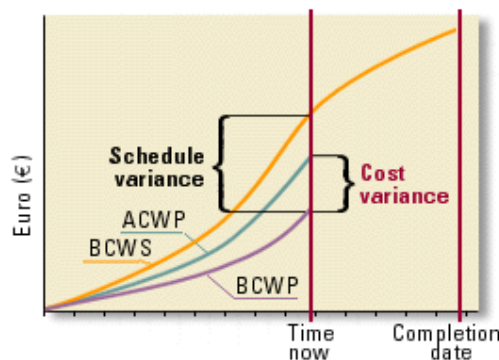


Figure 3.19 Schedule and cost variance curve

Schedule variance (SV) is the difference between the budgeted cost of the completed tasks (earned value or BCWP) and the tasks that should have been completed according to the work plan (BCWS) at a specific point in time as shown in the figure 3.19:

$$SV = BCWP - BCWS \quad 3.5$$

If SV is above 0, the project is ahead of schedule. The project has earned value faster than planned.

If SV is below 0, the project has earned value slower than planned.

A negative SV, as shown in the graph below, could be caused, for example, by the delayed supply of materials.

In the example, both SV and cost variance (CV) are negative. SV is calculated as follows:

$$BCWS = 80.000\text{€} \quad 3.6$$

$$BCWP = 40.000\text{€} \quad 3.7$$

$$SV = 40.000\text{€} - 80.000\text{€} = - 40.000\text{€} \quad 3.8$$

The cost performance index, or CPI, is a summary KPI which measures efficiency of efforts spent. The ratio represents the relationship between budgeted cost of (physical) work performed (BCWP) and actual costs of work performed (ACWP).

The CPI is calculated as follows:

$$CPI = BCWP / ACWP \quad 3.9$$

A project with a CPI less than 1 is not performing as efficiently as planned. If the CPI is greater than 1, the project is exceeding planned efficiency.

Assuming ACWP and BCWP of a hypothetical project are EUR 60,000 and EUR 40,000 respectively, CPI is calculated as follows:

$$CPI = 40.000\text{€} / 60.000\text{€} = 0,67 \quad 3.10$$

CPI can be used to recalculate ETC by applying the historical CPI to unearned tasks. Assuming budgeted at completion (BAC) for the project equaling EUR 120,000, ACWP equaling EUR 60,000, and CPI equaling 0.67, ETC is recalculated as follows:

$$ETC = (BAC - ACWP) / CPI = (120.000\text{€} - 60.000\text{€}) / 0,67 = 89.552\text{€} \quad 3.11$$

The schedule performance index, or SPI, is a summary KPI that determines whether the project is on, ahead, or behind schedule by calculating whether the project has earned (budgeted cost of work performed, BCWP) more or less than scheduled (budgeted cost of work scheduled, BCWS) by a given period. SPI is calculated as follows:

$$SPI = BCWP / BCWS$$

3.12

A project with a SPI less than 1 is not performing as efficiently as scheduled. If the SPI is greater than 1, the project work performed exceeds the Schedule. (Siemens AG Construction Project management standards, 2006)

Assuming BCWP and BCWS of a hypothetical project are EUR 40,000 and EUR 80,000 respectively, SPI is calculated as follows:

$$SPI = 40.000\text{€} / 80.000\text{€} = 0,50$$

3.13

3.5.2.9 US GAAP and required reports

Financial accounting and reporting helps decision makers by communicating where and when resources have been spent and commitments have been made, by evaluating performance, and by indicating the financial implications of putting strategy into action. Accurate financial data helps to predict the future effects of decisions and to direct attention to current problems/opportunities.

Finance professionals adhere to a set of accounting principles that are usually regulated by local government authorities. US GAAP (Generally Accepted Accounting Principles) is a set of accounting principles that must be used in the USA. Many international business entities also chose to use US GAAP.

The Company's consolidated financial statements will be published according to US GAAP for the first time in fiscal 1999/2000. At that point, The company will fulfill the basic requirements for a listing on the New York stock exchange.

Both internal and external factors contribute to the decision of the company to convert accounting to the US GAAP standards.

One of the most significant accounting changes with the introduction of US GAAP is the necessity for changing project business accounting to the percentage of completion (POC) method. The primary reason for recording revenue using the POC method instead of the completed contract method is to recognize revenue as it is earned on the contract instead of recognizing revenue upon delivery. (Genç, 2006)

3.5.2.10 POC Methods of calculation

Construction accounting applies to contracts for which specifications are provided by the customer. The company often refers to construction contract activities as projects. Project business is a major portion of the company business. Projects must be accounted for in a business entity's financial statements to provide a true and fair view of the business entity. Generally, projects can be accounted for under two methods: percentage of completion (POC) or completed contract. The POC method recognizes income as work on a contract progresses.

The completed contract method recognizes income only when the contract is complete. US GAAP/SEC requires the use of the POC method in most cases.

The basic formula for determining revenue under the POC method is:

$$\text{POC revenue} = \text{POC} \times \text{Total estimated revenue} \quad 3.14$$

This formula requires accurate data, which must be in accordance with fundamental guidelines. Since under the POC method income is recognized as work on a contract progresses, the measurement of the extent of progress toward completion is an essential factor in determining the amount of POC revenue that will be recognized.

The four acceptable POC methods of measuring the extent of progress toward completion are:

- Cost to cost method
- Earned value method
- Units of delivery method
- Contract milestone method

Each company business unit must define a policy of which of the four methods will consistently be applied for each class of construction contracts.

In the course of completing a project, many special situations can occur. These include changes in the total estimated revenue, changes in costs resulting in a projected loss on the contract, and the possibility of risks arising that can affect the project's profitability. Each of these special situations must be accounted for in the

POC calculation in order to ensure that a true and fair view of the project's progress is reported in the business entity's financial statements. (Genç, 2006)

3.5.3 Resource Control

Resource management in the company involves the following activities:

Planning includes setting objectives, defining scope and work, estimating labor and equipment requirements, assessing safety issues, and analyzing risks (contingency planning, developing alternative strategies, insurance). Planning also involves the development of a work plan. Project work can be decomposed into small, clearly identifiable work packages within a work breakdown structure (WBS). The work packages can be used for resource loading and resource leveling

Programming is the coordination of sequential work efforts over a longer time horizon. A clear structure is required to coordinate and monitor a number of activities within a project. Resources, both material and labor, need to be defined and allocated to the activities

Budgeting is the process of defining cost targets for work elements. It can be accomplished through top-down budgeting, bottom-up budgeting, and iterative budgeting. Various tools are used to establish budgets but tools which promote consistency of data between internal project management and financial reporting are encouraged. Earned value is such a tool

Executing funds management requires close monitoring of project progress and variances between budgeted and actual figures. Control accounts are used to control the execution of funds and disbursements for materials, labor, and subcontractors. Similar controls are required around funds receipts (Özdemir, 2006).

3.5.4 Schedule Control

Scheduling contract performance is done, for example, with the help of network techniques, such as critical path method (CPM), or with the help of Gantt charts. Project activities need to be synchronized in order to deliver on schedule.

To ensure that contract performance is in line with technical specifications requires regular review meetings concerning project progress and good communication within the project team as well as with the client. (Yaman, 2006)

As soon as the available resources for the work packages and tasks are defined, scheduling can occur. Scheduling is the process of establishing begin and end dates. Every work package and every task should have a defined begin date and a defined end date. This is followed by establishing the logical dependencies of the work packages.

The critical path method (CPM) is one of the most common approaches to scheduling project work in Siemens. It is a network technique that is used primarily for schedule management.

The focus of this method is to identify those tasks which have to occur on the schedule defined in order to accomplish the total project on time. There are other tasks which build up to the tasks on the critical path, so there is a priority to all tasks closely tied to the critical path tasks. The project manager can then allocate resources with a priority to these tasks.

CPM meets only some of the project controlling requirements. It cannot be used for budget and cost control without supplementary tools. CPM can be part of WBS packages that include both schedule and budget.

CPM identifies the project's critical path on which activities can not be delayed without delaying the completion of the entire project. It also indicates "slack" activities, those that can be delayed without lengthening the project completion time. (The Company's Construction Project management standards, 2006)

There are a few ways to improve the schedule. Like: Improving productivity, increasing staff, working overtime, reducing the work, subcontracting part of the work. Improving productivity is the best and cheapest way to increase the speed of doing the work, either by using better qualified workers or by improving management and work methods. Overtime is the next and most commonly used option in company. The system can immediately increase the available staff hours on a project by 15 to 30 percent. Reducing work load to regain schedule is another route that is considered. It is applicable only in those cases when some work operations can be eliminated to save time. (Özdemir, 2006)

3.5.5 Quality Control

The aim of Operative Quality Management in the company is to lay the foundations for trustbased, effective cooperation with our customers, partners and staff. Such

cooperation must be based on systematic, clear and proactive approaches towards honoring contractually agreed warranties and performances. The pragmatic approach in the project, with its focus on the requirements relevant for quality, supports the Project Manager in charge (as well as the project teams) in performance of their tasks.

Operative Quality Management (QM) is an integral part of the The Company's project management process and comprises the active planning and lasting assurance of quality requirements throughout the project, in an efficient and target-oriented fashion and in all phases. As an expert and partner, the Quality Manager (PQM) assigned to the relevant project supports the Project Manager in effective planning, implementation and control of the project-specific actions taken for quality control. These actions are of a predominantly preventive effect

QM has the additional goal of systematically generating findings through analyzing and drawing conclusions from past experience— strengths and improvement potential – which can be of benefit to future business.

All proposals and stipulations always relate to the project phase and are independent of the type of business. Quality assurance is of special significance, all the way from the planning phase right through to contract finalization. Deficits and errors committed in this phase can burden the entire project substantially and can rarely be rectified – with all resultant consequences for the customer and the company. (The Company's Construction Project management standards, 2006)

Quality control involves all project activities from the conceptual stage to project turnover. Substandard quality is not acceptable at any price. Everyone working on the project- owner (The Company's real estate department), project team (The Company's project team), design organization (design company), procurement group ((The Company's procurement department), and construction forces (construction company)- plays a major role in quality control. It is the owner's role to establish the quality desired and to ensure that it is delivered. The project managers are responsible for implementing the quality control processes for the project and leading and monitoring the quality control effort . (Yaman, 2006)

4 Conclusion

4.1 Evaluation of The Company's project management approach regarding the general PM approaches

It can be stated definitely that the company generally uses traditional project management approach combined partially with total quality management techniques.

Indications for traditional approach are:

- The general project management approach in the company is result-oriented rather than process-oriented.
- Plans usually push tasks to carry out.
- No buffer tasks are planned.
- Control is focused on time and control rather than tasks.
- The objective of time control is production and progress rather than productivity.
- A budget is prepared for each resource, and the use of resources is monitored against their budgets.
- WBS is the key element in project control.
- CPM is used as a scheduling tool.
- Causes of deviations are not investigated thoroughly.
- Progress toward project completion is tracked by accumulating the earned hours and comparing that to the total hours to be earned for the entire project.
- Quality control is implemented as a separate control mechanism.

Indications for total quality approach are:

- Customer satisfaction is highly aimed.
- The inside company communication is rather strong. Members from different project teams frequently come together in meetings.
- Teamwork is highly encouraged. But employees at all level are not involved in decisions.
- Continious education of project teams is highly valued.

4.2 Mistakes in operating the controls in the company

Despite the fact that the company has a well established project controlling system some serious problems occur in cost, schedule and labor resource control . Here are some examples:

- Occurance of non-conformance
- Overestimating the construction cost and thereby making the project uneconomical
- Failure to maintain good project and client/contractor relations.
- Failure to properly document meetings, project changes, telephone calls, and other important project happennings to defend its position against some possible criticism in case of trouble.
- Failure to control meetings, which makes them nonproductive.
- Failure in taking early action to correct project running behind schedule
- Failure in using overtime wisely

4.3 Recommendations

In summary, the following recommendations can be made for successful Project Controlling in the company:

Recommendation 1:

Establish a project-driven organization, and assign project teams (with clearly defined authorities and responsibility in the hands of the Project Manager as entrepreneur).

Modern Project Controlling that points out problem areas at the right time to its Project Manager and its own management must be integrated in a consistent project handling process that is characterized by a free flow of communication between the hierarchic levels concerned. However, Project Controlling can contribute to improving the results of the project only if clearly defined overall responsibility and authorities are assigned to the Project Manager. As a result, integration of projects in a project-driven organization becomes a matter of course.

Recommendation 2:

Empirical data shows that 60% to 70% of all non-conformance costs are identified during the handling of a project, but the causes of these costs lie in the bid phase of a project. For this reason, the cost controlling process must be performed continuously, all the way from the bid through to the end of all obligations entailed in a project. Modern cost controlling supports the management of risks/opportunities, claims and change orders as an integral part of the project process and lies within the Project Manager's sphere of responsibility.

Recommendation 3:

A project must be implemented consistently in accordance with defined rules and decision levels as early as in the bid phase. Mandatory milestones and associated documentation of the results have thus been introduced as a basis. In the project process, the mandatory milestones play an important role in the success of project activities. But also buffer tasks should be planned to switch to in case of unexpected situations.

Recommendation 4:

Standardized and regular reporting takes place at Group level; associated controlling parameters are defined in a business-oriented fashion. The main tasks of Project Controlling are to ensure that the project activities of all organizational units involved in the project are clear, and that support is provided for commercial project processing. The result-oriented processing of projects requires current and up-to-

date controlling of business administration, technical and contractual parameters. The controlling process, in dialog with management, is supported by standardized project meetings.

Recommendation 5:

A successful project manager must possess strong leadership and motivational capability, high standards of ethics and integrity, personal drive, multidiscipline capability, common sense, physical stamina and mental toughness. He or she also has to be an effective manager, a strong communicator, problem solver, patient and imaginative. It's in his or her hands to balance the relationship between client and contractor.

Recommendation 6:

The meeting leader's ability to control the meeting is the most important requirement for the meeting's success. The meeting leader must always keep the meeting goals in mind while controlling the meeting. Writing the goals makes them clearly understood and available for reference during the meeting. Although steering the meeting requires a firm hand, it also must be done with tact and diplomacy to permit valuable input from all attendees.

Recommendation 7:

Issue the meeting minutes promptly, to remind people to get started on their action items. They should not be given an excuse to forget about their assignments. Every effort should be made to issue the meeting minutes no later than 24 hours after the meeting.

Recommendation 8:

It should be avoided that overtime is used as a ploy to attract workers during periods of skilled-labor shortage because the high premium for construction pay and resulting loss of efficiency can combine to ruin the field labor budget.

Recommendation 9:

The company should start to implement contemporary project management techniques where productivity is aimed rather than production or progress, and

causes of deviations are deeply investigated and improved scheduling tools that can reflect flows between conversion processes are used.

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