Communication, Cooperation, and Coordination Model for Process Improvement of C2 Projects

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Abstract
Often overlooked in the development of technological advancements are the difficulties associated with integrating these technologies into existing processes. Technologists, scientists, and R&D engineers seldom identify problems that the new technologies will not solve. Technology programs can be divided into two categories – minor (limited or localized scope) and major (national or widespread scope). Large programs require sustainable commitment of financial and human resources, and must be managed more prudently. Management teams will have to develop adaptive plans, techniques, logics, and risk management strategies in the management continuum to ensure program success. The management plan must be cognizant of the fact that the entire management team may have to change abruptly over time due to political changes. This is particularly crucial for Command and Control (C2) projects. Thus, there must be a mechanism to ensure continuity and consistency of C2 projects over different life cycles of management. This paper presents the Triple C model of Communication, Cooperation, and Coordination to improve the management of technology in Command and Control projects. The suggested approach facilitates sustainable cooperation and upfront communication of the limitations of technology integration.

Keywords:
C2 Projects, Command and Control, Project Management, Communication, Cooperation, Coordination

Introduction
It is quite common to overlook the difficulties in integrating new technologies into existing processes. Technologists, scientists, and R&D engineers seldom identify the limitations of new technologies in solving the diverse problems that exist in the operating environment. Technology programs can be divided into two categories – minor and major. A minor technology program has limited or localized scope while and a major program has national or widespread scope. Large programs require sustainable commitment of financial and human resources, and must be managed more prudently. Management teams must develop adaptive plans, techniques, processes, and risk management strategies in the management continuum to ensure program success. The management plan must be cognizant of the fact that the entire management team may have to change abruptly over time due to political changes. This is particularly crucial for Command and Control (C2) projects. Thus, there must be a mechanism to ensure continuity and consistency of C2 projects over different life cycles of management. This paper presents the Triple C model for improving communication, cooperation, and coordination across decision-making processes in Command and Control projects. If implemented systematically, the model can facilitate sustainable cooperation and coordination of C2 technology projects. It can also help to enhance communication about C2 technology limitations within the context of project management, particularly for initiatives such as DOTMLP-F and JV2020. The proposed Triple C improvement approach can increase understanding and collaborative spirit among technologists, scientists, and C2 technology development engineers.

Definition of C2 Projects
C2 projects relate to the traditional military Command and Control processes designed to get a mission accomplished within the constraints of time, cost, and performance expectations. While the C2 approach has been effective in traditional military operations, the realities of 21st Century operations require that it be modified and transformed into a more adaptive process.

The complex civilian-military programs of the modern era particularly create muddled lines of responsibility and reasoning, for which conventional C2 may not be effective. The intertwining of policy, operations, and cost constraints makes it essential to look at traditional problems with new operational perspectives.

Definition of Project and Program Management

Project management is the process of managing, allocating, and timing resources in order to achieve a given objective in an expedient manner. The objective may be stated in terms of time (schedule), performance output (quality), or cost (budget). It is the process of achieving objectives by utilizing the combined capabilities of available resources. Time is often the most critical aspect of managing any project. Time is the physical platform over which project accomplishments are made. So, it must be managed concurrently with all other important aspects of any C2 project. Project management covers the following basic functions:

1. Planning
2. Organizing
3. Scheduling
4. Control.

The complexity of a project can range from simple, such as the painting of a vacant room, to very complex, such as the introduction of a new technology product. The technical differences between project types are of great importance when selecting and applying project management techniques. Figure 1 illustrates the various dimensions for the application of project management to C2 project control.

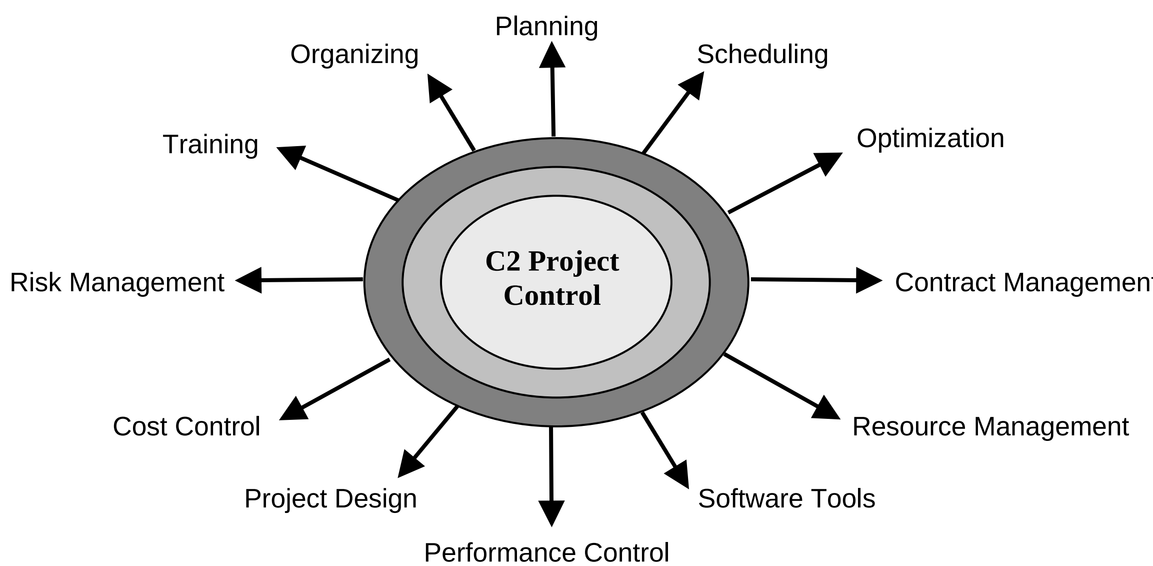

Figure 1. Elements of C2 Project Control

Project management techniques are widely used in many human endeavors, such as defense, construction, banking, manufacturing, marketing, health-care, sales, transportation, research, academic, legal, political, and government establishments. In most situations, the on-time completion of a project is of paramount importance. Delayed or unsuccessful projects not only translate to monetary losses but also impede subsequent undertakings. Project management takes a hierarchical view of a project environment, covering the top-down levels shown below:

1. System level
2. Program level
3. Project level
4. Task level
5. Activity level.

Figure 2 illustrates how process improvement can be achieved as a hierarchical build-up from activity level to overall system level. It is crucial to have communication, cooperation, and coordination of C2 elements at each level because each successive level is a function of the preceding level.

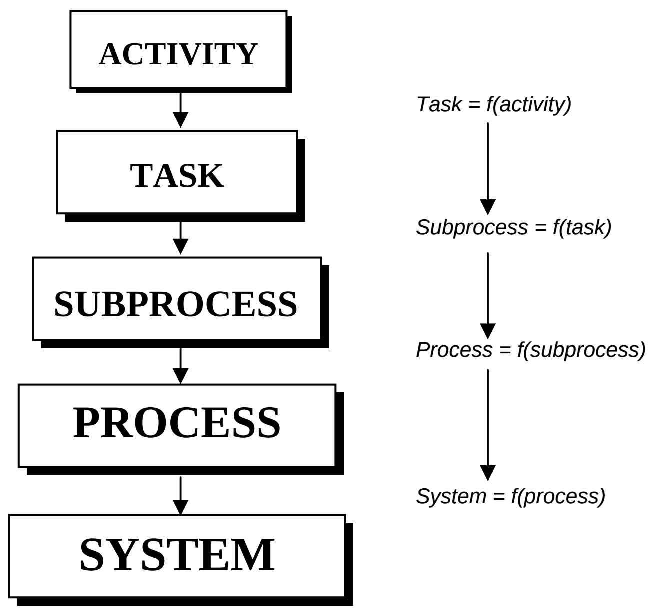

Figure 2. Hierarchy of process components

Technology System: A system is the global realm within which project efforts are carried out. A project system consists of interrelated elements organized for the purpose of a common goal.

Program: Program is the term used to denote very large and recurring endeavors. The term is typical in many undertakings that span many years. Programs are undertaken in sustainable systems, such as a national defense system.

Project: Project is the term generally applied to time-phased efforts of much smaller scope and duration than programs. Programs are sometimes viewed as consisting of a set of projects. The government sector tends to have programs due to the broad and comprehensive nature of governmental endeavors. The corporate sector tends to use the term "project" because of the shorter-term and focused nature of most corporate and business efforts.

Task: A task is a specific element of a project. A project is normally composed of contiguous networks of tasks that all contribute to the overall project goal.

Activity: An activity can be defined as the “atom” of a project, the most basic and indivisible work element. Activities are generally smaller than tasks. Such small-scale details of a project are crucial when troubleshooting a project to identify bottlenecks. Activities serve as the building blocks of C2 projects.

Applying Conventional Project Management to C2 Projects

C2 project is just like any other project involving people, tools, and process. As long as these elements exist in C2 projects, the conventional project management approaches can be applied. Such requirements as project selection, enmeshing of new technology into existing operations, and management sustainability can be handled by conventional project management techniques tailored or customized to the specific needs of C2 projects.

Technology Review and Selection Criteria

Technology project selection is an essential first step in focusing the efforts of an organization toward implementing a new technology. Figure 3 presents a graphical evaluation of project selection. The vertical axis represents the value-added basis of the project under consideration while the horizontal axis represents the level of complexity associated with the project. In this example, value can range from low to high while complexity can range from easy to difficult. The figure shows four quadrants containing regions of high value with high complexity, low value with high complexity, high value with low complexity, and low value with low complexity. A fuzzy region is identified with an overlay circle. The organization must evaluate each technology project on the basis of overall organization value streams and the specific technology’s potential to add value to existing processes. The figure can be modified to represent other factors of interest in C2 project analysis.

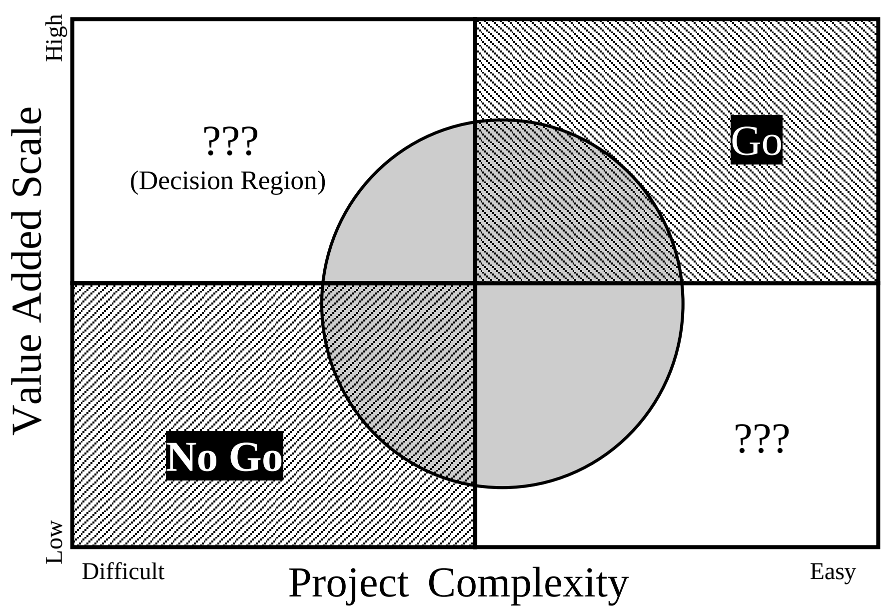

Figure 3. Project Selection Quadrant: Go or No-Go

Criteria for Project Review

Some of the specific criteria that may be included in technology review and selection are presented below:

- Cost Savings
- Process Improvement
- Operational Responsiveness
- Resource Utilization
- Simplification of work
- Cross-functional efficiency
- Partnering potential

Technology Product Assurance Requirements

Product assurance activities should be designed to govern product deliverables throughout a program development period. Specific product assurance activities accomplish the following:

1. Track and incorporate specific technologies: The technology management task will track pertinent technologies through various means (e.g., vendor surveys and literature search). More importantly, the task will determine strategies to incorporate specific technologies.
2. Analyze technology trend and conduct long-range planning: The output of technology assessment should be used to formulate long-range policies, directions, and research activities so as to promote the longevity and evolution.
3. Encourage government and industry leaders' participation: In order to determine long-term strategy, the technical evaluation task needs to work closely with government and industry leaders so as to understand their long-range plans. Technology panels may be formed to encourage participation from these leaders.
4. Influence industry directions: Like other developing programs, the program management will have the opportunity to influence industry direction and spawn new technologies. Since the effort can be treated as a model, many technologies and products developed can be applied to other similar systems.
5. Conduct prototyping work: Prototyping will be used to evaluate the suitability, feasibility, and cost of incorporating a particular technology. In essence, it provides a less costly mechanism to test a technology before significant investment is spent in the product development process. Technologies that have high risk with high payoffs should be chosen as the primary subjects for prototyping.

The triple constraints of time, cost, and performance provide a basis for managing C2 technology projects across all specifications for product assurance. The interrelationships of these constraints are summarized below:

- **Scope (Performance)➔ Performance Specs, Output Targets, etc.**
- **Schedule (Time) ➔ Due Date Expectations, Milestones, etc.**
- **Cost (Budget) ➔ Budget Limitations, Cost Estimates, etc.**

If the above three elements are managed effectively, all the other areas of project expectations will be implicitly or explicitly covered. Cost and schedule are subject to risk. Communications are required for effective scoping. Human resources affect scope, cost, and schedule. Procurement provides the tools and infrastructure for project delivery. Quality implies performance and vice versa. Integration creates synergy, accountability, and connection among all the elements. Strategic planning is the basis for achieving adequate attention to all the requirements of a project. The larger and more complex a project is, the more critical the need for using structured project planning as detailed in the next section.

Application of the Triple C Model

The Triple C model is an effective project planning tool suitable for adaptation for managing C2 technology projects. The model states that project management can be enhanced by implementing it within the integrated functions of

- Communication
- Cooperation
- Coordination

The model facilitates a systematic approach to project planning, organizing, scheduling, and control. The Triple C model is distinguished from the 3C (command, control, communication) approach in traditional military operations. The military approach emphasizes personnel management in the hierarchy of command, control, and communication. This places communication as the third element. The Triple C, by contrast, suggests communication as the first and foremost function. The Triple C model can be implemented for C2 technology planning, scheduling and control purposes. The model is shown graphically in Figure 4. It highlights what must be done and when. It can also help to identify the resources (personnel, equipment, facilities, etc.) required for each effort. It points out important questions such as:

- Does each project participant know what the objective is?
- Does each participant know his or her role in achieving the objective?
- What obstacles may prevent a participant from playing his or her role effectively?

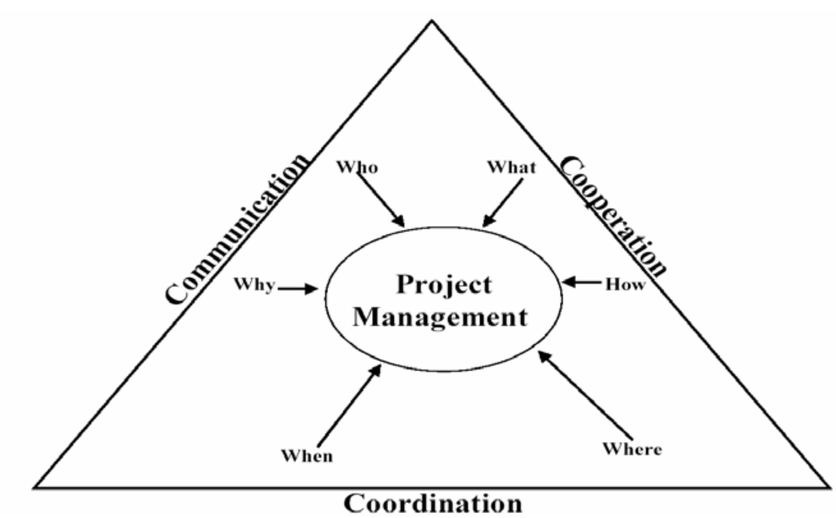

Figure 4. Basic Triple C Model

Communication

Communication makes working together possible. The communication function of project management involves making all those concerned become aware of project requirements and progress. Those who will be affected by the project directly or indirectly, as direct participants or as beneficiaries, should be informed as appropriate regarding the following:

- Scope of the project
- Personnel contribution required
- Expected cost and merits of the project
- Project organization and implementation plan
- Potential adverse effects if the project should fail
- Alternatives, if any, for achieving the project goal
- Potential direct and indirect benefits of the project

The communication channel must be kept open throughout the project life cycle. In addition to internal communication, appropriate external sources should also be consulted. The project manager must do the following:

- Exude commitment to the project
- Utilize the communication responsibility matrix
- Facilitate multi-channel communication interfaces
- Identify internal and external communication needs
- Resolve organizational and communication hierarchies
- Encourage both formal and informal communication links

When clear communication is maintained between management and employees and among peers, sustainability of good management practices can be assured. Project communication may be carried out in one or more of the following formats:

- One-to-many
- One-to-one
- Many-to-one
- Written and formal
- Written and informal
- Oral and formal
- Oral and informal
- Nonverbal gestures

Good communication is actualized when what is implied is perceived as intended. Effective communications are vital to the success of any project. Despite the awareness that proper communications form the blueprint for project success, many technologists, scientists, and development engineers still fail in their communication functions. This is particularly detrimental in C2 technology projects. Some of the factors that influence the effectiveness of communication within a C2 project organization structure are described below.

1. **Personal perception**. Each person perceives events on the basis of personal psychological, social, cultural, and experimental background. As a result, no two people can interpret a given event the same way. The nature of events is not always the critical aspect of a problem situation. Rather, the problem is often the different perceptions of the different people involved.

2. **Psychological profile**. The psychological makeup of each person determines personal reactions to events or words. Thus, individual needs and level of thinking will dictate how a message is interpreted.

3. **Social Environment**. Communication problems sometimes arise because people have been conditioned by their prevailing social environment to interpret certain

things in unique ways. Vocabulary, idioms, organizational status, social stereotypes, and economic situation are among the social factors that can thwart effective communication.

4. **Cultural background**. Cultural differences are among the most pervasive barriers to project communications, especially in today's multi-disciplinary and multi-technology organizations. Language and cultural idiosyncrasies often determine how communication is approached and interpreted.

5. **Semantic and syntactic factors**. Semantic and syntactic barriers to communications usually occur in written documents. Semantic factors are those that relate to the intrinsic knowledge of the subject of the communication. Syntactic factors are those that relate to the form in which the communication is presented. The problems created by these factors become acute in situations where response, feedback, or reaction to the communication cannot be observed. Science and technology projects are particularly prone to this type of problem.

6. **Organizational structure**. Frequently, the organization structure in which a project is conducted has a direct influence on the flow of information and, consequently, on the effectiveness of communication. Organization hierarchy may determine how different personnel levels perceive a given communication.

7. **Communication media**. The method of transmitting a message may also affect the value ascribed to the message and consequently, how it is interpreted or used. The common barriers to project communications are
   - Inattentiveness
   - Lack of organization
   - Outstanding grudges
   - Preconceived notions
   - Ambiguous presentation
   - Emotions and sentiments
   - Lack of communication feedback
   - Sloppy and unprofessional presentation
   - Lack of confidence in the communicator
   - Lack of confidence by the communicator
   - Low credibility of communicator
   - Unnecessary technical jargon
   - Too many people involved
   - Untimely communication
   - Arrogance or imposition
   - Lack of focus.

Figure 5 shows an example of a design of a communication responsibility matrix. A communication responsibility matrix shows the linking of sources of communication and targets of communication. Cells within the matrix indicate the subject of the desired communication. There should be at least one filled cell in each row and each column of the matrix. This assures that each individual of a department has at least one communication source or target associated with him or her. With a communication responsibility matrix, a clear understanding of what needs to be communicated to whom can be developed.

Communication in a project environment can take any of several forms. The specific needs of a project may dictate the most appropriate mode. Three popular technology communication modes are discussed below in the context of communicating data and information for technology management.

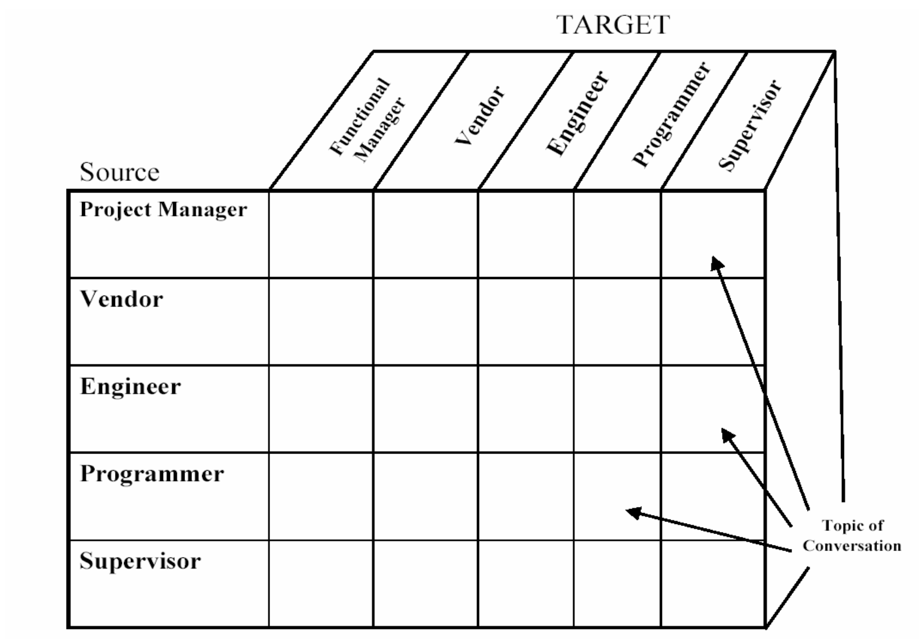

Figure 5. Triple C Communication Matrix

Simplex communication

This is a unidirectional communication arrangement in which one project entity initiates communication to another entity or individual within the project environment. The entity addressed in the communication does not have mechanism or capability for responding to the communication. An extreme example of this is a one-way, top-down communication from top management to the project personnel. In this case, the personnel have no communication access or input to top management. A budget-related example is a case where top management allocates budget to a project without requesting and reviewing the actual needs of the project. Simplex communication is common in authoritarian organizations.

Half-duplex communication

This is a bi-directional communication arrangement whereby one project entity can communicate with another entity and receive a response within a certain time lag. Both entities can communicate with each other but not at the same time. An example of half-duplex communication is a project organization that permits communication with top management without a direct meeting. Each communicator must wait for a response from the target of the communication. Request and allocation without a budget meeting is another example of half-duplex data communication in project management.

Full-duplex communication

This involves a communication arrangement that permits a dialogue between the communicating entities. Both individuals and entities can communicate with each other at the same time or face-to-face. As long as there is no clash of words, this appears to be the most receptive communication mode. It allows participative project planning in which each project personnel has an opportunity to contribute to the planning process.

Figure 6 presents a graphical representation of the communication modes discussed above. Each member of a project team needs to recognize the nature of the prevailing communication mode in the project. Management must evaluate the prevailing communication structure and attempt to modify it if necessary to enhance project functions. An evaluation of who is to communicate with whom about what may help improve the project data/information communication process. A communication matrix may include notations about the desired modes of communication between individuals and groups in the project environment.

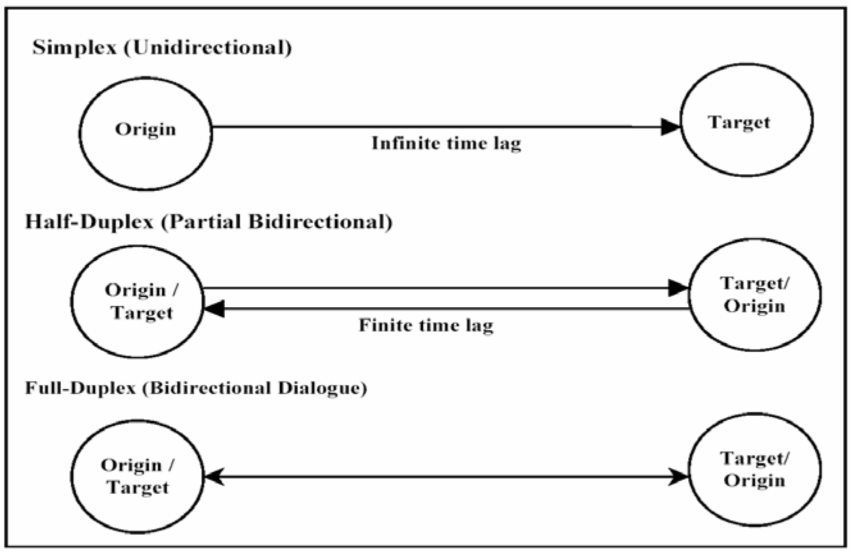

Figure 6. Project Communication Modes

Cooperation

The cooperation of the project personnel must be explicitly elicited. Merely voicing consent for a project is not enough assurance of full cooperation. The participants and beneficiaries of the project must be convinced of the merits of the project. Some of the factors that influence cooperation in a project environment include personnel requirements, resource requirements, budget limitations, past experiences, conflicting priorities, and lack of uniform organizational support. A structured approach to seeking cooperation should clarify the following:

- Level of cooperative efforts required
- Positive implications for future projects
- Negative implications of lack of cooperation
- Criticality of cooperation to project success
- Organizational impact of cooperation
- Time frame involved in the project

Cooperation is a basic virtue of human interaction. More projects fail due to a lack of cooperation and commitment than any other project factors. To secure and retain the cooperation of project participants, you must elicit a positive first reaction to the project. The most positive aspects of a project should be the first items of project communication. For project management, there are different types of cooperation that should be understood.

Functional cooperation. This is cooperation induced by the nature of the functional relationship between two groups. The two groups may be required to perform related functions that can only be accomplished through mutual cooperation.

Social cooperation. This is the type of cooperation effected by the social relationship between two groups. The prevailing social relationship motivates cooperation that may be useful in getting project work done.

Legal cooperation. Legal cooperation is the type of cooperation that is imposed through some authoritative requirement. In this case, the participants may have no choice other than to cooperate.

Administrative cooperation. This is cooperation brought on by administrative requirements that make it imperative that two groups work together on a common goal.

Associative cooperation. This type of cooperation may also be referred to as collegiality. The level of cooperation is determined by the association that exists between two groups.

Proximity cooperation. Cooperation due to the fact that two groups are geographically close is referred to as proximity cooperation. Being close makes it imperative that the two groups work together.

Dependency cooperation. This is cooperation caused by the fact that one group depends on another group for some important aspect. Such dependency is usually of a mutual two-way nature. One group depends on the other for one thing while the latter group depends on the former for some other thing.

Imposed cooperation. In this type of cooperation, external agents must be employed to induced cooperation between two groups. This is applicable for cases where the two groups have no natural reason to cooperate. This is where the approaches presented earlier for seeking cooperation can became very useful.

Lateral cooperation. Lateral cooperation involves cooperation with peers and immediate associates. Lateral cooperation is often easy to achieve because existing lateral relationships create a conducive environment for project cooperation.

Vertical cooperation. Vertical or hierarchical cooperation refers to cooperation that is implied by the hierarchical structure of the project. For example, subordinates are expected to cooperate with their vertical superiors.

Clarification of project priorities will facilitate personnel cooperation. Relative priorities of multiple projects should be specified so that a priority to all groups within the organization. Some guidelines for securing cooperation for most projects are

- Establish achievable goals for the project.
- Clearly outline the individual commitments required.
- Integrate project priorities with existing priorities.
- Eliminate the fear of job loss due to industrialization.
- Anticipate and eliminate potential sources of conflict.
- Use an open-door policy to address project grievances.
- Remove skepticism by documenting the merits of the project.

Coordination

After the communication and cooperation functions have successfully been initiated, the efforts of the project personnel must be coordinated. Coordination facilitates harmonious organization of project efforts. The construction of a responsibility chart can be very helpful at this stage. A responsibility chart is a matrix consisting of columns of individual or functional departments and rows of required actions. Cells within the matrix are filled with relationship codes that indicate who is responsible for what. The matrix helps avoid neglecting crucial communication requirements and obligations. It can help resolve questions such as

- Who is to do what?
- How long will it take?
- Who is to inform whom of what?
- Whose approval is needed for what?
- Who is responsible for which results?
- What personnel interfaces are required?
- What support is needed from whom and when?

Resolving Technology Conflicts with Triple C

When implemented as an integrated process, the Triple C model can help avoid conflicts in technology expectations. Through the process of communication and cooperation, it should be clear what the technology cannot deliver. Traditional management approaches usual do not address what a technology cannot do. Those unaddressed limitations then turn out to create project problems later on. The explicit approach of Triple C forces these limitations to be addressed up front; thereby preempting conflicts. When conflicts do develop, Triple C can help in resolving the conflicts. Several sources of conflicts can exist in large technology projects; as discussed below.

Schedule conflict. Conflicts can develop because of improper timing or sequencing of project tasks. This is particularly common in large multi-technology projects. Procrastination can lead to having too much to do at once, thereby creating a clash of project functions and discord among project team members. Inaccurate estimates of time requirements may lead to infeasible activity schedules. Project coordination can help avoid schedule conflicts.

Cost conflict. Project cost may not be generally acceptable to the clients of a project. This will lead to project conflict. Even if the initial cost of the project is acceptable, a lack of cost control during implementation can lead to conflicts. Poor budget allocation approaches and the lack of a financial feasibility study will cause cost conflicts later on in a project. Communication and coordination can help prevent most of the adverse effects of cost conflicts.

Performance conflict. If clear performance requirements are not established, performance conflicts will develop. Lack of clearly defined performance standards can lead each person to evaluate his or her own performance based on personal value judgments. In order to uniformly evaluate quality of work and monitor project progress, performance standards should be established by using the Triple C approach.

Management conflict. There must be a two-way alliance between management and the project team. The views of management should be understood by the team. The views of the team should be appreciated by management. If this does not happen, management conflicts will develop. A lack of a two-way interaction can lead to strikes and work stoppages, which can be detrimental to project objectives. The Triple C approach can help create amicable dialogue environment between management and the project team.

Technical conflict. If the technical basis of a project is not sound, technical conflict will develop. New C2 projects are particularly prone to technical conflicts because of their significant dependence on technology. Lack of a comprehensive technical feasibility study will lead to technical conflicts. Performance requirements and systems specifications can be integrated through the Triple C approach to avoid technical conflicts.

Priority conflict. Priority conflicts can develop if project objectives are not defined properly and applied uniformly across a project. Lack of a direct project definition can lead each project member to define his or her own goals which may be in conflict with the intended goal of a project. Lack of consistency of the project mission is another potential source of priority conflicts. Over-assignment of responsibilities with no guidelines for relative significance levels can also lead to priority conflicts. Communication can help defuse priority conflict.

Resource conflict. Resource allocation problems are a major source of conflict in project management. Competition for resources, including personnel, tools, hardware, software, and so on, can lead to disruptive clashes among project members. The Triple C approach can help secure resource cooperation.

Power conflict. Project politics lead to a power play which can adversely affect the progress of a project. Project authority and project power should be clearly delineated. Project authority is the control that a person has by virtue of his or her functional post. Project power relates to the clout and influence, which a person can exercise due to connections within the administrative structure. People with popular personalities can often wield a lot of project power in spite of low or nonexistent project authority. The Triple C model can facilitate a positive marriage of project authority and power to the benefit of project goals. This will help define clear leadership for a project.

Personality conflict. Personality conflict is a common problem in projects involving a large group of people. The larger the project, the larger the size of the management team needed to keep things running. Unfortunately, the larger management team creates an opportunity for personality conflicts. Communication and cooperation can help defuse personality conflicts.

Triple C Planning

The key to a successful technology is good planning. Project planning provides the basis for the initiation, implementation, and termination of a project, setting guidelines for specific project objectives, project structure, tasks, milestones, personnel, cost, equipment, performance, and problem resolutions. The question of whether or not the project is needed at all should be addressed in the Triple C planning phase of new projects, as well as an analysis of what is needed and what is available. The availability of technical expertise within the organization and outside the organization should be reviewed. If subcontracting is needed, the nature of the contracts should undergo a thorough analysis. The "make", "buy", "lease", "sub-contract," or "do-nothing" alternatives should be compared as a part of the project planning process. In the initial stage of project planning, both the internal and external factors that influence the project should be determined and given priority weights. Examples of internal influences on C2 technology project plans may include the following:

- Infrastructure
- Project scope
- Personnel relations
- Project home base
- Project leadership
- Organizational goal
- Management approach
- Technical manpower resources
- Resource and capital availability.

In addition to internal factors, project plans can be influenced by external factors. An external factor may be the sole instigator of a project, or it may manifest itself in combination with other external and internal factors. Such external factors include the following:

- Public needs
- Market needs
- National goals
- Industry stability
- State of technology
- Government regulations.

Strategic Triple C planning decisions may be divided into three strategy levels: supra-level planning, macro-level planning, and micro-level planning:

Supra-level Planning**:** Planning at this level deals with the big picture of how the project fits the overall and long-range organizational goals. Questions faced at this level concern potential contributions of the project to the welfare of the organization, the effect on the depletion of company resources, required interfaces with other projects within and outside the organization, risk exposure, management support for the project, concurrent projects, company culture, market share, shareholder expectations, and financial stability.

Macro-level Planning: Planning decisions at this level address the overall planning within the project boundary. The scope of the project and its operational interfaces should be addressed at this level. Questions faced at the macro level include goal definition, project scope, the availability of qualified personnel and resources, project policies, communication interfaces, budget requirements, goal interactions, deadlines, and conflict-resolution strategies.

Micro-level Planning: This deals with detailed operational plans at the task levels of the project. Definite and explicit tactics for accomplishing specific project objectives are developed at the micro level. The concept of MBO (management by objective) may be particularly effective at this level. MBO permits each project member to plan his or her own work at the micro level. Factors to be considered at the micro level of project decisions include scheduled time, training requirements, tools required, task procedures, reporting requirements, and quality requirements.

Large-scale C2 project planning should include a statement about the feasibility of subcontracting part of the project work. Subcontracting or outsourcing may be necessary for various reasons, including lower cost, higher efficiency, or logistical convenience.

Feasibility Analysis

The feasibility of a project can be ascertained in terms of technical factors, economic factors, or both. A feasibility study is documented with a report showing all the ramifications of the project and should be broken down into the following categories:

Technical feasibility. "Technical feasibility" refers to the ability of the process to take advantage of the current state of the technology in pursuing further improvement. The technical capability of the personnel as well as the capability of the available technology should be considered.

Managerial feasibility. Managerial feasibility involves the capability of the infrastructure of a process to achieve and sustain process improvement. Management support, employee involvement, and commitment are key elements required to ascertain managerial feasibility.

Economic feasibility. This involves the ability of the proposed project to generate economic benefits. A benefit-cost analysis and a breakeven analysis are important aspects of evaluating the economic feasibility of new projects. The tangible and intangible aspects of a project should be translated into economic terms to facilitate a consistent basis for evaluation.

Financial feasibility. Financial feasibility should be distinguished from economic feasibility. Financial feasibility involves the capability of the project organization to raise the appropriate funds needed to implement the proposed project. Project financing can be a major obstacle in large multi-party projects because of the level of capital required. Loan availability, credit worthiness, equity, and loan schedule are important aspects of financial feasibility analysis.

Cultural feasibility. Cultural feasibility deals with the compatibility of the proposed project with the cultural setup of the project environment. In labor-intensive projects, planned functions must be integrated with the local cultural practices and beliefs. For example, religious beliefs may influence what an individual is willing to do or not do.

Social feasibility. Social feasibility addresses the influences that a proposed project may have on the social system in the project environment. The ambient social structure may be such that certain categories of workers may be in short supply or nonexistent. The effect of the project on the social status of the project participants must be assessed to ensure compatibility. It should be recognized that workers in certain industries may have certain status symbols within the society.

Safety feasibility. Safety feasibility is another important aspect that should be considered in project planning. Safety feasibility refers to an analysis of whether the project is capable of being implemented and operated safely with minimal adverse effects on the environment. Unfortunately, environmental impact assessment is often not adequately addressed in complex projects.

Political feasibility. A politically feasible project may be referred to as a "politically correct project." Political considerations often dictate the direction for a proposed project. This is particularly true for large projects with national visibility that may have significant government inputs and political implications. For example, political necessity may be a source of support for a project regardless of the project's merits. On the other hand, worthy projects may face insurmountable opposition simply because of political factors. Political feasibility analysis requires an evaluation of the compatibility of project goals with the prevailing goals of the political system. In general, feasibility analysis for a project should include following items:

C2 Project Team Building

Team building is a key part of project management because workers are expected to perform not just on one team but on a multitude of interfacing teams. To facilitate effective team building, it is important to distinguish between functional organization structure and operational organization structure. Within a team, the functional structure is developed according to functional lines of responsibility while the operational structure takes into account the way workers actually organize themselves to accomplish a task. Figure 7 illustrates three common operational organization options within a team structure. The operational organization can be centralized, hierarchical, or "heterarchical."

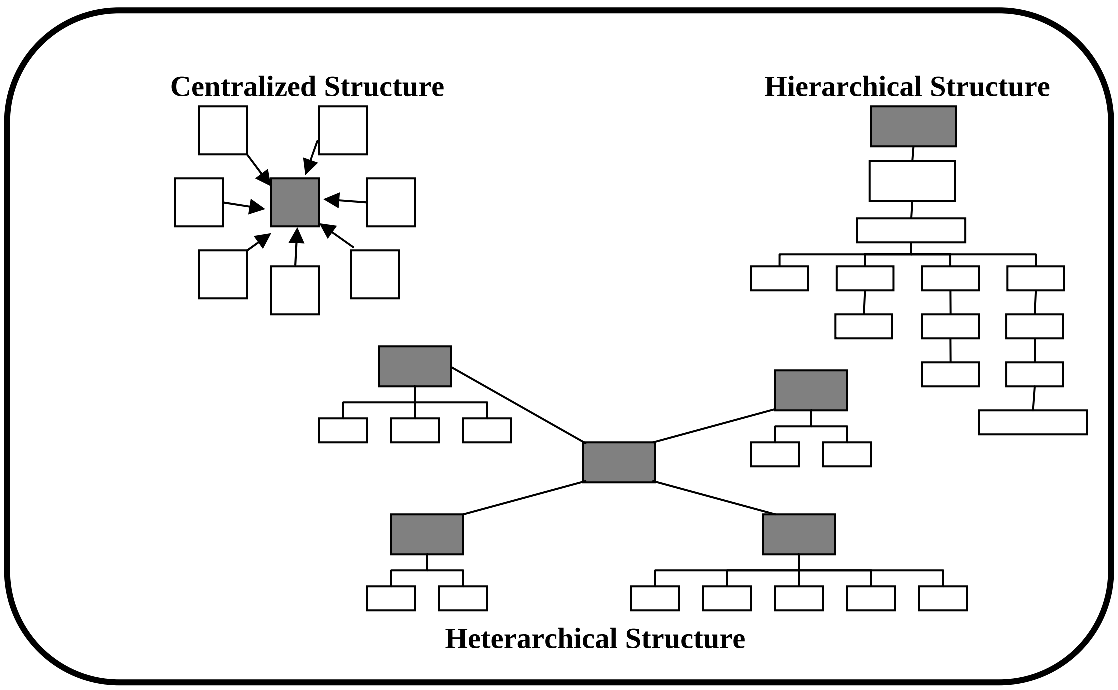

Figure 7. Team Operational Organization Structures

In a centralized structure, workers rely on a specific individual or office for reporting and directive purposes. In a hierarchical structure, the lines of functional reporting existing in the organization are observed as workers pursue their tasks. This approach may discourage free and informal interaction, thereby creating obstacles to effective work. In a heterarchical structure, different heterogeneous teams of workers interact to solve a problem with the aid of a central coordination agent. The effectiveness of a team can be affected by its size and its purpose.

Small teams are useful for responsiveness and prompt action. Large teams are useful for achieving a widespread information base, inclusion, and participation. Strategies for enhancing project team building:

1. Interoffice employee exchange programs,
2. Inter-project transferability of personnel,
3. In-house training for new employees,
4. Diversification and development of in-house job skills,
5. Use of in-house personnel as in-house consultants.

C2 Project Partnering

Project partnering involves having project team and stakeholders operating as partners in the pursuit of project goals. Benefits of project partnering include improved efficiency, cost reduction, resource sharing, better effectiveness, increased potential for innovation, and improvement of quality of products and services. Partnering creates a collective feeling of being together on the project. It fosters a positive attitude that makes it possible to appreciate and accept the views of others. It also recognizes the objectives of all parties and promotes synergism. The communication, cooperation, and coordination concepts of the Triple C model facilitate partnering. Suggestions for setting up project partnering are:

- Use an inclusive organization structure.
- Identify project stakeholders and clients.
- Create information linkages.
- Identify the lead partner.
- Collate the objectives of partners.

Appreciation of the Wider Context of Technology

The Triple C approach is expected to pay dividends as a result of achieving more sustainable cooperation and coordination among technologists, scientists, and R&D engineers. Through their deeper understanding of the wider context of technology impact, the groups can work together more collaboratively. Thus, organizational practices can be enhanced. This will improve the implementation of DOTMLP-F (doctrine, organization, training, materiel, leadership and education, personnel, and facilities). It will also improve evaluation metrics of the JCIDS and JV2020 within the DOD acquisitions framework. Figure 8 shows the integrative model that Triple C can facilitate for industry, academia, and government interactions.

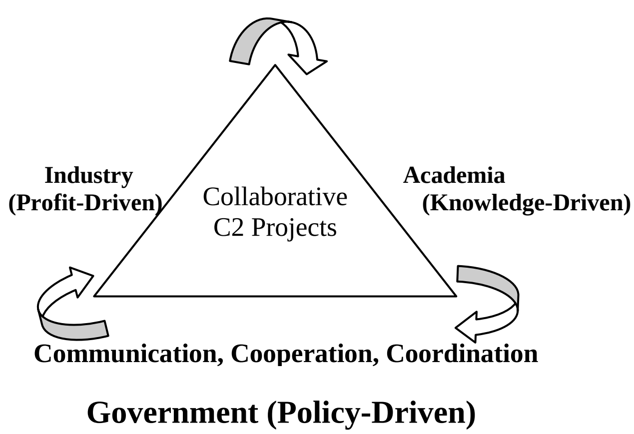

Figure 8 . Application of Triple C to Wider Context of Technology

Conclusion

Within the C2 technology projects, management teams must develop adaptive plans, techniques, processes, and risk management strategies to ensure program success. The management plan must be cognizant of the fact that the entire management team may have to change due to political changes during a project's life cycle. Thus, there must be a mechanism to ensure continuity and consistency of C2 projects. To achieve the desired continuity and sustainable project control practices, this paper recommends the use of the Triple C model, which can help in improving communication, cooperation, and coordination across decision-making processes in Command and Control projects One of the most important ingredients for establishing a good technology team is commitment. The Triple C approach can help achieve such commitment. The organizational structure must create an environment that promotes, or even demands, teamwork. The technology project manager should strive to provide and maintain an atmosphere that fulfills the needs and expectations of C2 technology workers. A team should offer opportunities for positive professional interactions as well as avenues for advancement. These are two of the major benefits of the Triple C approach.

About the Author

Adedeji Badiru is the head of Systems & Engineering Management at the Air Force Institute of Technology. He was previously the department head of Industrial & Information Engineering at the University of Tennessee in Knoxville; and formerly professor of Industrial Engineering and Dean of University College at the University of Oklahoma. He is a registered professional engineer. He is a fellow of the Institute of Industrial Engineers and a Fellow of the Nigerian Academy of Engineering. He holds BS in Industrial Engineering, MS in Mathematics, and MS in Industrial Engineering from Tennessee Technological University, and Ph.D. in Industrial Engineering from the University of Central Florida.