

A Synergistic Approach to Information Systems Project Management

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Abstract

This paper studies synergism in information systems project management. Both qualitative and quantitative effects of I.S. project team synergy have been assessed. The quantitative output from group synergy is a structured and on-task team with synchronized productivity. Qualitative factors in group synergy include: morale, supportiveness, participation, co-ordination, integration and commitment. It is believed that both qualitative and quantitative aspects of group synergy are of equal importance to successful systems development. They are complementary to each other and together can generate greater effectiveness in I.S. project management.

On the basis of a substantial literature review, the author formulated a model of group synergy in I.S. project management. In scholarly terms, the suggested model provides greater understanding of how technical and organizational factors inhibit/facilitate the success of information systems development. Practically, the qualitative and quantitative aspects of I.S. project management are brought together in a complementary manner under the umbrella of synergism. Being equipped with a broader framework, I.S. professionals can perform a better job in the field of systems development.

'More than 70 percent of all information systems developed within Canadian companies today are never implemented' (Canadian Manager, p.18, Fall 1992).

'The five-years' development effort of the Taurus trading system of London Stock Exchange , which sources estimated cost hundreds of millions of dollars, was termed a disaster, and the project was abandoned in March 1993. ... Meanwhile the London Ambulance Service was forced to abandoned its emergency system after it performed disastrously on delivery' (Software Magazine, p.34-35, Aug. 1993).

1. SYSTEMS PROJECT MANAGEMENT - WHERE DO WE START?

Project failure is probably one of the most serious concerns of the information systems community. During the past decades, numerous tools, techniques and methodologies such as project evaluation & review technique (PERT), critical path method (CPM), statistical process control (SPC), structured systems analysis & design methodology (SSADM), work breakdown structure (WBS), linear responsibility chart (LRC), computer-aided software engineering (CASE), etc. have been developed and used to improve the chances of successful information systems (IS) development. Project managers are challenged to solve a very fundamental problem from an 'alphabet soup of solutions' (Goldratt & Fox 1986) as shown in Figure 1.

	PERT	CPM	LOB
SSADM		WBS	LRC
			SOW

Systems Project Management - Where do we start?

MBWA	SPC	CASE	MBO
ZBB	HRM	TQM	

CASE - Computer-Aided Software Engineering	CPM - Critical Path Method
HRM - Human Resource Matrix	LOB - Line of Balance
LRC - Linear Responsibility Chart	MBO - Management by Objectives
MBWA - Management by Walking Around	SOB - Statement of Work
SPC - Statistical Process Control	WBS - Work Breakdown Structure
PERT - Project Evaluation & Review Technique	
SSADM - Structured Systems Analysis & Design Methodology	
TQM - Total Quality Management	ZBB - Zero-Based Budgeting

Figure 1 - Possible solutions to problems of I.S. Project Management

However the tremendous advance in technology and the availability of project management tools, on their own, seem to be inadequate to put an I.S. project on a safe track. 'Even when diligent about thorough project plans, budgets, schedules, progress reports and so forth, consistent project successes still prove elusive' (Culp & Smith 1992). Why? What can I.S. professionals bring to a systems project to make it a success? An exact formula for project success is non-existent. However, the path to effective systems project management, perhaps, starts with an understanding of the ends (objectives) and means (necessary conditions to achieve objectives) of I.S. projects.

2. GOAL & CONDITIONS OF SYSTEMS PROJECT MANAGEMENT (WHAT)

A project is 'a complex effort to achieve a specific objective' (Cleland & King, 1983). It is 'any activity that results in a deliverable or a product' (Rakos 1990). What are the 'objectives', 'deliverables' or 'products' of a systems project? An I.S. project aims to deliver a satisfactory system to users. In order to achieve this goal, crucial dimensions of systems development must be managed. Project management is about the 'planning, organizing, directing and controlling of resources' (Kerzner

1992) to maintain several necessary conditions of project development so that the target systems can be delivered successfully.

Three conditions that are generally used to evaluate the effectiveness of project management are 'performance, time and cost' (Kerzner 1992, Rakos 1990, Cleland & King 1983, etc.). Performance-time-cost (figure 2) is regarded as a 'magic combination' (Kerzner 1992) that is continuously pursued by project managers throughout the life cycle of their projects.

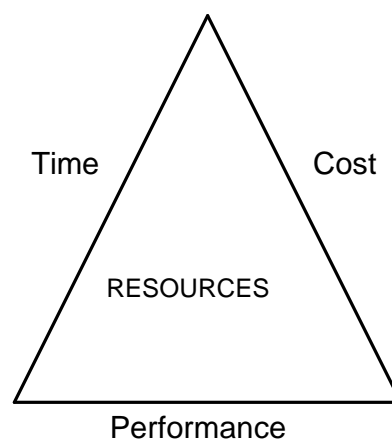


Figure 2: Project Management - Performance-Time-Cost Combination (Kerzner, 1992)

2.1 Performance

Performance is assessed by the degree to which the product meets the specification set for it. It is the key determinant of systems project success. For any I.S. development, certain requirements as to 'major functions, inputs/outputs, operation & environment, human interface, storage capability, speed, reliability, growth, maintenance & support, documentation & training' (Rakos 1990) must be defined at the start of the project. The degree to which a particular task in the development cycle meets these requirements is an assessment of the performance dimension. Most systems that fail go astray because the project team does not know and/or meet the user performance requirements.

2.2 Cost

Cost refers to the resources being expended to turn user requirements into a workable system. It includes direct costs such as salary of analysts/programmers, computer time, special equipment and overheads, e.g., heat, rent, administration, clerical support, etc. Project cost management is not only monitoring of costs and recording perhaps massive quantities of data, but also analyzing the data in order to take corrective action before it is too late. It is 'dependent on a well-thought-out and well-defined work scope, the time to implement the project plan, and a managed change control program' (Werderitsch 1990).

2.3 Time

Time refers to the timeliness of progress in terms of a schedule which has been set up. Most systems development contracts include the time requirement and specify damages that the owner will seek if completion dates are not met. Project time management starts with a schedule of 'direct time' (numbers of person-days of effort that are required to accomplish the project) and 'elapsed time' (calendar duration given by mapping direct time onto a real calendar). A project manager reviews the schedule 'for completeness and critical interface points among the various parties involved on the project. ... She determines if a target has been established and how effectively the schedule is being followed' (Werderitsch 1990).

2.4 Interrelationship of Performance, Time & Cost

What is the one thing that can make a project fail-free? That answer perhaps is to stay within the performance-time-cost triangle of Figure 2. Systems project management is designed to manage resources on a given project within time, within cost and within performance.

Unfortunately, many systems projects eventually stumble on crises where this balance necessary to attain the desired performance within time and cost changes.

This is shown in Figure 3 where the Δ s represent deviations from the original estimates (Kerzner 1992). The time and cost deviations are normally overruns, whereas the performance error will be an underrun.

In response to deviations, project managers very often juggle the three constraints and come up with a trade-off depending on some sorts of priorities placed on the three constraints. Trade-offs are commonly accepted as part of project management. As the saying goes, 'You can have it good (performance), cheap (cost) or fast (time): pick two'.

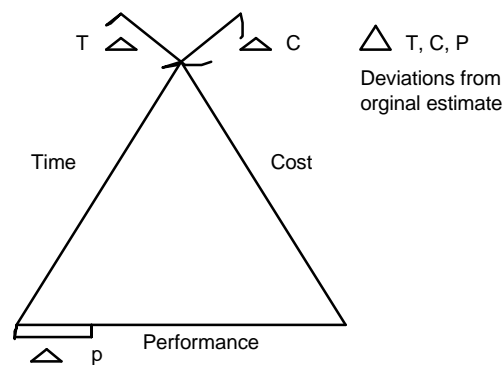


Figure 3: Deviations of performance, time, cost during project development (Kerzner, 1992)

However, it should be noted that it is not possible to sacrifice one of the three conditions without affecting the others. The following are some possible causes and effects of performance, time and cost trade-offs.

- a) Reducing time will increase cost (especially if overtime is required) and have negative impacts on performance.
- b) Reducing costs will delay schedule and have negative impacts on performance.
- c) Measures (as fire-fighting actions) to enhance performance will increase time and cost.
- d) Lowering performance standards may not pull the project back on schedule and within budget. A low performance standard very often leads to inadequate

quality which in turn results in excessive testing, rework and maintenance. This will delay delivery dates and decrease productivity and therefore increase cost.

e) Putting extra resources in an ongoing project does not necessarily reduce the task's duration or enhance the overall performance. One significant point is that the additional unit (human or non-human resource) may not be able to integrate with other established units as an organized whole (project team) and thus effectiveness will in fact fall.

f) Delaying completion dates of a project may not enhance performance and reduce cost. Information systems development is a manpower (analyst/programmer) intensive project and thus 'time is money'. As the duration of a task increases, so cost growth usually occurs. There is also no evidence to suggest that the longer the time an analyst/programmer takes to finish a task, so the better performance is the result.

The above points illustrate how performance, time and cost each continuously influences and is influenced by the other two. A former NASA (National Aeronautics & Space Administration, US) official compared the conditions of project management to a 'three-legged milk stool consisting of performance, time and cost. If any of the legs are missing, the stool will collapse' (Werderitsch 1990). This is very true in cases of I.S. development. A systems project completed on time and within budget, yet not meeting performance requirements, will not be accepted and paid for by the users. Similarly, a late and cost overrun system, even if it meets performance requirements, is still a failure because it comes in too late and is too expensive.

If we take a closer look, we find that systems project management is a whole, a single entity with three dimensions. Every managerial action thus must be evaluated not according to its impact on any one dimension but on the whole entity. If we can manage performance, time and cost *simultaneously*, we are in the right direction towards successful project management.

3. MECHANICAL ASPECTS OF SYSTEMS PROJECT MANAGEMENT (HOW)

While the performance-time-cost parameter is sufficient to determine if a project is following the right direction, it is, by itself, inadequate to measure the effectiveness and efficiency of specific operation actions throughout the systems development. A project manager has to address to issues such as: 'Will the use of computer hardware/software cause cost overruns?' 'Does the delay of a task change the completion day?' 'Can these two modules be coded at the same time?' 'Does this program meet the requirements elicited in the functional specification?'. We clearly need some mechanisms to ensure every smallest activity move towards the ultimate goal - successful project completion.

A project manager today is not short of these technical mechanisms. When properly applied, the tools and techniques shown in Figure 4 contribute to lower development cost and quicker delivery of a quality system.

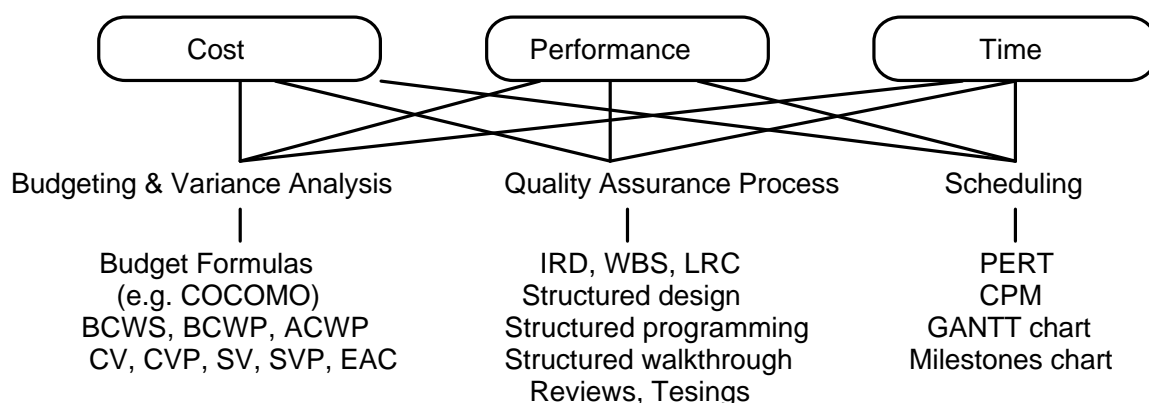


Figure 4: Tools & techniques to optimize performance, time & cost

3.1 Time Control - Scheduling

Schedule commitment and total project target schedule are the bases for time control. The following are some familiar project scheduling tools:

- Program Evaluation & Review Technique (PERT) is used to describe the sequences of activities and identify which activities will be going on simultaneously.

- b) Critical Path Method (CPM) defines the duration of a project. It also illustrates which activities to watch and which activities may be crashed.
- c) GANTT chart is a time bar chart giving us a quick overview of project status. It shows which task is ahead or behind schedule.
- d) Milestones chart is constructed by tabulating the completion dates and persons responsible for major events crucial to project progress.

3.2 Cost Control - Budgeting & Variance Analysis

Cost control can be made more effective by applying certain mechanisms, such as:

a) Budget formulas. One of the best known budget formulas is called COCOMO (Boehm 1981). It is used to estimate project cost, effort (person months), schedule (months) and staffing (number of staff) for each phase of the systems development life cycle.

b) Variance and earned value. There are three basic variables for the calculation of variances and earned values (Archibald 1976):

- Budget cost for work scheduled (BCWS) or planned earned value (PEV),
- Budget cost for work performed (BCWP) or actual earned value (AEV).
- Actual cost for work performed (ACWP)

Using these definitions, useful operation indicators could be obtained:

- Cost variance (CV) = $BCWP - ACWP$
- Schedule variance (SV) = $BCWP - BCWS$
- Cost variance % (CVP) = $CV/BCWP$
- Schedule variance % (SVP) = $SV/BCWS$
- Estimate at completion (EAC) = $(ACWP/BCWP) \times \text{total budget}$

3.3 Performance Control - Quality Assurance Process

Performance is most difficult to quantify. There is no unit of performance. So system developers opt for measuring speed and cost only - and this is one of the most common reasons for project failure. Quality assurance is a series of

systematic measures to ensure that the quality of the development project is kept within limits. Typical quality assurance processes (Davis & Olson 1986) are:

- Information requirements determination (IRD) processes to ensure complete and correct requirements;
- Work breakdown structure (WBS) to define proper decomposition of a project and the relationships among modules;
- Linear responsibility charts (LRC) to identify participants and to what degree an activity will be performed or a decision will be made;
- Program development procedures for quality control. These include structured design, structured programming, structured walkthrough, independent review of program logic and systems testing;
- Sign-offs at each phase of development to ensure adequate review and agreement on the system to that point;
- Conventional installation testing.

3.4 Tools Alone are not Enough

We are now back to a fundamental question - why do we still have a high percentage of project failure in spite of the wide application of powerful tools and techniques in systems project management? The answer is, 'tools alone won't make it happen'. It is as if asking 'Will the piano play great music?' We have heard it said before, 'it is not the piano that make music, it's the musician. People make the difference.' Similarly, techniques don't manage projects, people do.

Systems project management is often considered to be both an art and a science. It is an art because of the strong need for interpersonal and people skill, and the planning and control mechanisms attempt to convert parts of the art into a science (Kerzner 1992). Tools can only speed up some mechanical activities of the job. It is people that do the projects. Project success comes when technical skills are combined with effective people skills; people skills more often cause a project to fail than does the lack of technical skills (Culp & Smith 1992).

4. HUMAN ASPECTS OF SYSTEMS PROJECT MANAGEMENT - (WHO)

The human factors are especially important for I.S. development. The tasks of systems development are complex and specialized. The project environment is in a continual state of both cyclical and structural changes (Todryk 1990). New products, applications, technology, downsizing and corporate acquisitions are all dynamic elements that will disturb our performance-time-cost equilibrium. Disturbances and Murphy (i.e. nature always side with the hidden flaw) are part of systems development. In order to response and react to turbulent environment and ever-changing requirements, project managers have to rely on a more dynamic resource - people.

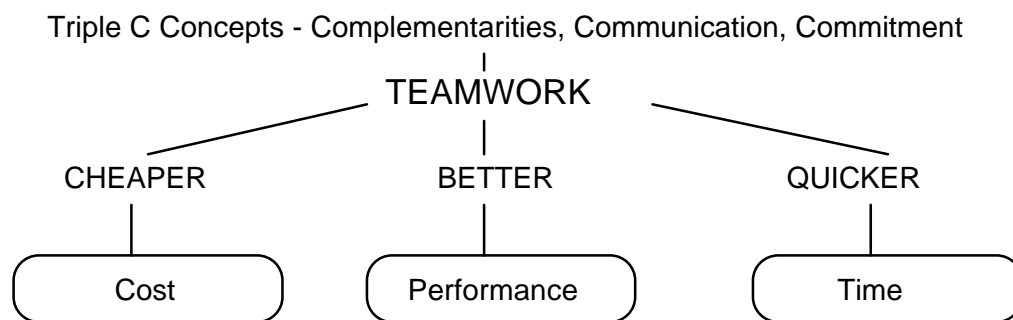


Figure 5: Human side of performance-time-cost parameter

Let us take a step deeper. There is a more human side of the performance-time-cost parameter. It is a means to achieve personal objectives at a higher level - the ultimate goal of being better, quicker and more cost-effective for most professionals (Figure 5). Systems personnel commonly regard an ability to develop better, quicker and cheaper systems as a key determinant of their career success. Project management is about actions as well as visions.

To be quicker, people must be able to respond more rapidly to sudden and complex problems. When the project schedule starts to slip, we have to bring out extra efforts that gets the late activity done on time. This means that systems

developers should have both the freedom and the right to make their own decisions, instead of waiting for the project manager to act.

To develop a cheaper system, people must not only focus on their own line items in a project budget. They need to be flexible enough to move resources from one part of the project to another to manage resources as a project evolves, in order to optimize the end result (Culp & Smith 1992). Cost saving is a shared responsibility.

Better quality systems result from involved people. One cannot inject quality into a project. The quality of an information system must be addressed during its creation and is an integral part of the development process (Chroust, Goldmann & Gschwandtner 1990). This implies that developers must be self-regulated, self-directed and make amendments as soon as standards of their tasks deviate from the required level.

What do we call a phenomenon that exhibits characteristics such as participative decision-making, shared responsibilities and self-directed action? It is teamwork.

4.1 Project Managers as Team Builders

True teamwork occurs in situations where members are performance-dependent on each other. It is *not* the summation of works from a group or collection of individuals (see Figure 6).

A team is 'able to focus energy, respond rapidly to opportunities, and share responsibilities and rewards. Teams are purpose-centered: members not only understand the purpose but are committed to it and use the purpose to guide actions and decisions' (Buchholz & Roth 1987).

It is believed that the implementation of an effective team-building process in a systems project management environment will significantly reduce delays and cost overruns while improving product performance (Todryk 1990). Yet how can a project manager create an effective team from 'diverse personalities, in a temporary

environment and obtaining commitment over which she may not have direct control' (Graham 1985).

Team building involves a whole spectrum of people skills, and again there is no exact prescription for its success. However, a triple C (complementarity, communication and commitment) concept may provide some meaningful guidelines to project managers.

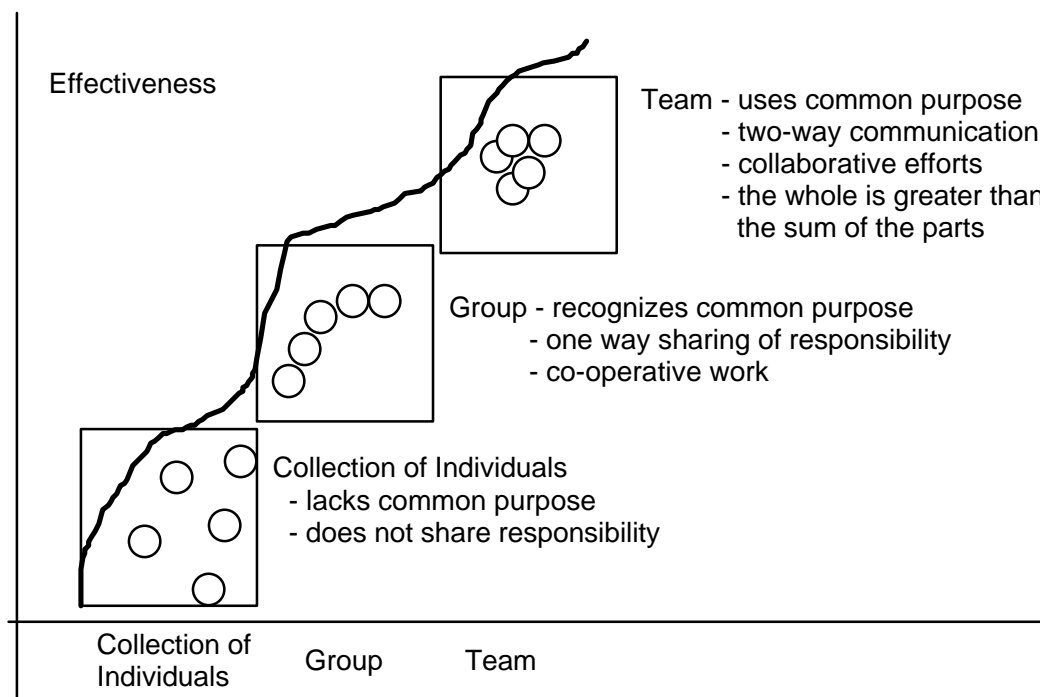


Figure 6: A team, group & collection of individuals (Buchholz & Roth, 1987)

4.1.1 Complementarity

The complex tasks involved in systems development require the pooling of multiple human resources. Each member on the project team has a specific job to do and a specific role to play (Rakos 1990). Analysts/programmers analyze/program and should be chosen for their analyzing/programming ability and experience with a particular application. The project leader is expected to provide technical supervision and solve any systems problem, so the most suitable expert should be chosen. The project manager is there to provide leadership and handle all

communication between project team and the outside world. She needs to possess excellent people skills supplemented by technical expertise.

A heterogeneous project team composition is useful to get several perspectives on the issue of information systems development. Contrary opinions among team members should be encouraged and utilized. Conflicts must be managed rather than avoided. A team builder aims to achieve unity through diversity and avoid 'groupthink' (Janis 1972, a phenomenon where a group of similar thinking people develops blind spots). Complementarities arise when team members 'recognize and reinforce each other's strength ' (Buchholz & Roth 1987).

4.1.2 Communication

Systems professionals are highly achievement oriented and need the feedback that a team provides (Stokes 1990). On a project team, everyone should know what is going on. Information must be held by all so that constructive feedback can occur and appropriate adjustments be made. A team builder should not only provide downward communication (project manager to team members), but also upward communication (team members to project manager) and horizontal communication (among team members).

According to Buchholz & Roth (1987), 'communication transmits energy. What you say has the potential to energize others'. What you say also creates an obligation to your work. Managers who create and maintain a high level of communication in their work units can enhance teamwork. It is logical to suggest that systems project have a higher chance of success if team members and the project managers are open with each other, exchanging ideas in an environment where they feel safe to speak freely.

4.1.3 Commitment

For a team to become a team and stay as a team, members have to perceive that their needs are being met through the team experience. A team builder should

know as much as possible about what motivates their members and then structure experience that will help meet those needs (Stokes 1990). When individual goals align with project goals and members feel that their contributions to the project are contributing to their personal goals, they turn their contributions to commitment. They are committed to the direction and outcome of the team. While there may be different points of views, team members are willing to set those differences aside in pursuit of a common purpose or goal.

A corporate group is transformed into a collaborative team. Stokes (1990) states, 'when project members take responsibilities to treat each other straightforwardly and are dedicated to their performance as individuals and as a whole, they begin to earn the right to be called a collaborative team'. Collaborative team efforts emerge as a force to counteract disturbances that arise throughout the systems development process.

4.2 Does Teamwork Necessarily Lead to Project Success?

One of the most important aspects of systems projects management is thus the nature of project team (Brown, Klastorin & Valluzzi, 1990). A major responsibility of the project manager is team building. She should understand the proper makeup and behavior of effective teams. Group attributes such as complementarity, communication and commitment are believed to be possible indicators of teamwork which consequently lead to higher project success.

However a recent research (Brown, Klastorin & Valluzzi, 1990) suggests that project teams with positive characteristics may not necessarily bring a project to fruition. Then, what makes an effective project team fail?

5. PUTTING IT ALL TOGETHER - A SYNERGISTIC APPROACH

The management of a systems project is one of the most difficult tasks that an I.S. professional may face. It involves 'exercising capabilities in defining the project and analyzing work; in planning for and wisely using resources; in setting performance

objectives, priorities, and standards; in developing a budget, getting it funded, and supervising expenditure; in establishing necessary controls and meaningful supervision; in facilitating adequate communication, reporting and evaluation systems, etc'. (Harris & Harris 1989). All of these functions must be performed properly by the project manager and project members, for the project to be a success.

One very crucial but often overlooked concept is that local success does not add up to the success of the *whole* project. An ability to analyze the whole project rather than the individual parts, is the first prerequisite for successful systems project management. The interconnections and interactions between components (people or tasks) of a project are often more important than the separate components themselves. In the I.S. development context, a project manager must not only ensure that separate elements perform effectively, but must also create a situation where all work units function towards a common purpose and accomplish what none of the work units could achieve singly. The conceptual term for this phenomenon is *synergy*.

5.1. What is Synergy and a Synergistic Approach?

Synergy, according to Fuller (1981), 'is the behavior of whole systems that cannot be predicted by the behavior of any parts taken separately. ... In order to really understand what is going on, we have to abandon starting with parts, and we must work instead from whole to particular'. It is 'the simultaneous actions of separate entities, which together have greater total effects than the sum of their individual effects' (Buchholz & Roth 1987). The belief is that 'the whole is greater than the sum of its parts' (Aristotle). Basically, synergism is focusing on a system's effort so that $2+2 > 4$. The '>4' is an 'emergent property' that only exists in the whole but has no meaning in terms of its parts.

A synergistic approach involves 'a new way of thinking which help to free one from outdated patterns and can break the shell of permitted ignorance' (Burger &

Bass 1979). With a new way of thinking, we may regard systems project management as a team of interdependent elements working together synergistically to achieve a common goal - the delivery of a successful system. The adopted approach should look at the 'total picture' 'work from whole to particular' and consider all the 'interaction necessary between various elements of the parties', including people and machines.

5.1.1 Start from the Performance-Time-Cost Combination

Let us put it all together on a total picture (Figure 7) and start working from the whole, the performance-time-cost parameter.

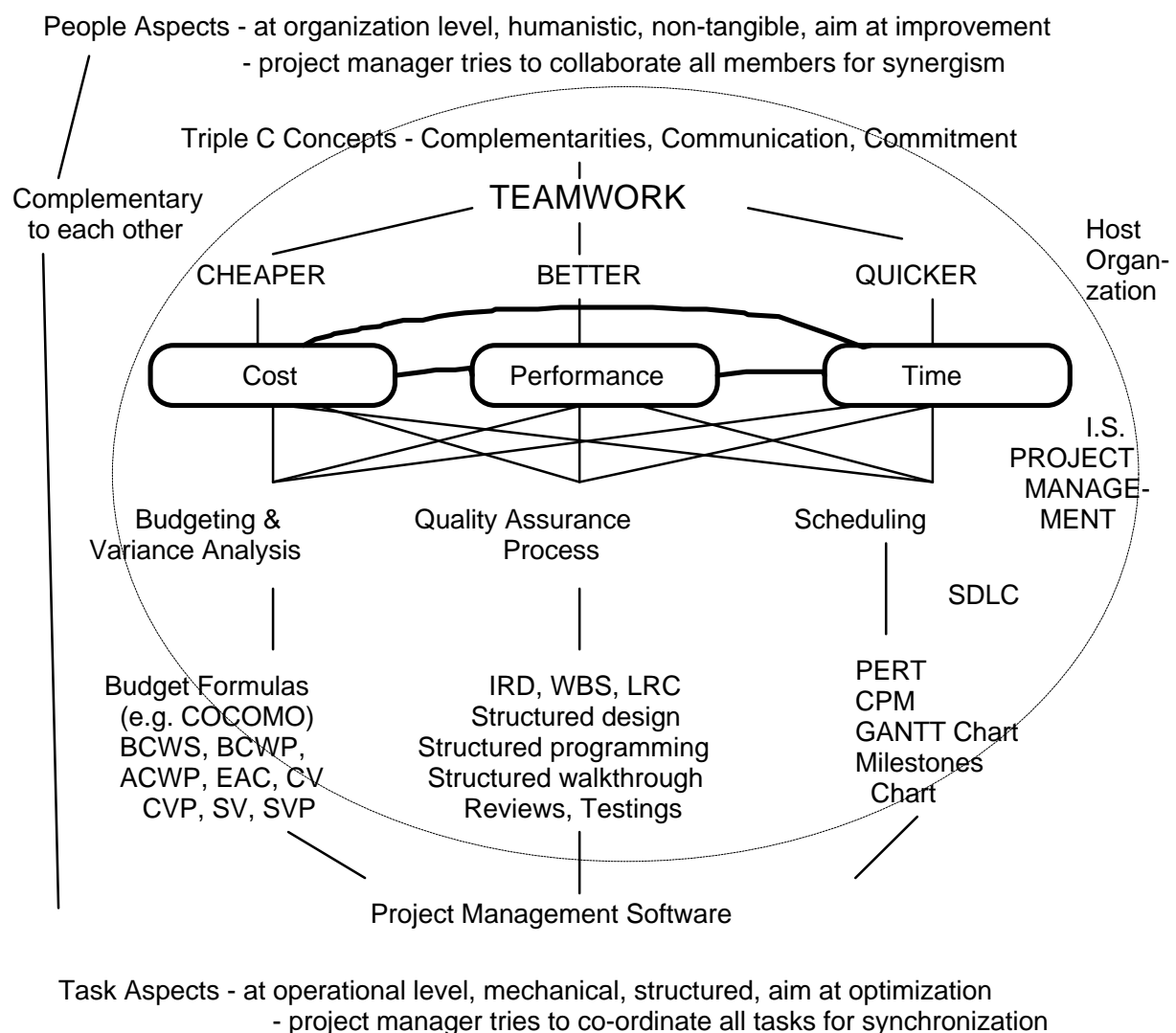


Figure 7: A Synergistic Approach to I.S. Project Management

Performance-time-cost is a whole with three parts. Like any other whole, its parts are interdependent and with unequal strengths and weaknesses. Synergism is built on achieving simultaneous success of all parts, and if one part fails, the whole project fails. The strength of a project may thus be determined by the strength of its most delicate part - the weakest leg which is most vulnerable to disturbance and causes the whole 'three-legged milk stool' (Werderitsch 1990) to collapse.

A synergistic view recognizes all project elements' strengths/weaknesses and facilitates supporting co-operative actions to counterbalance the weakness of any part at any time throughout the systems development. Practical concerns are:

- Identifying the most delicate part of the performance-time-cost parameter at a given point in time and under a particular development environment;
- Collaborating all efforts to protect the most delicate part (and thus protect the project). When the delicate part is safe, loop back and analyze the situation again.

The above processes are iterative and never ending as the most delicate part may change throughout the project life cycle.

A way to distinguish the most delicate leg of the performance-time-cost triangle is by analyzing a project's internal variables (phases of systems development life cycle) and external environment (the organization that an information system serves).

5.1.1.1 Constraints from the host organization

The nature of an information system is to serve an organization (Checkland 1982, Wilson 1984). The host organization of an information system is thus an external force that may determine which one of performance, cost and time is most crucial to the overall success of an I.S. project. The decision is situation-oriented. Appendix 1 illustrates the relative importance of performance, cost and time to different industries in the 1980s.

Generally speaking, time is most critical to projects developed for the commercial and financial sectors. For systems to support research and development, performance should never be compromised. Cost overrun is normally unacceptable to non-profit making organizations that derive their incomes from donations and/or governments. However, every project environment is unique and project managers must know how to make their own decisions.

5.1.1.2 Constraints from phases of the development life cycle

The cruciality of performance, time, cost also depends upon the life cycle phases of a given systems project.

Performance is of top priority one during the early definition stage. The quality of its outputs, such as requirements document and functional specification, is very difficult to control (Rakos 1990). Errors, which are not easily detected in analysis and logical design phases, may cause dreadful damage to the final product.

Most tedious jobs (such as physical design, programming, testing , etc.) are done in the development stage. During these phases, the schedule tends to slip unnoticeably, perhaps one day at a time. Timeliness is very vulnerable and should be protected by maximum efforts.

As a project moves towards its operational stage, cost becomes increasingly critical. The cost of numerous structural, procedural and attitudinal changes (Checkland 1982) involved in the conversion and implementation phases is difficult (if not impossible) to estimate. There must be considerable contingency measures to offset potential damages of cost overrun.

By examining the external and internal conditions of a systems development, a project manager (together with team members) should be able to make a decision on which is the weakest element, when, and how it can be protected. Once a decision is reached, all works units must function synergistically towards the target. Synergy might be established at both people and task levels.

5.1.2 Tasks are co-ordinated to achieve synchronization

At the operation level, a project manager plays the role of a co-ordinator. She aims to synchronize all activities with respect to the performance-time-cost constraint. Activities such as adding extra floats and contingency to a job, crashing a task, testing and/or retesting a program are geared towards the optimum of the identified critical part of the project (and thus the project as a whole).

5.1.3 People collaborate to create synergy

At the organization level, a project manager plays the role of a collaborator. She endeavors to create an environment where members are committed to a common goal, and moved to being interdependent. Team members help each other to become better, quicker and more cost-effective systems developers. Individuals' talents come together synergistically to keep the project within a performance-time-cost equilibrium.

5.1.4 Task and people effectiveness are complementary to each other

A synergistic approach also focuses on creating complementarity between task and organization effectiveness.

Project managers should use group dynamics to increase productivity. Peer pressure is as powerful as any highly technical mechanisms to stop the project slacking off. People are also more dedicated to the tasks whose budget, schedule, checkpoint and quality assurance measures are designed by themselves.

Project management tools such as PERT/CPM and milestone charts can be excellent means to team building. For example, network charts show the interdependencies of tasks in a very personal manner because people know exactly who is dependent on whom. This personal knowledge facilitates commitment from team members to each other and to the project.

5.2 Multi-Roles of a Synergistic Project Manager

With the synergistic approach, a systems project manager has an even more difficult task. She should take up several essential responsibilities at one time. These include:

- to analyze the relationship between an I.S. project and its host organization as well as the development life cycle phases;
- to co-ordinate all project tasks for synchronization;
- to collaborate all project team members for synergism;
- to complement task productivity with people effectiveness, and vice versa.

While the above processes of project management can entail difficulties and frustration on concerned systems professionals, the reward is great. The challenge is to create a work situation where all work units perform as if they were experiencing greater energy than they were supplying by individually - synergism.

6. CONCLUSION

Based on the above analyses, it could be comfortably assumed that there is a close relationship between synergy and the design, development and implementation of successful management information systems. A synergistic approach to information systems development aims to build up a project team where members take energy from one another for synergy. The management effective can be assessed by its outputs of both quantitative and qualitative nature.

The quantitative outcome is a structured on-task work force with synchronized productivity. Results in qualitative aspects include: team morale, supportiveness, participation, integration, commitment and creativity.

A combination of all the above competencies is likely to bring a greater success in the information systems development process.

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APPENDIX

Relative importance of performance, cost, time to different industries in 1980s

Industry	Time	Cost	Performance
Construction	3	1*	2
Chemical	2	3	1
Electronics	2	1	3
Automotive Manufacturing	2	3	1
Data Processing	2	3	1
Government	2	3	1
Health (nonprofit)	2	1	3
Medicine (profit)	3	1	2
Nuclear	2	3	1
Manufacturing (plastics)	2	1	3
Manufacturing (metals)	3	2	1
Consulting (management)	2	3	1
Consulting (engineering)	1	3	2
Office Products	2	3	1
Machine Tool	2	3	1
Oil	2	3	1
Primary Batteries	3	1	2
Utilities	3	1	2
Aerospace	2	3	1
Retailing	1	2	3
Banking	2	3	1

*1 indicates the most important success factor

(Source: Kerzner 1984)