Managing the Development of Building Projects for Better Results

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Introduction

It is reasonable to assume that the objective of a building project is to create the best possible facility for a given level of expenditure. If this is true, then the objective of management during the development stage of the project should be to establish an effective project team, a unity of purpose and commitment to results.

Yet the process of managing a project through the development phase is frequently not well understood by the principal players. And the dynamics of their separate interests may well run counter to the overall project objectives.

Indeed, in North America the adversarial attitude amongst the various segments of the building industry is so entrenched that it is some times difficult to persuade the parties to the project to act together in the common interest. At least, not without good communication, or perhaps a gentle education program.

So, the development manager, or project manager, must be aware of the dichotomies that exist and the pitfalls that he or she faces. This is the first step in understanding and improving the performance of the team and the resulting development process.

Management and the Principal Parties

The principal parties to a building project and their respective interests may be identified as follows:

- The "Owner as Sponsor" anxious to maximize return on investment, perhaps at the expense of operational costs
- The "Owner as Operator" anxious to minimize operating costs, perhaps at the expense of initial capital costs
- The "Designer" anxious to provide a good design service and build a reputation for future work, perhaps by creating a “professional image” in the final building
- The "Constructor" anxious to maximize profit, especially if severe market competition has resulted in tight firm-price margins
- The "Project Manager" anxious to set the stage for a successful project implementation through efficient management.

These relationships must be managed just as positively as the technical aspects of the project. Thus the objective of project management may be said to be the achievement of predetermined specifics within given targets of quality, time, cost, and client satisfaction. A successful project is therefore one which is perceived as having achieved satisfactory trade-offs within these parameters.

Management in the project context means to plan, organize, execute, monitor against the plan and then control by taking corrective action. Or in simpler terms: “To direct by saying what you are going to do before you do it.” This provides an opportunity to modify your actions at minimum cost and maximum effect. Provided always, of course, that this does lead to procrastination beyond the period of opportunity for effective action!

It must be understood that this approach is particularly sensitive amongst team members during the development stage of the project when its functional design is being determined. Professionals understandably do not like to feel that they are being restricted in their professional judgment, second guessed or criticized. Cautious but candid, constant and complete communication between all members of the project team is therefore essential.

The Project Plan

Establishing a conceptual project plan in terms of scope, quality, time and cost in the earliest phase of the project may sound simple. But even if it is, the subsequent monitoring of the development phase against the plan may be anything but simple. The problem arises because the way a project feasibility (financial viability) is put together is not the way the building is built and consequent hard costs collected.

For example, a pro forma analysis may well be established on the basis of a cost per square meter or other similar parametric units. Examples includes the number of suites in an apartment, number of rooms in a hotel, beds in a hospital, and so on. These parametric units are based on experienced and data collected on previous similar building projects. The construction costs on the other hand, and the forward estimating of these costs during the development stage for budgeting purposes will generally follow trade practices, as set out in the Canadian Masterformat or UCI coding systems.

The preparation of drawings and sketches during the development phase in effect converts concept unit costs into trade category costs by establishing form and choice of materials. Such matters as foundations, structure and finishes are selected from such alternatives as concrete, steel, aluminum, wood, glass, block, drywall, etc. Indeed, a number of materials and their respective installation trades may be used together to form a "system" such as the building "envelope." Certainly, the electrical and mechanical services designs will directly or indirectly affect a majority of the trades on the project and vice-versa.

Thus, the original budget in concept or pro forma terms must be converted into a corresponding working budget. This must be conducted through the design process, yet without losing control over the original project objectives. This essential aspect of the development stage is made the more difficult because the building industry is fragmented into various specialty trades. While each has a good understanding of its own technical processes, and vested interests, often they have less than complete understanding of the management process as a whole.

For example: the primary players

The owner as sponsor may have difficulty in understanding the length of time required to detail a preliminary design into working drawings, including meeting the necessary regulatory standards and approvals.

The owner as operator may have difficulty in understanding the importance of knowing in detail what he is getting as the design develops and the extra difficulty and costs involved in making changes and additions later on if he doesn't.

The designer is concerned with technical and professional excellence which impacts on the performance cost relationship and may conflict with cost effectiveness. Generally, neither the most expensive nor the cheapest ranks highest from a return on investment standpoint. The designer is understandably concerned with maintaining the profit from his fee by holding down the cost of design and supervision, as well as potential liability, This may well act as a brake on innovation. On the other hand, an increase in design scope may be promoted for an increase in fee, to the detriment of budgetary control.

The contractor may have difficulty in understanding the designer's problems and is probably never given the owner's objectives. He considers that these are not his concern. His concern is with productivity and costs on a fixed price contract and because contracting is a high risk business, his incentive is powerful. Other team members do not always appreciate just how powerful this incentive is, and the effect on the contract if this effort is frustrated by them, or the effect on the budget if the incentive is removed. The contractor, too, will be interested in genuine increases in scope of work since this will increase his opportunity to increase profit, although a myriad of small changes is almost always counter productive through reduced productivity.

There are others who are closely involved in the development process who may also have limited understanding.

For example: the secondary players

The financial accountant being generally unfamiliar with either the development or construction process has difficulty in understanding why the budget cannot be fixed from the beginning and hence is suspicious of any adjustments. He tends to be unsympathetic toward human error and oversight, not withstanding the highly complex nature of building design coordination and the construction execution of a modern building. Moreover, genuine savings between "actual" and "what might have been," receive scant attention because such numbers are "soft" and do not show up on a balance sheet.

The lawyer too, is often in a similar position and provides advice from the limited perspective of his professional calling. Indeed, there are all too few lawyers practicing in this specialized field with a knowledge of what it really takes to achieve a successful project,. Many contracts in use on building projects still consist of obscure legal language or legal niceties designed to protect one party against the other - perhaps unfairly. "Time is of the essence" and breach of contract are good examples of two such thorny issues.

Such contracts actually reduce the chances of success and increase the chance of conflict because of the difficulty the parties have in understanding their respective obligations. The situation is further exacerbated by the apparent absence of indications of good will and cooperative effort to mutual benefit. A contract can be so one sided as to be self-defeating.

Misuse of standard contract documents

On the other hand, good contract documents prepared by standard documents committees, but applied without legal advice, may be used "off the shelf" without understanding the real intent conveyed between the parties. Attempts to modify such documents in order to change the underlying philosophy of the division of responsibilities between the several parties involved in the design and construction processes, even with using legal advice, should be avoided. This can lead to a legal maze and the raising of fundamental issues.

The very approach of Development Project Management is a good case in point. There are still no well-established and well-understood project contract documents and agreements in this area. Documents which reflect the requirements of the knowledgeable owner who wishes to manage the project process himself or manage it through a project manager as his independent agent have not been well established.

The project manager is himself constrained by the often conflicting goals of scope, quality, time and cost. He may not appreciate that upon their successful attainment, the accolade so richly deserved by the team fades like a mirage as the serious business of start up and revenue earning gets under way. In fact, there are other objectives which in retrospect are often seen as of greater importance and should not be lost sight of. These include client satisfaction, follow on work, and business development spin-off for the project manager's own company or division. A tightrope walk indeed.

Improving Performance Through Understanding

The question is, how to make the development process work better? Good books and articles on project management and appropriate management tools and techniques are available to the manager for reference and the number is steadily growing. Too few are read by the specialists involved in the process as they are not seen as relevant to their work.

Yet projects are built by people and their effective interaction through understanding.

Successful companies succeed by putting together people who work well together, whether from within their organization or outside it. Virtually all their effort is committed to the common objectives, rather than the conflicts to which the complex relationships of the project are naturally prone. The twin keys are commitment and communication - commitment by team members to pre-established project objectives and continuous and effective communication of those objectives. Not necessarily more communication is required, but rather better quality and better directed information and understanding.

Even our educational establishments seem to be slow in taking this up as a challenge in the specific context of project work. It is the more regrettable, considering information and communication techniques properly handled on a project can result in substantial savings.

And bear in mind that in North America, the industry as a whole represents over a quarter of the gross national product.

The following diagrams have been developed from information on a large number of building projects, typifying the project development process.

The Project Life Cycle: Four Basic Phases

Figure I shows a typical project life cycle separated into its generally accepted four fundamental phases. The figure also lists the activities to be expected in each phase. The phase separations correspond to key decision points for purposes of executive level control.

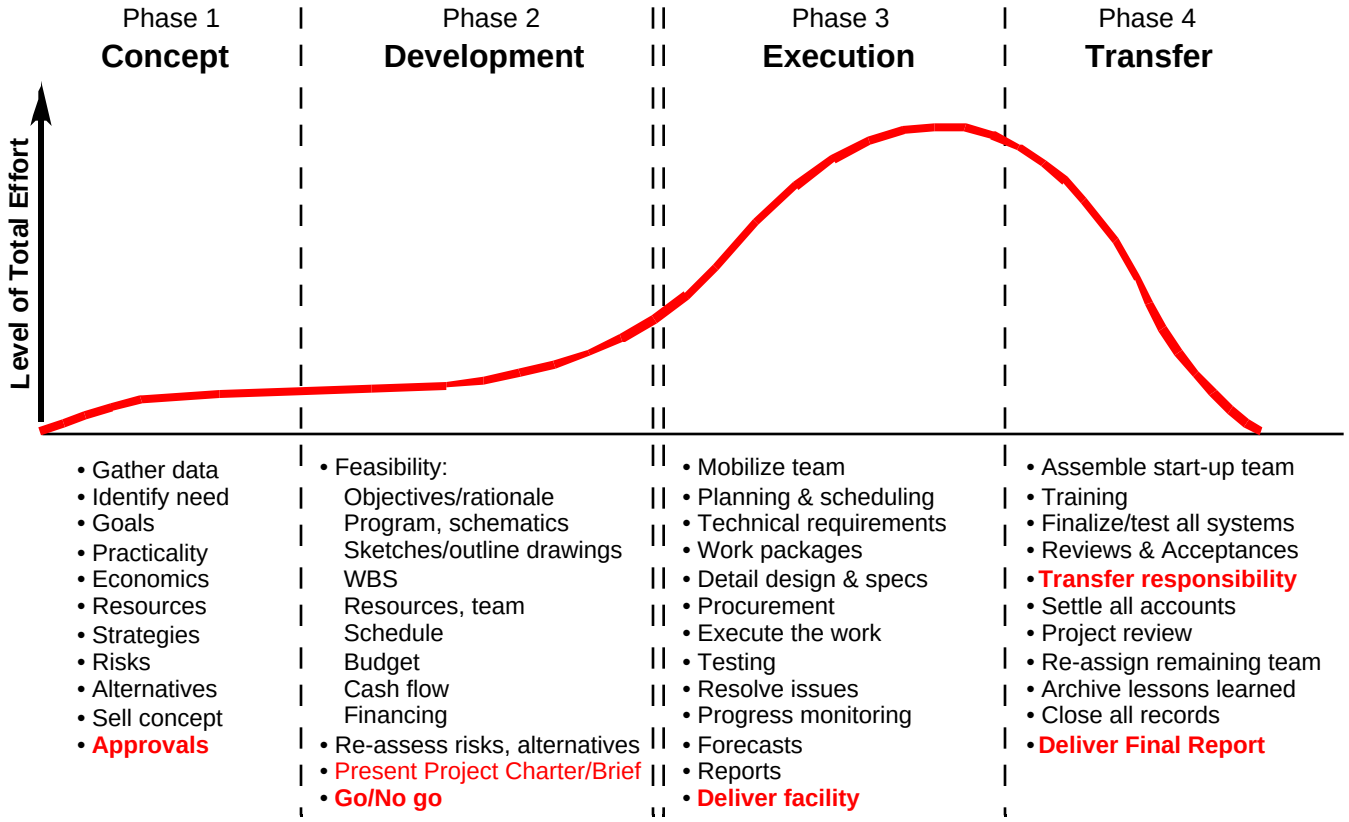

Figure 1

Not all projects, of course, conform rigorously to the stages shown and the activities within each may vary somewhat. However, less than satisfactory project performance and lack of control can frequently be traced to significant departures from the division of activities as shown. The so-called "fast-track" approach to project implementation, i.e. the sequential procurement of separate design packages may be viewed as a departure. Nevertheless, for effective control each design package must still follow the phases shown.

A Typical Building Project Bar Chart Schedule

Figure 2 shows a typical building project bar chart which relates the master schedule activities to the phases outlined in Figure 1. You will see that the acceptance of a tender and award of the major contract is taken as an arbitrary zero on the time base. This is because it is a clearly defined point in time and its significance in the life of a project is commonly understood. The time durations shown were derived from a fairly large sample of building projects costing from under $1 million to several million, and are considered to be representative.

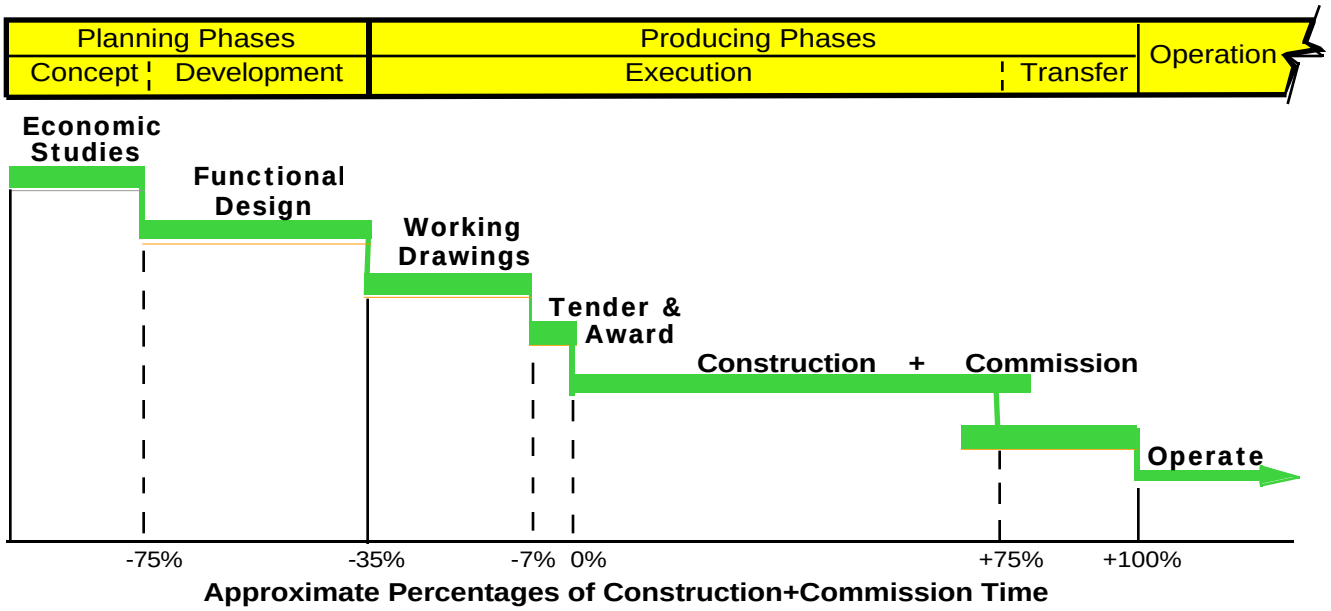

Figure 2

From the data, you will be interested to note that most projects have been in existence for as long as it will take to construct them. The implication is that the start of construction must be preceded by adequate time for conceptual and functional planning as well as the preparation of the necessary design and administrative documents and procedures.

Some Valuable Manpower Loading Data

Figure 3 shows typical manpower loadings for the design and construction forces on the same sample of building projects as for Figure 2.

Several broad points are of interest here:

- The manpower loading curve on a construction site over the duration of the construction schedule is typically an asymmetrical bell curve
- It is well represented by the trapezoid shown in the figure, where labor peaks at about 160% of average, from the 50% to 75% points of the construction schedule
- The man hours required for working drawings is approximately three times that required for the concept/feasibility consulting work

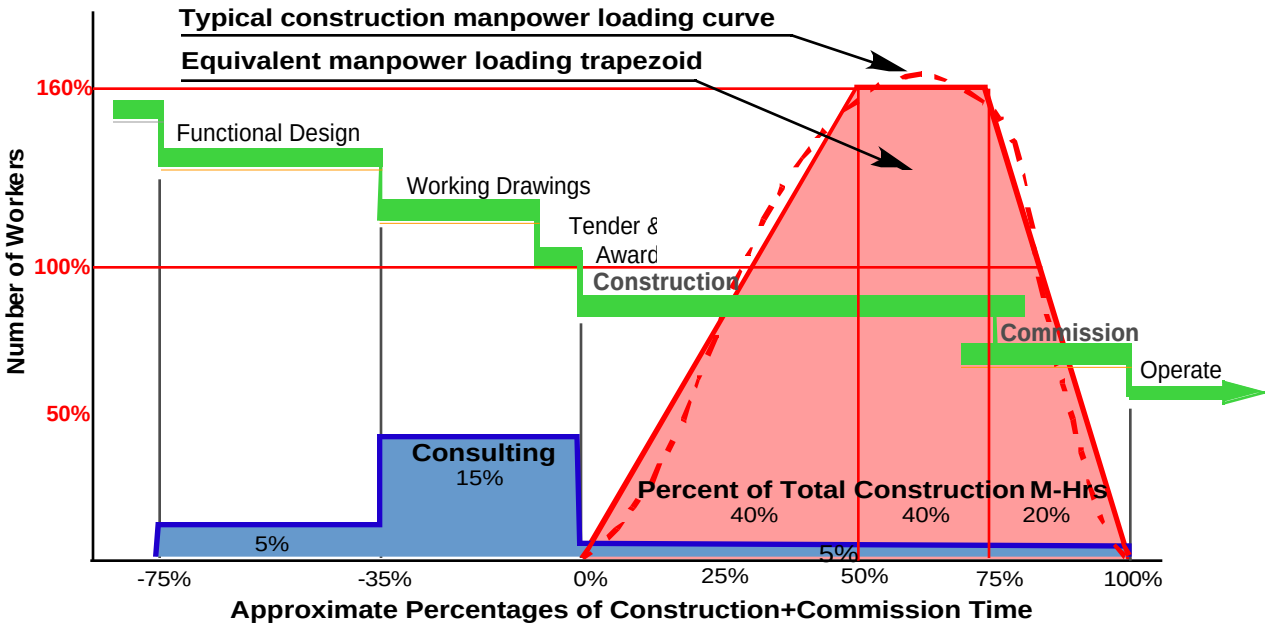

Figure 3

- Depending on the type of facility, the total man-hours invested by management and its design teams will amount to at least 25% of the on-site labor man hours, as shown in Figure 4

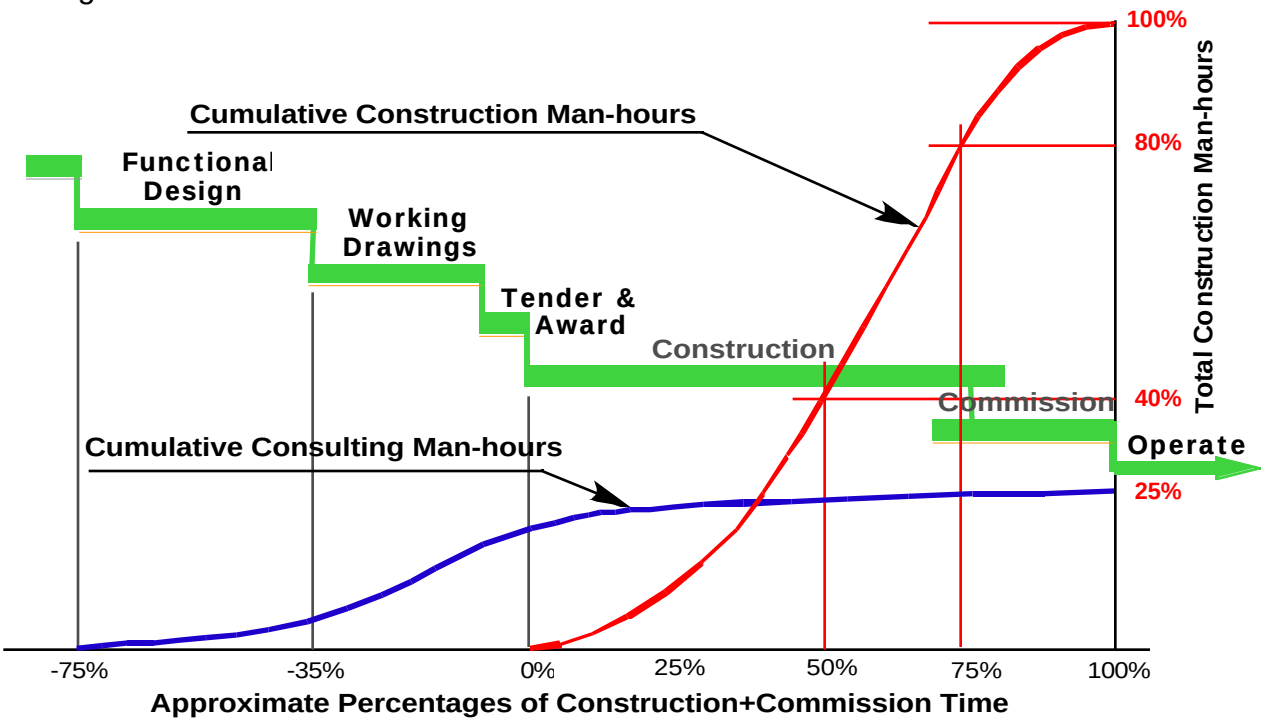

Figure 4

- Since on-site labor constitutes approximately 40% of the construction cost, it follows in very general terms that one dollar invested in design effort corresponds to ten dollars of construction investment

- A "fast -tracking" approach will enable some overlapping of the working drawings and early construction stages, perhaps as much as 30%. More than this will be counter productive in terms of increased time and cost of coordination efforts

An Information Explosion

Figure 5 shows the rate of development of information during the various stages of the project.

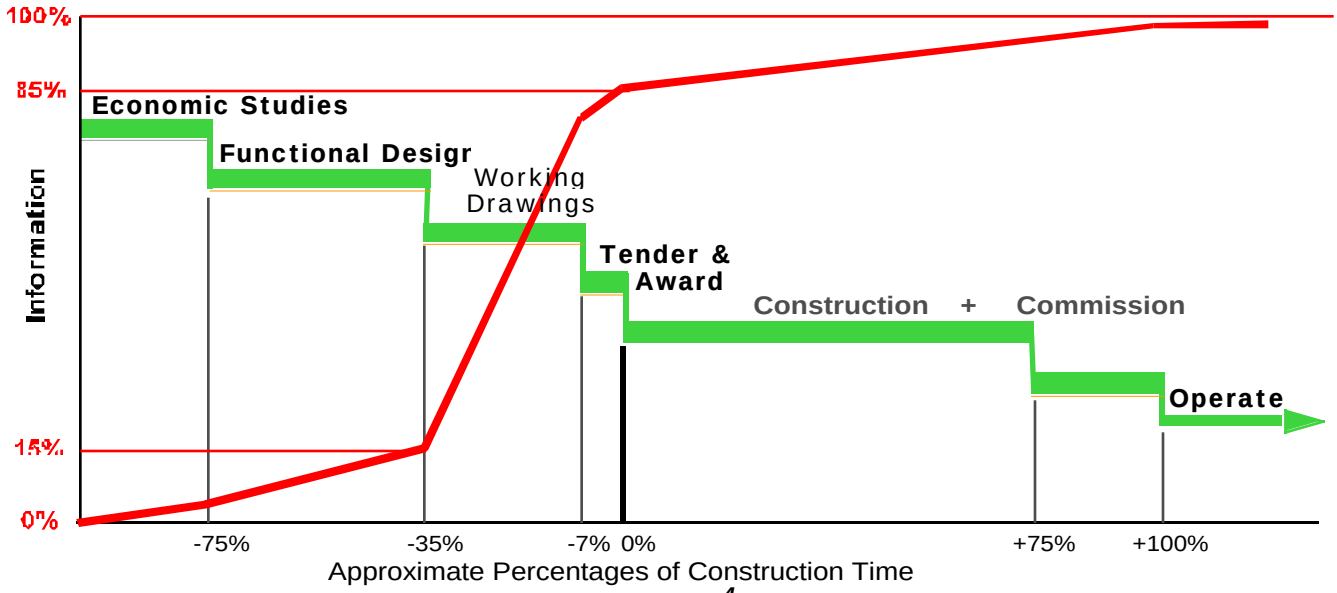

Figure 5[4]

As you might expect from Figure 3, project information expands rapidly during the detailed working drawings stage. In fact it probably grows from about 15% to 85% of the total in this stage. Since this work is highly dependent upon the quality of the work done in the previous phases it is vital that these earlier phases deal with all necessary aspects, the information is of high caliber and, above all, is reasonably firm. Equally, it is vital that the development of working drawings by all the disciplines involved be managed and monitored against the approved terms of reference.

Ability to Influence the Final Cost

Figure 6 shows the extent to which the ability to influence the final cost of the project diminishes as the project moves forward. Obviously, the owner's requirements, and to a somewhat lesser degree regulatory requirements, have primary impact on the project's final cost.

Some degree of iteration is inevitable and normal during the Concept and Development (Planning) phases of a construction project in order to test ideas and see what works best. However, assuming an otherwise orderly progression without significant back-tracking, the ability to influence the final cost drops rapidly during these phases. As the specifications and working drawings are developed during the first stage of the Execution phase, the opportunities are even further diminished.

The Significance of Project Management during the Design Stages

For the reasons just noted, significant management effort must be applied to, and accepted by, the design team during the planning phases of the project, if satisfactory control is to be maintained. Similarly, undue re-examination or shifts in original scope must be avoided by the owner/sponsor if design development is to proceed efficiently and on schedule. Conversely, if this work does come in for significant revision it is clear that the project is not in fact ready to move forward into more detailed work. In this case, the project should be paused until the issues are properly sorted out.

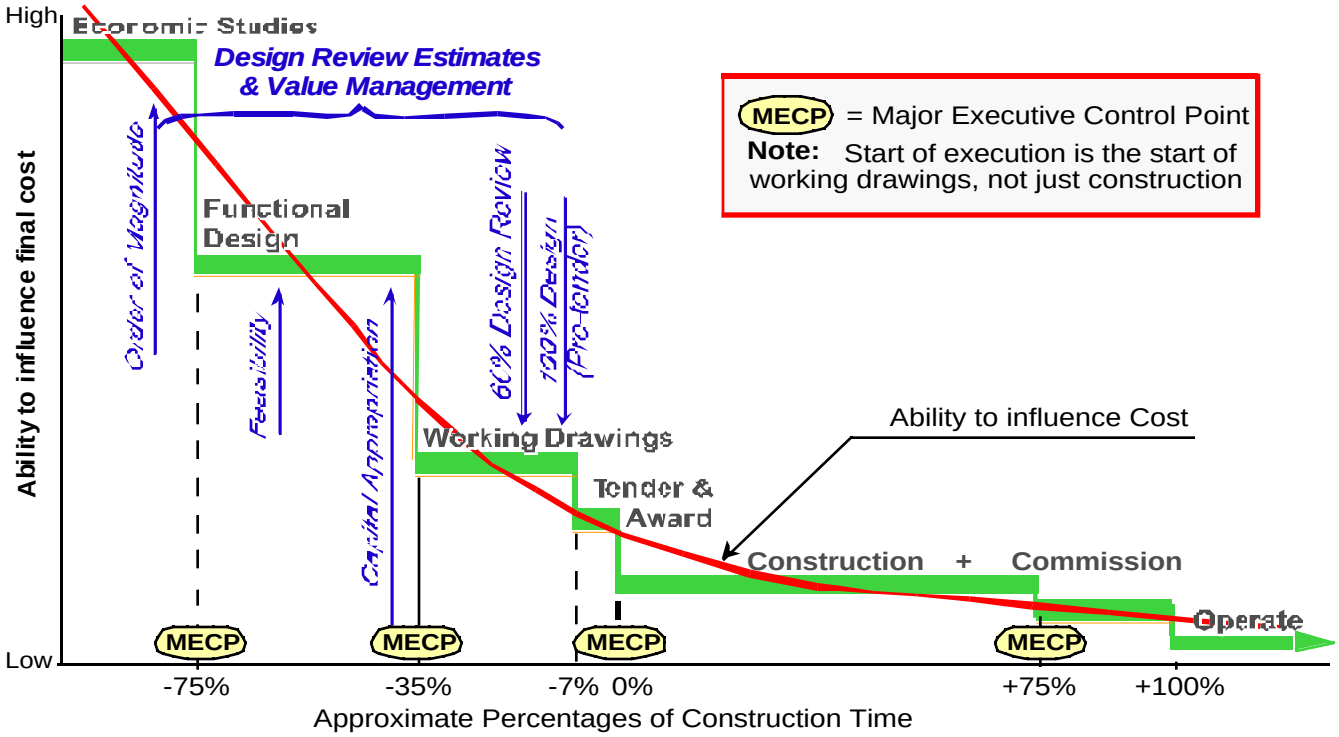

Figure 6[4]

It cannot be over emphasized how important it is to have a high caliber presentation of drawing, rendering and schematics for approval at the end of the Development phase. It is on this basis that the major investment decision will be made. If there are any doubts here, these will be greatly magnified during execution.

Far better to stop work and reconsider. It is not generally understood that it is far more difficult, and costly in design time, to make major changes to an existing design than it is to start from scratch. This is because of the added careful coordination required and the higher probability and danger of overlooking the impact on a related system.

During execution the contractor is certainly able to influence cost toward a favorable variance, but only to a much lesser extent. It is also common experience that cost saving or cost cutting efforts at this stage rarely return one hundred cents on the dollar. Aside from giving the

contractor opportunities to improve profit margins, disruption, delay and possibly wasted effort and materials are genuine and legitimate offsets.

Cost Effectiveness

The name of the game of project management therefore is "cost effectiveness." Cost effectiveness may be defined as best value for money. For analytical purposes, this needs to be more closely defined as the optimum trade-off between specific parameters. These parameters include affordable scope requirements, quality including aesthetic value, time to put in place, enhanced production or reduced operating costs, and so on, all according to the type of project and original basic project objectives.

Much of this may be subjective as in the case of assessing aesthetic value or forecasting the future labor cost trends. Yet, it is nearly always possible to make a value judgment in comparing alternatives and the better the project objectives are defined at the outset, the easier this judgment becomes. It goes without saying that the design consultants have a particular responsibility to ensure that their staff and sub consultants also clearly understand project objectives.

When design consultants accept an assignment to produce specifications and working drawings they, and all their support staff, should clearly understand that they are spending money on two different levels. First is the cost of their own design work. Second is the cost of putting the design physically into place. Every line on a working drawing and every sentence or even every word put into a specification has an associated cost downstream. And the cost is committed just as surely as the time is spent in its preparation.

What is not always appreciated by the owner/sponsor is the relationship between the cost of doing the design and the cost of constructing it. The ratio is about 1 to 8 or 10. There is therefore substantial leverage in "getting the working details just right" in the first place. As the Ability to Influence Cost curve indicates, the earlier the point in the development process of “getting it just right”, the greater the economy.

Making the Right Choices

There is also here an interesting anomaly. The more elegant and simple the solution to meet the design criteria, the cheaper the cost of both construction AND the detailing effort. It is well worth searching for.

The next question is how early and how detailed should cost effective comparisons be made? Bear in mind that, while it is easier to draw comparisons the more detailed costing efforts become, it is also easier to “lose sight of the woods for the trees”. How often does one find a project team’s design, schedule and cost functions getting "bogged down in detail"?

To state the obvious, cost-effective analysis should only be taken to the level of detail commensurate with the stage in the project and the ability to draw reasonable comparisons and hence make selections from amongst options.

This suggests that different guidelines should be set for evaluating costs at different stages of the project. These should range from macro levels during conceptual analysis to medium levels for design evaluations to micro levels during construction. Such values may also vary according to the relative emphasis on the various project restraints, such as the relative importance of budget versus time.

Bear in mind that a time delay near the end of the project is far more expensive, and therefore more important, than one earlier on by virtue of the much higher carrying costs.

Construction Costing and the 1/10th of 1% Rule

So, the “micro” level for cost monitoring, reporting, and controlling purposes during construction may be set at 1/10 of 1% of the total project construction cost as a good rule of thumb. That is, this is the minimum value that would be set to show up as a separately coded item in the routine cost reports. Conversely, items that exceed, say, 2 1/2% would be required to be broken down once more. This approach leads to more balanced items in the cost report, with a total of around eighty items being reported, which is manageable – especially when segregated by trade.

For example, for a building project with a construction budget of $10 million, the cost reporting structure would be set up to code items of not less than $10,000 and not more than $250,000. Such guidelines help considerably in developing initial budget strategies and maintaining balanced judgment during the life of the project.

So, in evaluating design alternatives in the earlier planning phases, a lower limit of significance might be set at say 2 1/2%. Hence, in the example given above, in comparing the merits of design alternatives of elements in the $250,000 range, differences of $6,000 or more would be considered significant and worth pursuing. This assumes, of course, that the design team has been diligent in maintaining a reasonable and consistent level of cost consciousness.

Applying Value Management

As stated earlier, significant effort by the management team should be exercised during the planning phases and working drawings stage to maintain control of the project’s scope, quality, time and cost. This should at least take the form of specific and contractually required design reviews, the timing of which is also suggested in Figure 6. These reviews, and earlier or additional ones if need be, can best take the form of a project management technique known as value engineering, value analysis or Value Management.

Value Management, a recognized service in the United States, is commonly defined as "An organized approach whose objective is to optimize the total cost and/or performance of a facility or system." The methodology of this approach is to first identify the areas of high cost, identify their essential purposes, and to systematically develop alternatives that perform the required functions at the same quality but at lower cost.

Note that this does not necessarily mean cheapest or lowest first cost, because account should be taken of the total life cycle cost of the building. That is, the overall cost to design, construct, operate, maintain and dispose of or rehabilitate the facility over its entire life cycle.

Stages of a Value Management Design Review

Stage 1: Information

Objectives	- Provide an information base or "Cost model"
	- Select areas for detailed study
Questions	- What is it?
	- What must it do?
	- What does it cost?
	- What is it worth?
Techniques	- Functional analysis
	- Cost-Worth Concept
	- Graphics
	- Cost & Energy Modeling

Stage 2: Speculative

Objective	- Generate alternatives for meeting requirements
Questions	- What else will perform the required function?
Technique	- Creative thinking process (i.e. brainstorming)

Stage 3: Analytical

Objective	- Evaluation & selection of best cost saving alternatives
Questions	- What will alternatives cost?
	- Will the alternatives meet the required functions?
	- What proposals have greatest cost savings?
Techniques	- Life cycle costing
	- Weighted constraints evaluation
	- Idea ratings

Stage 4: Proposal

Objective	- Presentation of best alternatives to the decision maker
Question	- How best to present proposals?
Techniques	- Narrative reports
	- Schematic overlays
	- Graphics

Stage 5: Final Report

Objective	- Define and quantify results
Question	- What was implemented?
Techniques	- Life cycle costing

Life Cycle Cost of Building Ownership

Figure 7 shows the total overall cost of ownership of a typical office building over a forty year life cycle. It is interesting to note that the initial costs are only one half of the total cost. For buildings that are more labor intensive in their operations, such as airports and hospitals, the

capital cost fraction may be less than 10%. Conversely, for buildings such as museums and churches, the proportion is much higher.

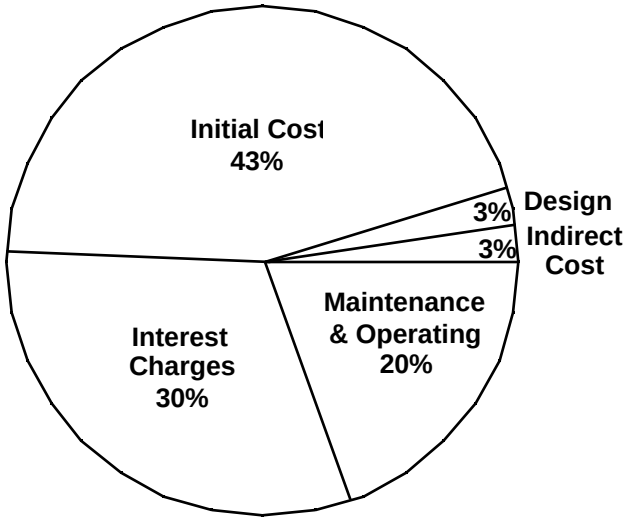

Figure 7

Consequently, focus only on initial cost without regard to the present value of future maintenance and operating costs is often a serious shortcoming in the programming, planning and design of facilities.

Traditional Practice and Value Management

Under traditional practice, the design professionals, architects and engineers, develop plans and specifications to meet the design criteria of the owner/operator. However, each design discipline being compartmentalized often by sub-agreement, tends to generate its own requirements and then review and modify these requirements more or less in isolation. Since each discipline tends to prescribe maximum performance and safety factors, in its own self-interest of professional liability, unilateral decisions are taken which may have the effect of modifying the criteria and standards of the owner.

Under these circumstances, decisions are reached which are not the most economical or acceptable for the end use of the facility. Effective decisions involving total overall costs require a team approach by people knowledgeable in all costs. The value management stages described earlier provide the means for this team approach.

To some, value management appears as an interruption to the design process, particularly as not all professional disciplines advance at the same pace. In fact, in building work, because of their logical dependencies, architectural design leads the parade followed by structural, mechanical and electrical, in that order. Thus, electrical design may be only 15% advanced when architectural design is already 60% complete.

In fact, the early application of value management accelerates design and saves time by clarifying design scope, avoiding unnecessary design work, preventing false starts and

reducing time loss when budgets are exceeded. In practice, the tighter the schedule for design the more beneficial the application of a value management design review workshop.

The cost of these reviews may range from 0.1 to 0.5% of project costs, yet result in savings of 10% or more. A pay-off of up to 100 times is not uncommon, especially if it is determined that certain elements could be eliminated altogether!

Summary

The writer hopes that these notes will provide an insight into the opportunities and pitfalls of managing the project development process. With better understanding, the project team can be more effective, have greater unity of purpose and be committed to better results.

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