The Logic of Project Management System: An outline for system approach to project management planning[1]

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Abstract

In essence, project management *plan* is defined by activities, where activities are the most detailed and unique elements of a project management planning contents. Symmetrically, project management *system logic* is defined by particles, where particles are the most detailed and unique elements of a collection of general project management system contents.

The *symmetry in definition* of project management plan and project management system logic extends usage of scientific methodology for project management planning to study of project management system logic. This is a great challenge. For example, if project management system logic can be systematically revealed then it can be applied as *system approach* to improve definition of project management plan. In this case we need to:

1 - Understand *current state* of the scientific methodology for project management planning. 2 - Analyze project management system contents *top-down* to the particles level of system contents. 3 – *Reveal* relationships among particles of project management system contents. 4 - Synthetize project management system contents and contents relationships *bottom-up* to the top level of system contents. *5* – Reveal project management *system logic* gradually, by identifying unique sequence for particles of project management system contents. 6 – *Debug and sense* project management system logic. 7 - *Use* project management system logic as perfect outline for definition of project management plan.

In the current state of the scientific methodology for project management planning we can analyze, relate and synthetize elements of project management planning contents and project management system contents.

Project management planning contents have been systematically framed, advanced, explained and applied for project management planning since 1962.

Project management system contents have been systematically studied to reveal system logic and improve project management planning since 2002.

By understanding current state of the scientific methodology for project management planning I provide *disambiguation, integration, imagining* and *system logic* for collection of general project management system contents. Then, I use system logic to address system approach to project management planning and improve definition of project management plan.

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Think about project management plan. While a collection of general project management system contents introduces constellation of visions and motives for project management planning, its system logic outlines sequence of actions and attributes for project management plan.

Introduction

Project management is science and art of handling planned responsibility. As each project is different, from understanding of men made endeavors to study of humanity and exploration of the universe, then it must be handled by comprehensive project management planning that may well be applied across all types of projects.

But evidences show two massive gaps in project management planning: the gap between understandings the scientific methodology for project management planning and its *practical* potentials, as well as the gap between understanding a collection of general project management system contents and its *innovative* potentials - two essential, yet unfinished work of project management planning.

I was incited by the causes behind the lack of understanding the gaps. What project management scholar, manager, practitioner, or management trainee in front of the gaps needs next? How individual reveals the practical and innovative potentials of project management planning? Each idea in all its different ways is very much up for consideration, but when we draw the line? If we do not expose the structural and integral originality hidden within project management planning then the gaps are about to get even wider.

So, this outline is about *practical* and *innovative* project management planning; it brings to reader awareness about the following *subjects*:

- How the methodological related subjects help understand the steps of *project management plan.*
- How the skills related subjects help produce the steps of *project management plan*.
- How the above subjects help understand and produce the steps of *project management system logic.*

Details of both the *project management plan* and *project management system logic* are needed to understand outline for system approach to project management planning. First, the outline reminds on fundamental theories and resulting methodologies for project management planning, which simplify learning and application of the best practices for project management planning. Second, the outline explains the path to reveal project management system logic, which simplifies understanding and application of huge collections of general project management system contents. Both explanations reduce interpretations of project management planning and support practitioners, students, researchers and managers by *system approach* to project management planning.

To get there, I first remind how the fundamental theories and resulting project management planning methodologies have to be applied. Then I use essentially the same methodologies and derive symmetric tools that help reveal and explain the system logic of recognized project management system. Next, having the project management system logic, I discus the practical and innovative aspects of system approach to project management planning and move of project management system from training to application.

The cause of the difficulty to reveal and explain either project management system logic, or project management plan is in human communication; i.e., do we use *narrative* or *structural* approach to analyze, relate and synthetize the contents of project management system or project? For example,

Narrative approach is complicated by holistic elements of system or project contents that can be all of a sudden oriented and related in loops, which creates ambiguous, fractional and biased interpretation of project management system logic, or project management plan.

Structural approach is simplified by detail elements of system or project contents that are timely oriented and related sequentially, which reveals unique, complete and applicable interpretation of project management system logic, or project management plan.

Accordingly, project management system logic, or project management plan has to be more specific in terms of its contents and the contents relationships. When a structure of project management system logic, or project management plan reaches the most detail level, i.e., particle levels of system, or activity levels of project, then we can reveal how a system, or a project contents evolves into system logic, or project plan respectively. It means that *we can understand system logic, or project plan as good as we know its structure*. This was the reason behind decision to base this outline primarily on structural approach and reveal system logic, or project plan in explicit and applicable terms. As a result, this outline is *alternative* to narrative interpretation of project management plan, or project management system logic.

Project management plan is organized, approved and formal project documentation that helps manage project planning objectives. Documentation is based on measurable and reasonable approaches for analyzing, relating, synthetizing, updating and communicating project information of normal, unusual, uncertain and emergent situations during project lifecycle or lifespan. Project management plan consists of two stages; the development of project management plan and the implementation of project management plan.

The development of project management plan starts at the moment when project is formally authorized and ends when the project management plan is approved. The development of *project management plan* consists of the processes for analyzing, relating and synthetizing the project management planning contents. In general, the development of project management plan can be expressed through the following processes:

The development of project management plan starts by the top-down *analysis of project contents* defined by a series of project phases, (e.g., sales, design, procurement, installation, commissioning, handover). Each phase is breakdown successively to more detailed contents, all the way to the level of discrete pieces of a work defined by activities. When the structure of the contents reaches the most detail level, i.e., the *activity* level of a project, then we can perceive the contents of project management plan. This part of top-down analysis is accomplished by use of the Work Breakdown Structure. To complete the top-down analysis we must define the *relationships among defined activities* by use of the Critical Path Method (CPM) or a similar network method. The development of project management plan is finalized by the bottom-up verification, i.e., *synthesis of project contents* and *contents relationships* to more abstract contents, all way to project level defined with project phases. The bottom-up synthesis is accomplished by use of both the Work Breakdown Structure and the Critical Path Method and may change initial assumptions of project contents. These methods, besides many supplementary methods (e.g., assessment of requirements and conditions; quantity takeoff; time and cost estimating; quality planning; risks analysis, procurement planning; valuation and acceptance of project plan), are fundamental for the *development of a project management plan.*

The implementation of project management plan starts at the moment when general project contract is signed and ends when all project contracts are completed. The implementation of project management plan consists of the processes for managing the accomplishments of planned project work and updating project management plan. During implementation of project management plan, we must concurrently handle three forms of the plan; the *original* plan, *target (baseline)* plan and *current* plan. In general, the implementation of project management plan can be expressed through following processes:

The implementation of project management plan starts by *executing project activities* and ends when all project activities are completed. This frequent and sequential management process, known as *feedback*[)] process, (planning, executing, controlling and back to planning), occurs at project data date; it updates the activities in progress on data date, as well as the related succeeding activities after data date. The feedback process includes from time to time the initiating process and/or closing process for major activities or a group of activities. The result of update for the activities are used to build a dynamic and integrated picture of project status, progress, causes and forecasts, as well as to show how the results of project activities change the results for higher levels of project contents. The implementation of project management plan is accomplished by use of the Feedback Method (FM). This method, besides many supplementary methods (e.g., quantity surveying, quality control, risks assessment, *change controls*, earned value management, payment requests processing and claims processing), is fundamental for the *implementation of a project management plan*.

Accordingly, we can understand that practice-oriented approach to project management planning has to be foremost specific in terms of the development and implementation of planning objectives. Indeed, overwhelming examples show that characteristics of current project management planning are appropriate for management of project and project planning objectives. Some general and important characteristics of current project management planning help:

Define planning contents and understand what influence planning objectives. This is achieved by evaluation of alternatives, their scope, time, cost, risks, priorities and other attributes associated with components of project management plan.

Communicate planning contents and build the trust in planning objectives. This is achieved by instructing each stakeholder to understand the integrity, components, objectives and results of project management plan.

Explain dynamism of planning contents its control and impact on planning objectives. This is achieved by updating project conditions and works, as well as assessment of status, progress, changes and forecasts of project management plan.

Evaluate decisions process and actions to ensure support for planning objectives. This is achieved by cooperating with each stakeholder in assessment of related contents, requirements and responsibilities defined in project management plan.

Motivate project stakeholders to accomplish planning objectives. This is achieved by developing the incentive scheme that is consistent with accomplishments of project management plan

Current project management planning is applicable to contents that can be identified, quantified, implemented, controlled, selectively reported, paid and updated. It can be used for research, development, or maintenance projects in engineering, construction, information technology, production and other. *This part of the outline reminds to project management planning contents, which is essential for professionals and students interested in understanding and producing project management plan.* Figure 'Management Summary' illustrates a simple, sufficient and reliable management summary report for the project closely valued $500 million, completed in 36 months and defined by eight thousands activities approximately and in excess of hundred thousand of activity attributes. The report helps top managers to assess the status, progress and forecasts of project and major contracts and make responsible decisions. Forms, selection, organization, usage and update of project management planning data and reports are transparent to any cluster of structural components of any project, or program. Understanding this part of the outline is condition for a successful project management planning in the world of today.

Project management system logic is other parts of this outline. For that purpose we must have a documented project management system and the knowledge to reveal and explain its system logic. If we present project management system logic in sequential form then it can be used as perfect outline for project management planning.

I use the current project management planning and derivative tools to reveal, explain and apply project management system logic of project management system contents. Reader can find in the outline distinctive descriptions as, how she/he can establish the critical links among abundance of project management system contents and reveals its logic, or how he/she can modify the system logic for specific requirements. Those pages help reader to enhance the contents and advance the application process of both the project management system logic and project management plan. *This part of the outline is ahead of time and explains project management system contents, which is essential for academics interested in understanding and studying project management system logic.* Figure 'Critical Output Sequence' illustrates the system logic, or steps of critical outputs sequence of the PMBOK Guide Fourth Edition; it can be used for various purposes, including further analysis and updating of project management system contents and its logic, as well as subsequent updating of processes for the development and implementation of project management plan. The identical approach can be now used to reveal, explain, improve and apply the unique system logic of any collection of project management system contents. Understanding this part of the outline is necessary for project management planning in 21st century.

System logic ideas are almost everything that will be discussed in continuation of this outline. But there are many details that must be argued to frame the whole *path from practice to applied research of system knowledge and system approach to project management plan*. Let's make some explanations that are essential for understanding an entirely new development and use of project management system knowledge and system approach to project management planning.

Project Management System Logic

Let's remind, 'a system means a grouping of parts that operate together for common purpose', (Forrester, J. W., 1968, p.1/2). *Then a system must show the contents of parts in each group and relationships of parts within a group and among groups.* In view of that, *project management plan* is based on the contents of activities in work packages and relationships of activities within a work package and among work packages. Analogically, *project management system logic* must be based on the contents of particles in project management processes and relationships of particles within a process and among processes.

Clearly, we are looking here for methodological symmetry that rules both the project management plan and project management system logic *by their most detailed elements*. The methodological symmetry in our case requires that the development and implementation of project management system logic must be bounded *by the same knowledge base and procedures* used for the development and implementation of project management plan. Therefore, if we analyze, relate and synthesize the system particles, as we do with project activities, we arrive at definite knowledge of selected project management system that reveals a form of *project management system logic*. Such system logic can be methodically analyzed and modified to aid the development and implementation of a project management plan consistent with project requirements and selected system.

Forrester emphasizes that 'a structure is essential if we are to effectively interrelate and interpret our observations in any field of knowledge', (Forrester, J. W., 1968, p.1/2-1/3). Each project management plan may include the same set of phases, however, the structure of selected phases are different for each project management plan; the structure ends with specific sets of activities and their sequence that *cannot be applied to other projects*. Quite contrasting, project management system logic may include different set of general knowledge areas, however, the structure of selected set of knowledge areas are same or alike for each project management system; the structure ends with same or alike set of general particles and their sequence that *can be applied repeatedly as outline to other projects*. This creates situation for the system approach to project management planning.

To develop comprehensive structure of system contents, we must develop the equivalent contents of knowledge for each level of the system structure. The levels of system structure could be organized as, e.g., the system, system functions, function processes, individual processes and particles of each process. If is meaningful and needed then we can reorganize the contents of knowledge at intermediate levels of system structure, e.g., the system, system process groups, group processes, individual processes and particles of each process. In all cases, we must assure that each level of a system structure includes development of all steps necessary to achieve outcomes assumed in the preceding level of system structure and that the same contents of knowledge is developed to succeeding levels in more details. When a system structure reaches the particles level of the system, regardless how we organize the intermediate levels of system structure, it always ends with *the same set of unique* particles. Consequently:

Each particle from the set can be uniquely *related* to one or more other particles.

Related set of unique particles reveals *unique* system logic.

Such system logic becomes *integrative* source for relationships among components at higher levels of the system structure.

Let's see some more details.

Why can the particles of a project management system be *related in one way at a moment of time*? Since the process output particles are unique and a particle from the process is identified as an *input requirements* for the development of a succeeding process, then such relational particle fill in the input requirement for succeeding process. Therefore, for well documented system *we rather reveal than construct the system relationships; in fact the relationships of unique particles evolve in one way at a moment of time and almost entirely without our directions*. This is important; e.g., well-structured system contents allow that particles from different processes expose their ultimate relationships and connect into logically flexible strings.

Why particles of a project management system reveal *unique* system logic? The top-down analysis of contents and contents relationships always results into more detailed and unique components. It means, each component is described by a set of unique succeeding components, which exclude repeating of components in a system contents. Once the system contents reach the process level of system structure then each process relates by one or more unique particles to preceding and/or succeeding processes. Such unique and relational particles create a network of relationships for a given contents of a project management system and show exactly how the system logic evolves. *It follows that there are no alternative relationships between particles but only those relationships that form unique system logic at a moment of time.*

Why particles of a project management system reveal *integrative* system logic? The higher levels of system logic are the result of the bottom-up synthesis of system particles, i.e., synthesis of the particles and their relationships into higher whole components. Once the system logic is synthetized at the process level by relational particles then each process is synthetized indirectly in a higher whole of the system structure by relational processes. Therefore, the network of relationships between unique components of system contents is analyzed top-down to the lowest level of system structure and synthetized bottom-up to higher whole. At a moment of time *the network of relationships stays integrated at each level and across the levels of the system structure.*

The above observations were tested for three editions of PMBOK Guide. It was realized that particles of each edition can be *related in one way at a moment of time* and when related they reveal *unique* and *integrative* system logic of particular PMBOK Guide edition. (Abdomerovic, M., 2009b, 2005b, 2002).

Before we decide about system approach to the development and implementation of project management plan we must select a recognized and well-structured project management system that can be used for practical purpose. Selected *system has to be considered as project* and the system particles have to be analyzed, related and synthesized as project activities. Such system must be adaptable for structuring to the particles level of the system; otherwise the system is problematic and cannot be used for project management planning. Among available project management systems I found that the PMBOK Guide matches the requirements of the study; the voluminous, open, well-structured and manageable contents of PMI's the PMBOK Guide differs significantly from other project management systems by its unique *relational outputs/inputs characteristic* that allow development of the PMBOK Guide's system logic. This fact was used to examine the contents and contents relationships for each input and output of three editions of the PMBOK Guide. The evidence has proved that the relationship between the particles, i.e., outputs/inputs of each the PMBOK Guide edition reveal unique, integrative, adaptable and applicable system logic. Such system logic has been used in this outline to discuss the system approach to project management planning.

By acknowledging that system particles can be related in one way only at the time, which results in the unique and integrative system logic, we can:

1. *Display the system logic in a relative time frame* by revealing the relationships and sequential position of each particle.

2. *Discuss meaning of the system logic*; e.g., detect and fix errors in development of system logic caused by interruptions of relationships or inaccurate, unusual or impossible sequence among system particles.

3. *Change the system logic* by revealing different conditions, input requirements and relationships for the system processes and consequently for particles of the system.

4. *Assign each particle of the system logic by codes structure* for higher levels of system knowledge and use the codes primarily to reorganize intermediate levels of system logic, as well as to connect system logic to system structure of the company and external organizational entities.

5. *Apply system logic repeatedly* because its contents represent general accepted project management knowledge in distinctive and accessible form, (e.g., PMI, 2008; 2000; Abdomerovic, M., 2009b; 2002).

Comprehensive system structure can help explain and improve project management system contents in many ways. Before we add another set of project management system knowledge to its current edition it is necessary to systematically *debag* and *disambiguate* existing contents, or eventually *compare* and *integrate* project management system contents to other systems.

<u>*Debagging of project management system contents*</u> requires thorough analysis of contents and contents relationships of the most detail elements of a system. For this purpose we need to understand inputs/outputs chains revealed from the system. All higher levels of a system can be revealed and proved only by understanding their structural details, i.e., particles of the system. For example:

The output '11.5.3.3', (PMI, 2008, p.274), cannot be ‘Project management plan updates’ since:

The process '11.5 Plan Risk Responses' belongs to the Planning Process Group and all the outputs from this group, including the output '11.5.3.3', are inputs to the '4.2.1.2 Outputs from planning processes', which is substantial for development of ‘Project management plan’, (PMI, 2008, p.73).

Therefore, the output '11.5.3.3' should be renamed as the ‘Risk management plan updates’ because ‘Project management plan’ is first time used in the Project Risk Management area at process '11.6 Monitor and Control Risks', therefore, it cannot have its update in the preceding process '11.5', (PMI, 2008, p.274, Abdomerovic, 2009b, p.230).

Disambiguation of project management system contents gradually decreases complexity of a system. For this resolution we must analyze each ambiguous component of system and proceed to its disambiguation. Such component can be disambiguated if we breakdown the element to particles with specific meanings, which tell us more about the component and its use in process relationships. For example:

Let's take a look at the output '6.3.3.3 Project documents updates'. This output contains particles the ‘Activity lists’, ‘Activity attributes’, ‘Resource calendars’, (PMI, 2008, p.145). Those particles can be used to relate to other processes and explain five missing links between: the process '6.3 Estimate Activity Resources' and the processes' 6.4 Estimate Activity Duration', '6.5 Develop Schedule' and '7.2 Determine Budget'. In this case:

1. The ‘Activity lists’ can be used to relate with the input '6.4.1.1 Activity lists'.

2. The ‘Activity attributes’ can be used to relate with the input '6.4.1.2 Activity attributes'.

3. The ‘Resource calendars’ can be used to relate with the inputs '6.4.1.4 Resource calendars', '6.5.1.5 Resource calendars' and '7.2.1.5 Resource calendars'. (Abdomerovic, 2009a, ‘Issues related to Project Documents’).

Comparison between systems and integration of systems may have growing impact on framing of project management standards. There are great ideas (Wideman, 2004, p.91) that may lose opportunity to compare with other generally known systems. For example:

A high level of alignment was found with the [GAPPS’s] 48 categories [topics] and other corpora [standards], although this was of varying consistency. (Crawford, L., et al., 2007, p.15). Association of identified keywords, (Crawford, L., et al., 2007, Appendix, p.19-21), suggests a broad similarity of emphasis between the existing standards … and general trends in the development of international standards for project management, (Crawford, L., et al., 2007, p.15).

However, some fundamental elements of this study, e.g., comparison and relationships between the standards, could not be considered. Here are some examples. The PMBOK Guide “provides guidelines for managing individual projects” (PMI, 2008, p.3), while the GAPPS “helps an assessor infer whether an experienced, practicing project manager is likely to be able to perform competently on future projects” (GAPPS, 2007, p.9), cannot be compared. If we try to identify

GAPPS topics within the contents of PMBOK Guide Fourth Edition, we can find that the GAPPS topics, (GAPPS, 2007, p.41), are scattered throughout different levels and structures of the PMBOK Guide contents:

Scope Management, Time Management and some other GAPPS topics can be found at the knowledge areas level of the PMBOK. Guide. (PMI, 2008, p.103, 129).

Change Control, Project Closeout/Finalization and some other GAPPS topics can be found at the process level of the PMBOK Guide. (PMI, 2008, p.93, 99).

Business Case, Requirements Management and some other GAPPS topics can be found at the input or output level of the PMBOK Guide. (PMI, 2008, p75, 109-111).

Information & Communication Management, Negotiation and some other GAPPS topics can be found at the tools and techniques level of the PMBOK Guide. (PMI, 2008, p.87, 227).

The only way to overcome this problem is to develop the GAPPS and other general standard to the level of particles, where all commonness, differences and relationships between topics of the standards meet. In this case is possible to fully analyze, compare, or integrate project management standards, which may contain some different topics and intermediate structural levels for each topic, however, the same topic of any standard is ultimately comparable at level of particles.

There must be the rules for to systematic analysis of project management system contents. The rules should help user to handle relational output/input characteristics of system processes and reveal, explain and apply system logic. Such rules, which mirror the knowledge base used for project management planning, have been developed and successfully applied for several editions of the PMBOK® Guide, (Abdomerovic, 2009b, 2005b, 2002). The rules can be classified in three sections:

1. The rules for relating particles of system logic, or condition that control how a particle of a process is related to its predecessors and/or successors.

2. The rules for developing the chronological sequence of particles, or conditions that allow incremental explanation of system logic, in step by step procedure, until entire contents of the system is included.

3. The rules for verification of system logic, or condition that prove and set the system logic as an outline for the development and implementation of project management plan.

Excerpt from the rules for relating particles of system logic.

This part of system logic is illustrated in figure 'Relationships of System Particles'. Some holistic statement as "project management process groups are linked by the outputs they produce" (PMI, 2008, p.40), must be analyzed in more details. This was possible after a set of rules for relating particles of a system structure were established. Let's illustrate *relationships of system particles* for one typical case that relates uninterrupted processes. To follow this relationships reader must refer to the PMBOK Guide Fourth Edition (PMI, 2008) and figure 'Relationships of System Particles' in this article. For example:

Relationships within a knowledge area, (d), are established by relating particles from one process as input requirements to another process or processes, all way to the last process in a chain. This is observable by moving forward from the first process (e.g., from *'dA'* to *'dB'* and/or *'dC'*) to the last process (e.g., from *'dB'* to *'dC'*).

Complete explanation of the rules for relating particles of system logic has been described earlier, (Abdomerovic, M., 2009b).

Excerpts from the rules for developing the chronological sequence of particles

This part of system logic is illustrated in figure 'Critical Outputs Sequence'. It explains unique sequence of outputs, i.e., particles for the development of a project management plan. The figure shows slightly simplified chronological order in which the critical particles, i.e., critical outputs of the PMBOK Guide Fourth Edition need to be processed, step by step, to develop a project management plan. The figure presents the integration, imagining and system logic of critical contents of the Initiating Process Group and Planning Process Group of the PMBOK Guide Fourth Edition. Let's illustrate by *the first two steps* how the critical outputs sequence develops. To follow this development, reader must refer to the PMBOK Guide Fourth Edition (PMI, 2008) and figure 'Critical Outputs Sequence' in this article.

Step 1

Process 4.1 Develop Project Charter – The process of developing a document that formally authorizes a project or a phase and documenting initial requirements that satisfy the stakeholder's needs and expectations (PMBOK® Guide Fourth Edition p.403, 73-77).

The inputs to this process are open start inputs, which represent initial step in development of the critical output sequence.

The inputs into this process are:

4.1.1.1 Project statement of work
4.1.1.2 Business case
4.1.1.3 Contract
4.1.1.4 Enterprise environmental factors
4.1.1.5 Organizational process assets

The output from this process is:

4.1.3.1 Project charter

The first critical output in the sequence is the 'Project charter'. (See Figure 'Critical Outputs Sequence').

Additional Notes for the Step1

The components 'Organizational Process Assets', 'Enterprise Environmental Factors', and 'Project documents' have a broad meaning. If there is a possibility of identifying and extracting a specific part of their meanings in the form of inputs or outputs, then we can use these specific parts and relate them to input or output sets of other processes.

The 'Contract' appears as an input to the processes 4.1 (Develop Project Charter) and 12.3 (Administer Procurements). Beside this, 'Contracts' appears as an input to process 7.2 (Determine Budget). As these inputs, 'Contract' and 'Contracts', do not have defined unique outputs with the same name and meaning, then we must search for some other outputs that can relate to inputs 'Contract' and Contracts'. To find such outputs we must first examine the definitions of inputs 'Contract' and 'Contracts'. As described:

Input 'Contract', within process 4.1 (Develop Project Charter), "is an input if the project is being done for an external customer" (*PMBOK® Guide Fourth Edition* p.76). Based on this definition for input 4.1.1.3 (Contract) and logical position of process 4.1 (Develop Project Charter), we can say that input 4.1.1.3 (Contract) is an open start input. However, this input should have a specific name which reflects its definition, e.g. 'Contract with client'.

Input 'Contract', within process 12.3 (Administer Procurement), is a procurement contract "awarded to each selected seller" (*PMBOK® Guide Fourth Edition* p.333, 337). Based on this definition for input 12.3.1.3 (Contract), we can say that the unique output 12.2.3.2 (Procurement contract award) is the one that relates to input 12.3.1.3 (Contract). However, this output and input should have the same name to reflect their relationship.

Input 'Contracts' within process 7.2 (Determine Budget) is "contract information and costs relating to products, services, or results that have been purchased are included when determining the budget" (*PMBOK® Guide Fourth Edition* p.176). Based on this definition for input 7.2.1.6 (Contracts), we can say that unique output 12.2.3.2 (Procurement contract award), by its definition could be used to relate to input 7.2.1.6 (Contracts). However, output 12.2.3.2 (Procurement contract award), belongs to 'Executing Process Group', while input 7.2.1.6 (Contracts), belongs to 'Planning Process Group', which causes the loop within the following outputs/inputs: 12.1.3.1 – 12.2.1.1 – 12.2.3.2 – 7.2.1.6 - 7.2.3.1 - 12.1.1.9 – 12.1.3.1.

Therefore, process 7.2 (Determine Budget) cannot contain input 7.2.1.6 (Contracts), or this must be considered as open start input. However, the input 7.2.1.6 (Contracts) can receive contract information if it is partially related to outputs 7.1.3.1 (Activity cost estimates) and 7.1.3.2 (Basis of estimates).

The process 4.1 (Develop Project Chapter) should contain output 'Resource calendars'. A resource calendar is usually developed way before the time of contract specification. This new output in the early project stage can help to remove several open start inputs in later processes.

The succeeding process in development of the critical output sequence is the process 10.1 (Identify Stakeholders).

Step 2

Process 10.1 Identify Stakeholders – The process of identifying all people or organizations impacted by the project, and documenting relevant information regarding their interests, involvement and impact on project success (PMBOK® Guide Fourth Edition p.406, 246-250).

The inputs into this process are independent or already defined, including Project Charter.

The outputs from this process are:

10.1.3.1 Stakeholder register
10.1.3.2 Stakeholder management strategy

The next critical outputs in the sequence are 'Stakeholder register'. (See Figure 'Critical Outputs Sequence').

Additional Notes for the Step2

Figure 10-3. Identify Stakeholders Data Flow Diagram (*PMBOK® Guide Fourth Edition* p.247).

As described earlier, there is no relationship from process 12.1 (Plan Procurements) to process 10.1 through the component 'Procurement documents'. Process 12.1 belongs to 'Planning Process Group' while process 10.1 belongs to 'Initiating Process Group', which causes a loop.

The output 'Resource calendars' should be added to the process 10.1. This new output in the early project stage can help to smoothly run several later processes.

Complete explanation of critical output sequence has been described earlier, (Abdomerovic, M., 2002; 2009b).

By applying the above rules to each particle of a project management system contents I show how project management processes are controlled by the outputs, i.e., particles they produce. Consequently, the control of processes is automatically passed to control of process groups, or any other structure immanent to a system. After this stage, the s*tate of a system at a moment of time* is powered by dynamic feature and is ready for reconstruction caused by different conditions. For example, if there is an actual need to place a particle within the system logic, then we can: reconnect the particle to the existing input requirements, split the particle and reconnect its parts to existing input requirements, split some input requirements and observe different set of resulting output particles, or introduce new input requirements or even new process that can result to expected contents and position for the particle.

In case of large projects, programs or sustainable business opportunity, where strategic project management has increased its role, the compilation of system logic may be different. As project work packages are built by activities, project deliverables by work packages then program is built by projects and other components of program. If characteristics of large projects are such 'that we do not find in classical theory of project but which are core to describing the various aspects we encounter on these project' (Prieto, B., 2015, p.32) then we must firs compile a set of processes with specific inputs and outputs to express new conditions that enable development of system logic for large projects.

If we contradict the development of a project management system to the level of its most detailed elements, i.e., generally known particles, then we will not be able to understand the system and move forward to its application and improvements. Consequently, new project management ideas may not connect to general project management system and may not be understood. Therefore, before we rush over a project management system we need to reveal its system logic since:

System logic is hidden, but inseparable characteristic of project management system. It comes into view from relationships among the most detailed and generally known elements of project management system.

System logic proves theoretical and methodological base of project management planning. The development of system logic is in symmetry of the rules to the development of project management plan.

System logic reduces the complexity of the system to simple steps that show how system evolves. This facilitates testing and improving the contents and conditions for both the particles of the system and whole system.

System logic helps examine differences between project management systems. It provides data built on generally known elements of systems, so we can understand the root causes of variations for the systems.

System logic proves why a project management system is, or is not suitable as an outline for the development and implementation of project management plan. It exposes the differences between requirements for project management planning and restrictions within the system.

System logic helps avoid increasing threat of irrelevance of ever growing knowledge of general project management system. It can be used to show how particular system or its particles contribute to a cumulative project management body of knowledge and to a project.

System logic helps depart from fuzzy explanation for overlaps between high level components of a project management system. It proves that overlaps and other associations between high level system components are governed by particles of system logic.

In absence of references for the development and application of project management system logic a list of observations may additionally help to explain the situation and put this research in a new perspective:

When a system was developed and adopted to express the best practice of company, then it assumes certain contents, processes and their output/input chains. Therefore, a real system operates at the particle level; however, we rarely see such level of details for the models of project management systems.

There is evident disconnection between expectations from practice and narrative approach to developing project management systems. Practitioners in various project management areas are able to structure problem and respond to requirements, while supporters of narrative project management systems rather talk in general terms and leave their systems as unfinished models.

There are fewer and fewer managers informed about current project management planning and about logic of available project management system knowledge. Yet, there is an obvious rush for more sensational discussions about a *new systems, paradigm shift* and *reconstruction* of project management system.

Are we realistic here? While we rarely assess inadequate application of scientific approach to project management planning but often attributing it as 'source of high application cost', 'causes of failed projects', 'lack of dynamism',' lack of flexibility' and other substitutes for arguments. However, we over and over again experiment with some narrative or derivative systems. Let's see the following arguments that may help reader move forward.

We learned from previous sections that the same methodological principles, used for the development and implementation of project management plan are applicable for the development and implementation of project management system logic. *It means that the methodological symmetry governs both the project management plan and project management system logic.* In summary:

The development of project management plan (analysis, relationships, synthesis and updating of project contents) is in symmetry with the development of project management system logic (analysis, relationships, synthesis and updating of system contents*). These symmetries must be at this time essential for explanation of project management plan and project management system logic.*

As a result, the general form of project management system contents in terms of particles of system logic (e.g., resource assignment, …) performs in a system the same way as the specific form of project management knowledge in terms of activities of project plan (e.g., assignment of people, money, machine, space, …) performs in enormous number of projects around us.

If we make reorganization for intermediate levels of knowledge for the structure of project plan or for the structure of system logic then resulting project plan or system logic will not change. However, if we make changes at the level of activities of project plan, or at level of particles of system logic then all upper levels, including the intermediate levels for project plan or for system logic will change. This proves that any level of project plan is controlled by relationships between activities of the plan and that any level of system logic is controlled by relationships between particles of the system. This can be observed only if the project structure is developed at level of activities and the system structure is developed at level of particles.

The simplicity and integrity of the same structural approach is rooted in handling of both the project plan and system logic. Besides, the same approach has been used to explain the *interactions* between technological and management processes, as well as the *overlaps* among components of system or project contents. It also helps integrate the historical achievements and the new perspectives of project management planning.

Conclusion

This article springs from forty years of site experience in project management planning and has developed over the fifteen years through four books, many journal articles and correspondences with project management professionals. The article show how we can advances the current project management planning by revealing and applying project management system logic *as an outline* for the development and implementation of simple, reliable and sufficient project management plan.

Suggested approach is *different* from other views in genre for two main reasons. First, the outline discusses the *new perspective* for the principles and relationships of fundamental theories and resulting methodologies for project management planning, which improves the practice of project management planning. Second, the outline explains the path to *reveal* system logic, which simplifies understanding and application of huge collection of recognized project management system knowledge. Both reasons reduce *interpretations* of fundamental project management knowledge and offer reliable and convenient pattern for improvement of project management planning. Anything that looks as indefensible past or future planning approach is not in the core of this outline.

The *audience* for whom the outline is intended belongs to almost everyone interested in reading about project management planning, or project management system logic. The outline is beneficial to wide scale of individuals involved in learning or practicing project management and project business management, from small project businesses to big organizations that host large programs, as well as for schools having project management in their program of study. Their common interest is to improve the process of project management planning, as well as to understand, use and develop recognized project management system knowledge.

There is a gap between narrative proclamation what project management system should do and the structural approach that has capacity to explain what the system actually does. This can be the beginning for transformation of huge collection of general project management system knowledge from complex and sporadically used entity to simple steps understandable, applicable and continuously mediated by mass population of average project management performers.

Figures (on following pages)

Figure – 1.1

Management Summary

Project 95, Data Date 13 Mar 09, Factored Values in $ (millions)

Activity Description	Start Date	Finish Date	Baseline Value At Completion (1)	Current Schedule % Complete To Date (2)	Earned Value To Date (3=1*2)	Baseline Value To Date (4=1*6)	Value Variance To Date (5=3-4)	Baseline Schedule % Complete To Date (6)
PROJECT	20 Apr 07	30 Apr 10	350,032.72	89	311,294.82	324,870.55	-13,575.73	93
Phase 1	20 Apr 07	28 Aug 09	291,366.98	97	281,805.02	291,366.98	-9,561.96	100
PLC Commissioning	05 Nov 07	19 May 09	23,689.12	83	19,751.74	23,689.12	-3,937.38	100
Equipment Manufacturing	20 Apr 07	08 Dec 08	125,201.64	100	125,201.64	125,201.64	0.00	100
Installation Electrical	13 Jul 07	21 Apr 09	76,814.47	94	72,447.53	76,814.47	-4,366.94	100
Installation Mechanical	21 May 07	14 Jun 09	53,476.75	98	52,219.11	53,476.75	-1,257.64	100
Steel Installation	01 Jun 07	22 Dec 08	12,185.00	100	12,185.00	12,185.00	0.00	100
Phase 2	08 Aug 08	30 Apr 10	58,665.74	50	29,489.80	33,503.57	-4,013.77	56
PLC Commissioning	13 Mar 09	14 Dec 09	6,407.66	0	0.00	1,815.68	-1,815.68	28
Equipment Manufacturing	05 Sep 08	10 Jul 09	20,586.16	74	15,326.35	13,335.78	1,990.57	63
Installation Electrical	20 Sep 08	12 Oct 09	15,706.48	36	5,610.10	8,324.18	-2,714.08	53
Installation Mechanical	22 Sep 08	04 Sep 09	12,859.44	50	6,413.75	7,770.73	-1,356.98	61
Steel Installation	11 Aug 08	10 Jul 09	3,106.00	69	2,139.60	2,257.20	-117.60	73

Project Status: Project schedule and cost are within approved Performance Measurement Baseline. Although negative Value Variance indicates work deficiency, however, it is completely part of non-critical activities and minor disputes.

Management action: Further delay of PLC Commissioning (Phase 2), caused by Installation Electrical delay, have to be watch closely. The details have been discussed at the Construction Manager meeting and recorded on project web page.

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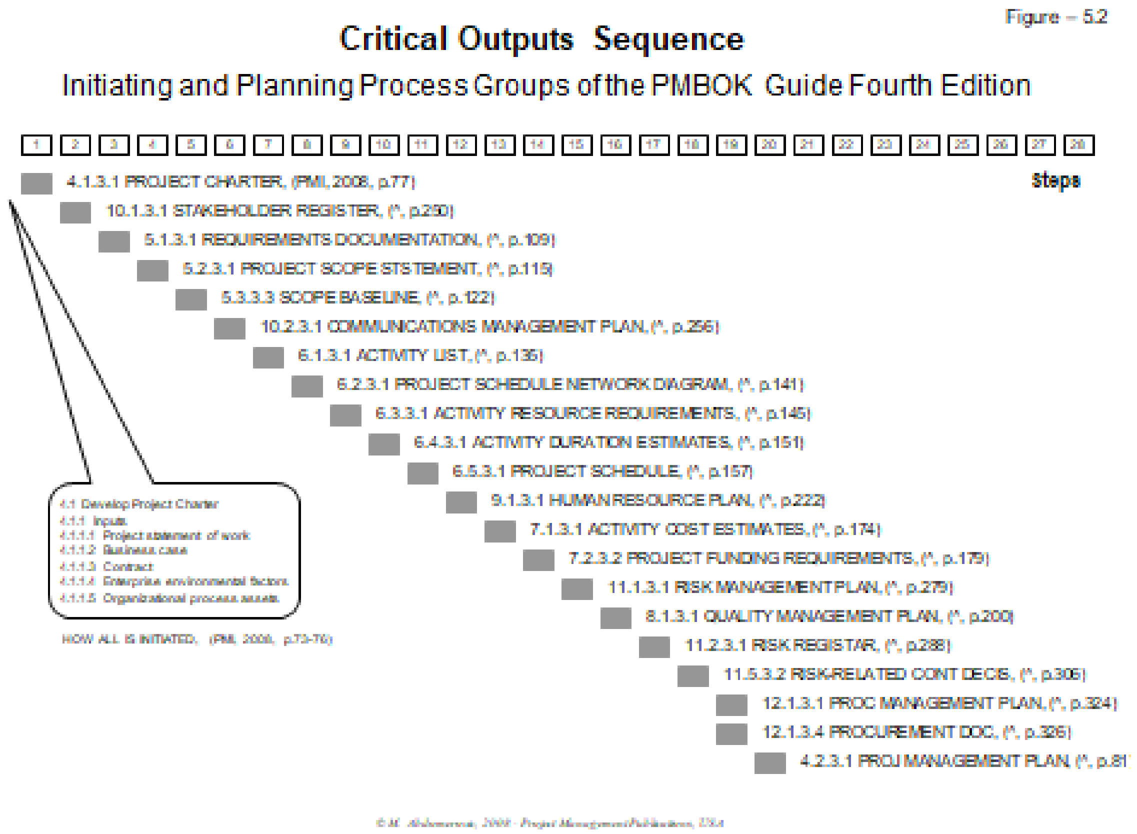
Figure – 5.2
Critical Outputs Sequence
Initiating and Planning Process Groups of the PMBOK Guide Fourth Edition
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Steps
4.1.3.1 PROJECT CHARTER, (PMI, 2008, p.77)
10.1.3.1 STAKEHOLDER REGISTER, (^, p.250)
5.1.3.1 REQUIREMENTS DOCUMENTATION, (^, p.109)
5.2.3.1 PROJECT SCOPE STSTEMENT, (^, p.115)
5.3.3.3 SCOPE BASELINE, (^, p.122)
10.2.3.1 COMMUNICATIONS MANAGEMENT PLAN, (^, p.256)
6.1.3.1 ACTIVITY LIST, (^, p.136)
6.2.3.1 PROJECT SCHEDULE NETWORK DIAGRAM, (^, p.141)
6.3.3.1 ACTIVITY RESOURCE REQUIREMENTS, (^, p.145)
6.4.3.1 ACTIVITY DURATION ESTIMATES, (^, p.151)
6.5.3.1 PROJECT SCHEDULE, (^, p.157)
9.1.3.1 HUMAN RESOURCE PLAN, (^, p.222)
7.1.3.1 ACTIVITY COST ESTIMATES, (^, p.174)
7.2.3.2 PROJECT FUNDING REQUIREMENTS, (^, p.179)
11.1.3.1 RISK MANAGEMENT PLAN, (^, p.279)
8.1.3.1 QUALITY MANAGEMENT PLAN, (^, p.200)
11.2.3.1 RISK REGISTAR, (^, p.288)
11.5.3.2 RISK-RELATED CONT DECIS, (^, p.306)
12.1.3.1 PROC MANAGEMENT PLAN, (^, p.324)
12.1.3.4 PROCUREMENT DOC, (^, p.326)
4.2.3.1 PROJ MANAGEMENT PLAN, (^, p.81
4.1 Develop Project Charter
4.1.1 Inputs
4.1.1.1 Project statement of work
4.1.1.2 Business case
4.1.1.3 Contract
4.1.1.4 Enterprise environmental factors
4.1.1.5 Organizational process assets
HOW ALL IS INITIATED, (PMI, 2008, p.73-76)

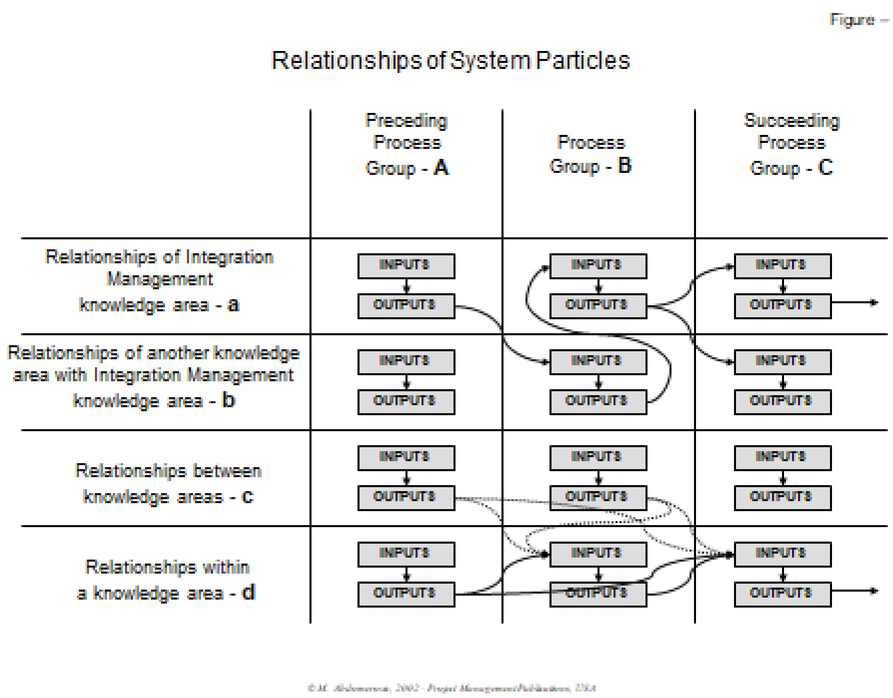
Figure – 5.1
Relationships of System Particles
Preceding Process Group - A
Process Group - B
Succeeding Process Group - C
Relationships of Integration Management knowledge area - a
Relationships of another knowledge area with Integration Management knowledge area - b
Relationships between knowledge areas - c
Relationships within a knowledge area - d
INPUTS
OUTPUTS

Terms

Particle - A particle is the most detailed and unique element revealed from contents of common and generally known project management system knowledge. It shows a general character of essential project management knowledge described or asserted in factual project documentation. For example, the particle ‘resource assignment’ can be found in factual project documentation that contains information about the process of assignment of people, money, space, etc. Particles are not only definite knowledge of project management system, but also the building blocks of project management system logic and higher structural components of project management system. The level of particles is the only platform that can fully explain the contents, contents relationships and dynamic of a project management system. We can differentiate the following particle types:

Open end particle – A process element that indicates distinct output within a system and has not successor relationship. However, project management system overlaps other disciplines and open end particle may relate to inputs of some other discipline.

Open start particle – A process element that indicates distinct input within a system and has not predecessor relationship. However, project management system overlaps other disciplines and open start particle may relate to outputs of some other discipline.

Relational particle - Conditions at the point in time that controls how an output particle is related to an input particle or particles. To be relational both the output and input particle must have the same name, contents and properties. Relational particles always maintain the ‘finish-to-start’ relationship.

A number of project management particles are limited and generally known, however, a number of project management systems and their variations that can be generated by a set of particles are unlimited. Different needs, requirements, knowledge and conditions will certainly result in different processes, input / output chains and consequently in different systems. Imagine how many different type of houses can be built by standard building elements.

Particle attributes - A details of a particle defined in terms of association with elements of factual project documentation. A particle of project management system logic, e.g., the ‘resource assignment’, can be associated within the factual project documentation through the ‘assignment of people’. The particle ‘resource assignment’ and the factual project documentation ‘assignment of people’ can be then associated trough their *attributes*; i.e., properties for the particle ‘resource assignment’ (e.g., unit of measure, qualification, working conditions, associated risk, hiring/reassignment policy) and elements of factual project documentation ‘assignment of people’ (e.g., man, carpenter, project site, site safety, full-time position).

A problem of reaching the attributes in development of system logic comes to a problem of responsibility for terminology in project management. For example, term for activity cost attribute, e.g., ‘planned value’ is also synonymous with ‘planned value for work scheduled’, ‘budget cost for work scheduled’, ‘scheduled value’, or ‘allocated budget’. Although the ‘budget cost for work scheduled’ term was explained and lined up with related project management terms more than half century ago, however, we have today many new names for the same meaning.

Besides, as forthcoming system approach to project management planning becomes more intelligent its particles and attributes tend to be more detail to accommodate an automated development and implementation of project management plan. Such a plan will almost independently drive daily process of project and project business management.

Project management system logic - A characteristic of project management system at a moment of time, which shows how project management system contents is integrated by means of relational particles. Integration starts by analysis of system contents and contents relationships at the level particles and then by synthesis of system contents and contents relationships to the higher level components of system and the system as a whole. System logic presents step-by-step development of a project management system contents and can be used in practice as an outline for the development and implementation of project management plan. System logic is always unique and integrative because it is defined by a set of unique and relational particles of the system contents.

Symmetry - Here is passage about symmetry in natural science that may give an orientation in studying the exclusivity of methodological bases of current project management:

A symmetry principle is a simply statement that something looks the same from certain different points of view. … The symmetries that are really important in nature are not the symmetries of *things,* but the symmetries of *laws.* A symmetry of the laws of nature is a statement that when we make certain changes in the point of view from which we observe natural phenomena, the laws of nature we discover do not change. (Weinberg, S., 1992, p.136-137).

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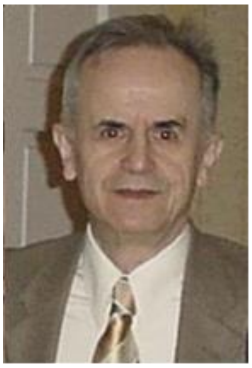
About the Author



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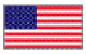

Muhamed Abdomerovic, D.Eng., Civil, has had a diverse and progressive career experience for over thirty years in the development and application of scientific principles to project management planning. He has learned and experienced the challenge of project management planning through involvement in or management of many projects with total budget exceeding $12.5 billion. While employed on a variety of projects in information technology, construction, process industry and energy sectors, he has gained a broad insight into project management methodologies and practice.

Muhamed is currently an independent consultant. He was previously project planner with Vanderlande Industries, master scheduler with FKI Logistex's and program manager with Luckett & Farley. Twenty five years ago he made the decision to permanently move with his family from Bosnia to the United States of America. His earlier experience in Bosnia ranged from construction manager trainee with Vranica to planning department manager with Energoinvest.

Throughout his career he has been an active participant in the development of the project management profession. He has published over 50 journal articles on project scope, time, cost and communication management. He has also published articles in six proceedings of Project Management World Congresses and has published four books. His current research covers the relationships among project management processes, project management system logic and system approach to project management planning.

In recent years he has been concerned with thoughtful project management planning issues. For example, we are observing today how promoters of project management planning derivatives are misrepresenting the scientific approach to project management planning. His most recent papers help reduce disconnects among project management system knowledge, planning and its derivatives.

He was consecutively recertified as a Project Management Professional (PMP) from 1998 to 2010 and has contributed to the development of the PMBOK Guide. He joined the International Project Management Association (IPMA) in 1972. He graduated from the University of Sarajevo with the Diploma of Civil Engineer. *Contact details:*1100-F Metropolitan Ave., Unit 201, Charlotte, NC 28204, mabdomerovic@gmail.com