The Six-Phase Comprehensive Project Life Cycle Model Including the Project Incubation/Feasibility Phase and the Post-Project Evaluation Phase

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Abstract

A holistic systems perspective of projects and programs is required today to achieve the full benefits of systems thinking[4] in project management. To achieve this perspective, the need to establish a **Comprehensive Project Life Cycle** definition and to promote its application on all important projects is first presented. This Comprehensive Project Life Cycle Model recognizes that there is always a **Project Incubation/Feasibility Phase** prior to the currently existing Project Starting Phase of most project management (PM) standards, and also recognizes that there must be an additional **Post-Project Evaluation Phase** after the standard Project Close-out Phase. These phases are defined and discussed for two basic types of projects: 1) delivery or commercial projects and 2) transformational projects. It is recommended that this Comprehensive Project Life Cycle Model be considered for adoption as a standard for important projects. While many PM practitioners and authorities limit the scope of 'project management' to the traditional start-plan-execute-closeout phases, projects begin their existence before the traditional start phase and their products or results continue to exist and must be evaluated after the projects are closed out. The authors assert that these before and after phases must be recognized as belonging within the domain of project management. Regarding the Post-Project Evaluation Phase the need to differentiate between 'project success' and 'project value' is discussed.

Genesis of this paper: The authors became acquainted early in 2012 via the Internet through the *Istituto Italiano di Project Management/ISIPM* LinkedIn discussion group. After an initial on-line exchange of ideas, this multi-generational, multi-cultural trio decided to collaborate to produce this paper. Russell, age 88, an American who has lived in 6 countries on 3 continents, brings a perspective formed by 62 years in engineering, executive, program and project management across several industries and cultures; Ivano, age 52, an Italian, brings a perspective formed by 20 years in IT, 15 in project management and 25 years in charge of 'front-end' human resources in the Operations Center of the largest Radiotaxi company in Italy and Europe, in addition to his university student years in the medical field; Daniele, age 22, also Italian and the son of Ivano, has of course grown up in the Digital Age, has a strong interest in human behavior, and completed his university degree in IT engineering in July 2012. This unique combination has produced a team effort that has created the perspectives presented in this paper. Short CVs of each follow the References.

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[4] Senge, Peter M. (1990), **The Fifth Discipline**, Doubleday/Currency; Gharajedaghi, Jamshid (1999), **Systems Thinking: Managing Chaos and Complexity**, Burlington, MA: Butterworth-Heinemann.

Bob Prieto, and Prof. Jorge Tarazona, whose brief CVs are shown in Appendix A. The content remains solely based on the opinions of the authors, however, except where quotations are specifically stated.

Part 1. Introduction

A company that wants to compete in the international market knows the importance of adopting a Business Process Management (BPM) model as a holistic management approach. The BPM Model is the set of activities needed to define, optimize, monitor and integrate business processes in order to create the desired outcome for each stakeholder. In addition to driving a company's on-going operations, Business Process Management (which includes the concept of Business Performance Management) (Ref. 1) drives its projects and programs, integrated with their multi-project portfolios to achieve high performance development that is characterized by new success criteria, where project management metrics are based on performance indices as shown by a matrix between KPIs and CSFs (Ref. 2):

- *Key Performance Indicators (**KPIs**) are commonly used by an organization to evaluate its success or the success of a particular activity in which it is engaged.*
- ***Critical success factor** (CSF) is the term for an element that is necessary for an organization or project to achieve its mission successfully, and for ensuring the success of a company. Critical success factors are those few things that must go well to ensure success for a manager or an organization, and therefore they represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance.*

In achieving improved success in project, program, and portfolio management there are two desirable goals:

- A new way to define more broadly and manage more comprehensively the Project Life Cycles for both the transformational and the delivery projects and programs within an enterprise; and
- The proper and effective use of Information Technology (IT) with Business Process Management (BPM) plus Project, Program and Portfolio Management (PPPM.)

Use of Information Technology (IT): In order to implement the powerful and widely used Business Process Modeling software systems and the business software systems for managing projects, programs, and their portfolios, we must have integrated information models of those projects and programs. Examples of these software systems (applications) are listed in Appendix B. In fact, these powerful systems are the enablers that make it possible to gain the insights of systems thinking in improving all management processes, procedures, and practices. The greatest challenge in this regard today is to properly integrate project management software with corporate and operations management software within a large organization[5]. The full benefits from application of these powerful information systems can only be achieved through development of fully integrated project life cycle models that are the subject of this paper.

Project versus Product Life Cycle Management and Models: Since a project ends when its final results (or products) have been delivered to the owner, investor, marketer, or user in accordance with the project contract or internal project charter, the standard project life cycle comes to an end when the

[5] **Bob Prieto** says: "Often a barrier to effective lifecycle management is a split responsibility within an owner's organization for CAPEX [capital expenditures], OPEX [operations expenditures], and sales. Another barrier to lifecycle management systems is often corporate accounting systems which do not provide a total cost of ownership picture that includes initial studies, CAPEX, OPEX, cost of sales and financing costs."

project close-out phase is complete. The *product life cycle* begins at the moment the product begins to be used, sold or placed in operation, thus producing the benefits that justified the project in the first place. There may be some overlap between the standard project close-out phase and the initiation of the product usage and thus its product life cycle. For consumer products the product life cycle typically has five phases: introduction, growth, maturity, decline, and termination. There may of course be product improvements (new projects) to extend the product life. If the project produces a new facility, such as a petrochemical processing plant, the product life cycle will consist of these phases: commissioning (usually also an overlapping phase with the project that produced the plant), operation (with periodic maintenance and modification projects interrupting productive operation), decommissioning, and demolition (including any ecological cleanup.) For an IT software project that produces an information system, the product life cycle phases will include commissioning (placing the system in full operation), operation, and decommissioning (usually replaced by a new system.) When agile project management methods are in use, there will often be a long period of continuous improvement as new features are added or unforeseen deficiencies are corrected during the project execution phase. In these cases it may be difficult to know when the original project scope has been achieved and to identify exactly when the project has been closed out and the system (product) operation phase begins.

Significant versus Small or Trivial Projects: This paper focuses on *significant* projects within human organizations. Of course there are many small, simple, relatively unimportant projects (perhaps fairly informal 'task forces') that exist in any organization, and they can usually be managed without the application of the ideas presented here. Determining whether or not a specific project is 'significant' enough to require application of these ideas must be accomplished by the responsible managers within each organization. Any project that is considered to be strategically transformative will be significant regardless of its size in terms of cost or number of people involved.

The Importance of Project Life Cycle Models: All projects consist of a number of different phases that form the life cycle (or life span) of each project. In the early years of the development of modern project management practices it was common to see each phase of a project being planned, scheduled, and managed as a separate project, from start to finish of each phase. Frequently a new project manager would take over as the next phase was started. This usually resulted in many un-resolved design or other conflicts being swept forward into the next phase, especially in design/construction/field operation projects, as well as in IT projects. The field project manager of a new process plant, for example, had to solve the problems during that construction phase that should have been solved during the design phase. The cost of operating the plant was often increased because the designers and constructors took short-cuts to reduce their costs and increase their profits, but these short-cuts increased the cost of operating and maintaining the plant.

As the project management discipline matured it was recognized that overlapping these phases when practical will save a considerable amount of time and money, and assuring that one project manager maintains responsibility for the entire project life cycle forced the resolution of conflicts as early as possible in the project life cycle. This led to 'fast-tracking'[6] in the engineering-procurement-construction categories of projects, as well as in many other project categories.

[6] **Bob Prieto** says: "'Fast tracking' was driven by a need to accelerate time to market initially but later was recognized as a way to aggregate and transfer risks, particularly those risks in the 'white space' between project phases that were often unmanaged."

As the power of business process and project management information systems grew over recent decades, building on the rapid advances of computer supported systems and information technology in general, the power and benefits of documenting and integrating all of the project life cycle phases became more evident and more important.

This led to the development and use today of a number of project life cycle process models consisting of a number of phases or stages and related decision points for the many different project categories and sub-categories that exist (Archibald, 2003, pp 45-46; see also Appendix C, as discussed later.) The models within each category and sub-category show similarities but in most cases there are significant differences from one category/sub-category to the next. To be sure, the simplest four-phase life cycle model (starting or concept, organizing or definition, execution, and closeout) will be the same for all categories (PMI 2008, p 16.) But such a simple model is of little practical value in actually planning, authorizing, scheduling, and controlling any complex project.

Purposes of Project Life Cycle Process Models: The purposes of designing and documenting the overall project life cycle process for any project or project category (Archibald 2007) are to:

- Enable all persons concerned with creating, planning and executing projects to understand the processes to be followed throughout the life of the project.
- Capture and document the best experiences within the organization so that the processes within each project phase can be improved continually and applied on future similar projects.
- Enable all the project roles and responsibilities and the project planning, estimating, scheduling, monitoring and control methods and tools to be appropriately related to the overall project life cycle management process; this includes most importantly assigning qualified persons to the roles of Project Executive Sponsor and Project Manager at the proper points in the project life cycle phases, as discussed later in this paper.
- Enable the effective application of project management software application packages that are integrated with all appropriate corporate information systems.

In other words a well-documented project life cycle model enables us to apply **systems thinking** to creating, planning, scheduling, and managing the project through all of its phases, and to evaluating both the success and the value of both the project and the results that the project has produced. This is of greatest benefit to the project owner, key stakeholders, the ultimate user of the project results, and the social beneficiaries of those results -- whether it is a new process plant, a highway, a new business process or system, or a new product. It will not be of similar interest to a project manager or an organization that only holds responsibility for one phase, or one aspect of one phase, of the entire project. Unless a well-documented, integrated, understandable picture of the overall life cycle process – the model -- for each project category/sub-category exists, it will be difficult to achieve the full benefits of modern, systematic project management.

Life Cycle Phases and Decision Points: There is generally held understanding (PMI 2008 p 16) that the four broad, generic project phases are as shown in Figure 1:

- Starting the project (concept, authorization, initiation, identification, selection, project charter and business case, planning, scheduling.)
- Organizing and Preparing (definition, feasibility confirmation, development, demonstration, design prototype, quantification.)
- Carrying out the work (execution, implementation, realization, production and deployment, design/construct/ commission, installation and test.)

- Closing the project (handover of the project results to the user, project termination, sometimes including post-completion evaluation.)

Each of these phases contain critical decision points (proceed, cancel, revise scope/cost/schedule/quality.)

Figure 1. Typical current "standard" top level project life cycle model. (PMIa 2008, p 16)

An "Extended life cycle" model is promulgated in the widely used Association for Project Management/APM Body of Knowledge is shown in Figure 2, in which these four basic phases are clearly shown and labeled "Project life cycle." This model also shows an "Extended project life cycle model" that moves toward the comprehensive model proposed in this paper, but is still incomplete, as discussed in the remainder of this paper.

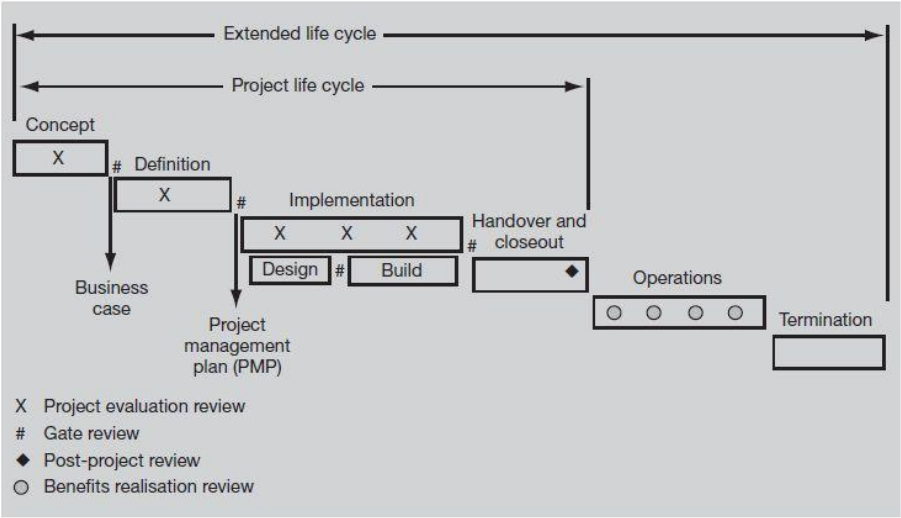

Figure 2. A second "standard" project and extended life cycle model. (APM 2006 p 80.)

The phases shown in these two models are so broad and the titles so generic that they are of little value in documenting a specific project life cycle process so that it can be widely understood, used, reproduced, and continually improved. What is needed is the specific definition of six to ten (or more as needed) basic phases for each project category and sub-category, usually with several sub-phases defined within each of the basic phases. Archibald (2007 and 2003 Chapters 2.5 and 3.5) discusses in detail the need for such specific project life cycle models and the application of systems thinking to such models, and presents a number of examples of both predictive and adaptive project life cycle models:

- **Predictive life cycle models** *"favor optimization over adaptability"* (Desaulniers and Anderson 2002) and include:
    - **Waterfall** (also known as traditional and top-down): linear ordering of the phases, which can be strictly sequential or overlapping to some extent; no phase is normally repeated.

- **Prototyping:** functional requirements and physical design specifications are generated simultaneously.
- **Rapid Application Development (RAD):** based on an evolving prototype that is not thrown away.
- **Incremental Build:** decomposition of a large development effort into a succession of smaller components.

- **Adaptive life cycle models** *"accept and embrace change during the development process and resist detailed planning"* (Desaulniers and Anderson 2002) and include:
  - **Adaptive Software Development/ASD:** Mission driven, component based, iterative cycles, time boxed cycles, risk-driven, and change-tolerant. The IBM Rational Unified Process (RUP) (Ref. Appendix B), driven by risk and customer need is a good example of an adaptive software development model.
  - **Spiral:** Repetition of the same set of life-cycle phases such as plan, develop, build, and evaluate until development is complete.
  - **Extreme Programming/XP:** Teams of developers, managers, and users; programming done in pairs; iterative process, collective code ownership.
  - **Agile and SCRUM:** Similar to above adaptive life cycle models with iterations called "sprints" that typically last one week to 30 days with defined functionality to be achieved in each sprint; active management role throughout.

Figures 3 through 6 illustrate some typical examples of project life cycle models now in use for a few of the many different project categories.

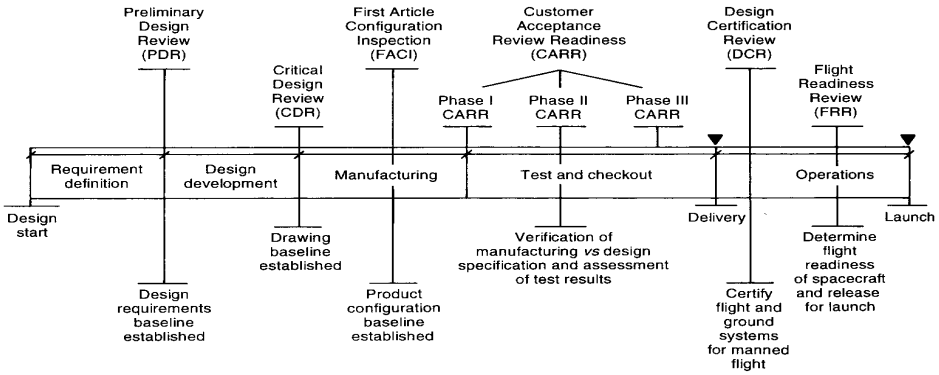

Figure 3. NASA's Project Life Cycle Process.

See http://spacese.spacegrant.org/uploads/Project%20Life%20Cycle/PPF_WallChart_color.pdf for a very detailed wall chart that expands this simplified version.

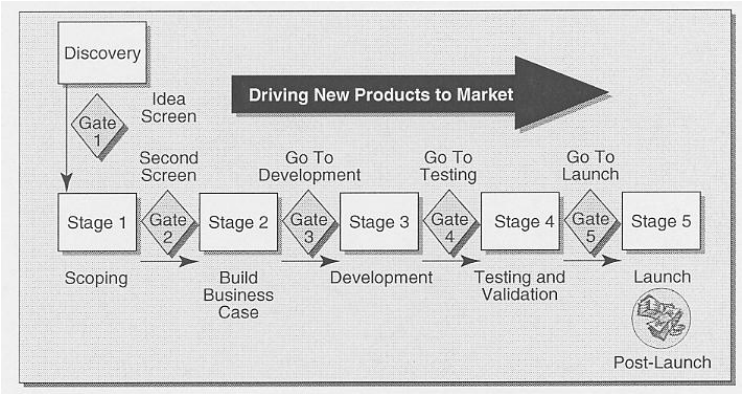

Figure 4. Overview of a typical Stage-Gate™ project life cycle process for new product development.
Source: Robert G. Cooper et al, Portfolio Management for New Products (Cambridge, MA, 2001), p. 272.
www.perseuspublishing.com

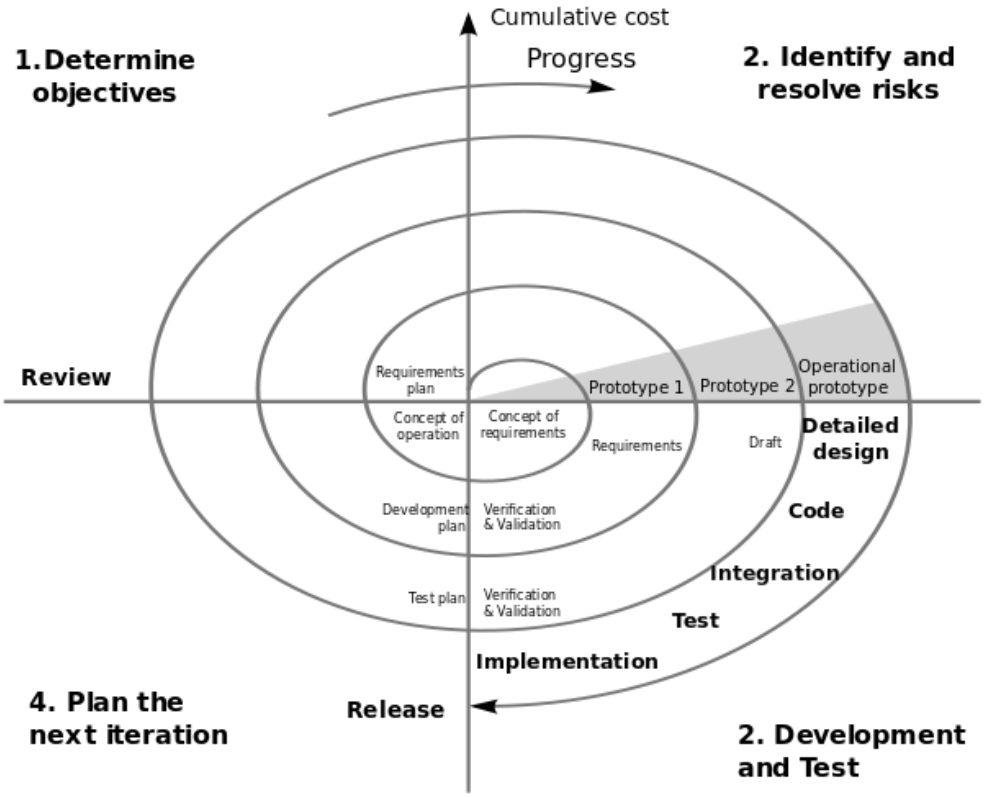

Figure 5. Spiral software development project life cycle model. Source:
http://commons.wikimedia.org/wiki/Category: Spiral_model_of_Boehm?uselang=en

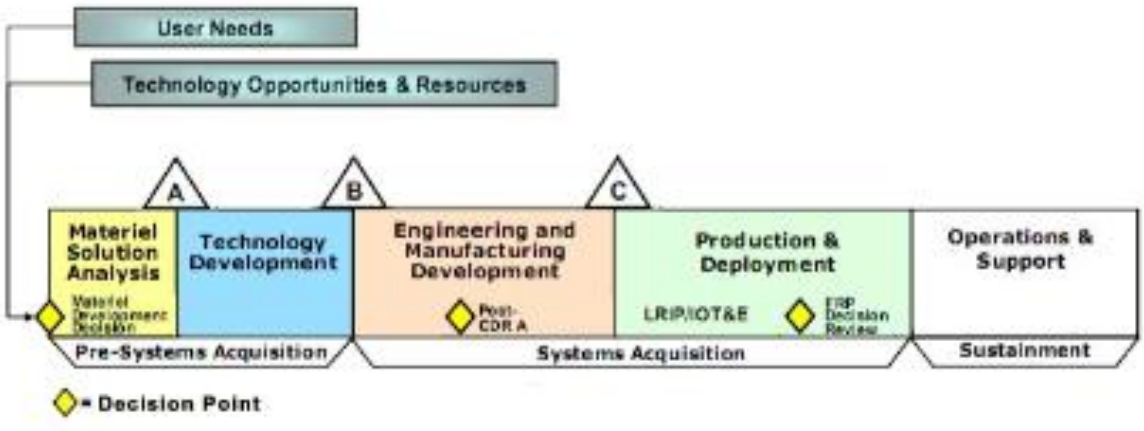

Figure 6. United States DoD 5000 Defense Acquisition System Life Cycle
Source: DoD Defense Acquisition System

https://dag.dau.mil/Pages/Default.aspx

The Defense Acquisition System (Figure 6) is the management process that guides all USA Department of Defense (DoD) acquisition programs, clearly showing the need for the Incubation/Feasibility Phase (User Needs and Technology Opportunities & Resources) prior to the decision to proceed with the Pre-Systems Acquisition Phase. As stated in DoD Directive 5000.01, the Defense Acquisition System provides the policies and principles that govern the defense acquisition system. DoD Instruction 5000.02, Operation of the Defense Acquisition System, in turn establishes the management framework that implements these policies and principles. The Defense Acquisition Management Framework provides an event-based process where acquisition programs proceed through a series of milestones associated with significant program phases. The instruction also identifies the specific statutory and regulatory reports and other information requirements for each milestone and decision point.

Project Life Cycle Models for Specific Project Categories

To emphasize the importance of developing more detailed project life cycle models for specific categories, Appendix C lists the many project categories and sub-categories that exist, together with references to some of the related project life cycle models that have been developed and are in use today.

Part 2. Proposed Comprehensive Project Life Cycle Model

Two Additional Project Phases are Required

The project life cycle models that are described in the project management standards today **fail** to fully recognize the genesis of projects prior to the standard "project starting or concept phase" and **fail** to include the importance of post-project evaluation of the success of both the project and its product or operating results. We propose in this paper that the standard Comprehensive Project Life Cycle include these two additional phases: **Project Incubation/Feasibility Phase** and **Post-Project Evaluation Phase**, as shown in Figure 7. These two additional phases are described in the following sections.

Figure 7. Proposed six-phase comprehensive top level project life cycle model.

These two additional phases are required when the intermediate phases are expanded to show the detailed life cycle model for specific projects within any of the various project categories that exist.

Some General Comments on the Comprehensive Life Cycle Model by Reviewers of Earlier Versions of this Paper:

Franco Caron: "I think that an extended view of the project life cycle is necessary. Also PMI considers operation benefits as part of program management (I don't understand why the same view can't be applied to large engineering projects.) Since I deal with large engineering projects, in any case projects with an external client, at the outset of the project I introduce the distinction between proposal phase (something like project incubation) and project phase (articulated in the classical stages) separated by the contract signature. During the proposal phase the project configuration is fluid and during project execution is fixed by project constraints. From the point of view of incubation phase, a distinction between internal and external projects is necessary."

Jean-Pierre Debourse: "Your proposal is very excellent and there is nothing to change; it's the best presentation I've seen and I think that its diffusion will be very important."

Gianluca Di Castri: "In my opinion, all matters relevant to project management and controls will be extended in the next years in two different directions: horizontally including on one side the strategic phase and on the other side the complete life cycle of the project, until its dismissal or revamping, as well as vertically, to include multi-project, programme and, in some cases, portfolio management. It is important to take into consideration the distinction between hard projects (infrastructure, industrial, military operation) and soft projects (information technology, research, change) since both metrics and management techniques are in some way different. Project metrics will become more important in hard projects, while in soft projects priority could be given to other skills."

Bob Prieto: "In the discussion of project life cycle process models you deliberately bold the term "systems thinking" which I whole heartedly agree with. In fact, I believe this is the real, central tenet of what you are trying to convey and that it is intimately linked to the "holistic" management approach you call for at the beginning of Part 1…. In my March, 2012 paper[7] in PMWorldToday, "Application of Life Cycle Analysis in the Capital Assets Industry", I focus on this more holistic aspect by calling for Life Cycle Analysis (that is an analysis with a triple bottom line perspective[8]) versus more traditional lifecycle costing (only the economic bottom line). In that paper I schematically show a simplified lifecycle which includes a generic planning and preparation phase before the initiation of all the various design, procurement and construction activities and I will expand my thoughts in that regard as it relates to your paper below. Finally, your post-project evaluation period also warrants more specific comment but you will see in the above referenced paper I have included actual decommissioning as this is a more significant lifecycle cost in many areas of the capital assets industry."

Jorge Tarazona: "I think that your work is a very important contribution to the holistic and systems thinking approach applied to Project Management. I totally agree that it is very important to develop detailed life cycle models for each specific project category."

Part 3. Project Incubation/Feasibility Phase

When does a project truly start? How does it grow from an idea in someone's head (or several heads) into an approved concept for which a Project Charter can be written? In almost every case the standard "Project Starting Phase" must begin with a reasonable understanding of what the principal objectives, scope, schedule, and cost of the project are expected to be, including:

- What the project will create (new product, facility, service, information system, organization, other principal deliverables);
- What business benefits will be produced for the organization that will pay for the project, as will be detailed in the Business Case that is produced during the Project Starting Phase;
- Verification that the project is aligned with the strategic plans and objectives of the sponsoring organization;
- A reasonable idea of the overall scope of the project together with its expected time schedule and cost, and whether the needed money and other key resources can reasonably be expected to be available, as will be verified and detailed in the Project Charter that is produced during the Project Starting Phase.

[7] Not available on-line; contact Bob Prieto (see Appendix A.)
[8] Prieto, Bob, "A Triple Bottom Line Opportunity For Our Cities," March 8, 2008. Contact Prieto.

- Preliminary or conditional approvals that the project will require from governmental authorities or other agencies (environmental, economic, health, others) as well as any intellectual property and physical rights of access that are needed for the project to succeed.
- Overall economic, technological, political, social[9], and physical feasibility of the project, including the level and acceptability of the various risks that are involved..

A project will not normally be authorized to enter the Project Starting Phase (as that phase is now described in various project management standards) until sufficient information, as listed above, is available and its feasibility has been established. The basic question here is **"Where does this initial 'embryonic knowledge and understanding' about the potential project come from?"** This information must be accumulated through a process of "information buffering[10]" (Di Filippo 2011) over a period of time prior to authorizing any project to enter the current standard Project Starting Phase, and this occurs in every case during the previously undefined but always present **Project Incubation/Feasibility Phase**. This information buffering is similar to downloading a movie on your television set: the movie (or the project) cannot begin until sufficient data and knowledge has been obtained and compiled locally.

Project Empowerment during the Incubation Phase: During this incubation/feasibility period we also begin creating the project empowerment. While we are compiling the information we are simultaneously loading the cognitive strengths needed to go till the end of the project. We begin attenuating the Cognitive Constraints[11] during this phase within the stakeholders and potential project team members, and during the project starting, planning and execution we will work to remove them completely. Our objective here is to create the "heuristic consent", which is that particular mental state that can build the:

- Real COMMITMENT to the project,
- Raise the EFFORT threshold (that will bring resilience to the team),
- TUNING UP among the potential team members (Esopo experiment[12]),
- MOTIVATIONAL FACTOR (that leads to the Agency[13]),
- The P INCLUSION (P for project)[14],

[9] For example, the social feasibility of designing and constructing a nuclear power plant in 2013 near Fukishimo, Japan, is considered to be close to zero.

[10] We "buffer" and store in an appropriate manner the information about the project, its scope, results and feasibility, and the COGNITIVE CONSTRAINTS that exist within the project team members:

- information compiled during a cognitive pre-SWOT analysis
- noting what are the cognitive change resistances
- noting the context where the project results will be used or placed in action
- identifying what are the KPIs and CSFs.

[11] See "Cognitive Constraints: A Key Element in Project Management Metrics," Russell Archibald, Ivano Di Filippo, Daniele Di Filippo, 2012, for a discussion of this subject.

[12] In the Esopo Experiment some people are asked to act together to remember something. At the end of the experiment you usually can see the creation of a new team (almost self-generated) who did not even know each other. The cognitive overload perceived by the participants became the motivation to overcome the cognitive dissonance overload.

[13] "Agency" in the Bandura theory can be defined as the ability to act, both actively and proactively, in a context in which someone has to achieve a result. The perceived self-efficacy is the engine of agency.

[14] "P inclusion" is for "Project inclusion." The stakeholder involvement is important, the team member involvement is essential; everyone can become the success key of the project.

- GOING TO A RESULT: we communicate to the potential members of the project team and the key project stakeholders the positive feeling of “moving towards”, “moving to creating”, “getting something done”.

This enables a rapid transition between the Project Incubation/Feasibility Phase and the Project Starting Phase when the project is formally authorized to begin.

Origins of Projects: To fully understand the several sources or origins of projects we must point out that there are two types of organizations that plan and execute projects (Archibald 2003, p.7):

1. **Project-driven organizations** that derive most (if not all) of their revenue and/or other benefits from creating and delivering projects (software systems developers, engineering/construction contractors, consulting firms, some government agencies such as NASA, others); and
2. **Project-dependent organizations** that derive most (if not all) of their revenue and/or benefits from producing and selling products or services, or otherwise providing services (as most governmental agencies do), and depend on projects to create or improve new products and services, enter new markets, or otherwise improve or change their organizations.

Frequently there are project-driven departments (such as the IT or new product departments) within large, otherwise project-dependent organizations.

Within both of these organizational types there are two general types of projects (Archibald 2011):

1. **Commercial or Delivery Projects** that are similar to projects that the organization has planned and executed before, including as examples projects to modify and install a new information system; to design and construct a building, plant, or other facility with minor site adaption changes to a previous facility; and similar mostly repetitive projects; and
2. **Innovative, Development or Transformational Projects** that are substantially different from other projects that the organization has executed or purchased, including as examples new products or services development using new technologies or materials; new management or physical production processes; creating new organizations; acquiring and/or merging existing organizations; and other projects that transform the organization in some significant manner. These projects may be innovative in regard to the project management processes themselves, or to the results that the project creates, or in regard to both of these aspects.

Table 1 indicates the usual sources of the “embryonic knowledge and understanding” of these two types of projects within the two organizational types described above.

Table 1. Origins of two project types within project-driven and project-dependent organizations.

Project Type > Organization Type	Commercial or Delivery Projects	Development or Transformational Projects
Project-Driven Organizations	**>** Marketing or Business Development Department develops four project portfolios: 1) customer relationship, 2) network relationship, 3) delivery, and 4) offering portfolios.[15] They evaluate **requests for proposals/RFPs** from	> Statements below for Project-Dependent Organizations also apply here to Project-Driven Organizations.

[15] Tikkanen et al 2007.

	customers that result from usually long-lasting relationships and extensive marketing efforts, or develop proposals initiated internally: **> Project proposals** that comply with well-established strategic goals and are within the known capabilities of the organization are prepared and approved prior to submittal to the customers. **> Project Starting Phase** is not initiated until a proposal is negotiated and a contract is signed by both parties. **>** A full-time **Project Manager** is usually appointed only during the Project Starting Phase. **> Project management functions** must be applied in proposal preparation but frequently they are not.	
Project-Dependent Organizations	**>** Few if any commercial/delivery projects exist in these organizations. If so the above comments apply.	**>** Ideas for **projects** for major organizational change; acquisitions; mergers; or new markets, products, processes or services **come from** strategic managers, marketing/business development, R&D, past customers, consultants, or individuals. **>** Development of the idea into **project objectives, scope, et al** occurs over a period of time prior to the project entering the Starting Phase. **>** Only when **the 'embryonic understanding' of the potential project** has been approved does the project enter the Project Starting Phase.

It is worth noting that many transformational projects or programs include the purchase of delivery projects from outside suppliers that are actually project-driven companies or agencies. This depends on the internal decision whether to "buy" or to "make" the products or results for selected portions (sub-projects) of the transformational project or program.

Definition of the Project Incubation/Feasibility Phase: The Project Incubation/Feasibility Phase in the Comprehensive Project Life Cycle is the phase prior to initiation of the Project Starting Phase, during which the necessary information and "embryonic knowledge and understanding" of the potential project is collected, compiled, buffered, and analyzed sufficiently to enable a well-informed decision to proceed with initiation of the Project Starting Phase. The time required for this Project Incubation/Feasibility Phase will vary from a few days to many months, depending on the nature of the industrial, business or governmental sector; the project itself, its category and its complexity and risks;

the time required to obtain the needed clearances, approvals, technology and physical access; and the availability of the pertinent information. The time, money, and skilled resources that are expended during the Project Incubation/Feasibility Phase are provided, justified, and recovered in several ways, as indicated in Table 2, for both the organization types and whether the project is either a delivery or transformational type.

Table 2. Sources and recovery of the cost of the Project Incubation/Feasibility Phase.

Project Type > Organization Type	**Commercial or Delivery Projects**	**Development or Transformational Projects**
Project -Driven Organizations	**>** Developing project proposals is the normal function of the Marketing and/or Business Development staffs. **>** The **associated costs are recovered** in the contract price for each project as agreed with each customer, usually in the overhead rates used in the project hourly labor rates. **>** These costs for project bids, including 'offering projects' that are speculative in nature and not in response to specific request for proposals, that are not accepted by the customer are included in the overall general & administrative overhead rates for the organization. Of course these costs are accounted for and must be recovered in future contracts if the company wished to continue in business.	**>** Statements below for project-driven organizations also apply here.
Project-Dependent Organizations	**>** Few if any commercial/delivery projects will exist in these organizations. If they do the above comments apply.	**> Costs** related to the Incubation/Feasibility Phase of any transformational project are generated by staff members and consultants who 1) develop the organization's strategic plans, 2) identify potential mergers and acquisitions, 3) develop plans for major organizational changes, 4) create new product and service ideas, and 5) conduct market, product and process research activities. **> They include** costs associated with obtaining regulatory agency approvals and use of proprietary knowledge or physical access, etc. **> These costs** are usually included in the appropriate General and Administrative or Research and

		Development costs of the organization, or they may be accounted for and recovered as either direct or overhead costs.

Project Incubation/Feasibility Phase for Commercial/Delivery Projects: Within project-driven organizations the Marketing (or Business Development) Department devotes essentially all of its efforts to this phase of potential new projects, which are the life blood of such organizations. They develop long-lasting relationships with old and new customers and prospects, and buffer many kinds of information about their established and potential markets. As prospective new project offerings are identified specific new project opportunities are conceptualized and developed. Frequently the marketing department actually prepares the customer's Request for Proposal to which the organization will subsequently respond with a formal project proposal, leading to approval of a contract for the new project.

Project Incubation/Feasibility Phase for Transformative Projects: Within both project-dependent and project-driven organizations the initial ideas for transformative projects, which are in every case significant innovations of some type, may come from any one of the several sources listed in Table 1. Those organizations that conduct periodic strategic planning activities find that many of their transformative projects emerge from that activity. Good practice demands that an Executive Sponsor and a Project Manager be assigned to each potential transformative project as soon as it has been decided that the project should be incubated and its feasibility established.

Commercial Projects are often part of Transformative Projects (or Programs): In many if not most cases, commercial projects delivered to a second organization are vital parts of a larger transformative project or program within the organization that purchased the commercial project. Thus the owner of the transformative project/program must include the delivery project (often there will be more than one of those) within its overall plan for the transformative project or program.

The Need for the Project/Feasibility Phase and Its Relationship to Organizational Capacity Planning

Harold Kerzner says, in commenting on an earlier version of this paper:

"Perhaps the most challenging problem facing executives today is the determination of how much additional work they can take on without over-burdening the existing labor force. We refer to this as capacity planning. Executives can always come up with ideas for new projects, even opportunistic projects that create business value and are aligned with strategic objectives as stated in your paper on P.9. But having great ideas for projects and insufficient resources defeats the purpose of having an Incubation Phase. The later you perform capacity planning, the more time and effort may have been fruitlessly expended on projects that may never get approved. We traditionally perform capacity planning after a well-defined business case is prepared just to learn that we have insufficient resources or funding for such a project.

"There are also other constraints that may identify the need for an Incubation Phase. As an example, if projects require some degree of innovation, then we may have added complexity to the project. We can look at the levels of innovation:[16]

- Add-ons and enhancements to existing products
- New family members
- Next generation product
- Radical technical breakthrough

"As we read down the list of bullets, a significant increase in resource capacity is most likely required together with the possibility of large capital expenditures. If there are limitations to available resources, facilities and capital, then proceeding to the Scope Development Phase or business case development is inconsequential. The Incubation Phase must include high level estimates to properly evaluate whether these possible limitations exist. The scope development phase must then validate either the accuracy of these estimates, refine the estimates or decide that the idea requires euthanasia.

"For the incubation phase to work effectively, the organization must have a clear understanding of the differences between benefits and value. Value is the quantification of the benefits. In other words, if these benefits actually materialize, then what is the "financial" value to the firm? It is true that for some projects the value may be difficult to quantify in the incubation phase. The actual value may not be able to be determined until we have the beneficial use of the deliverables possibly after the project has been completed.

"I have seen way too many companies embark on projects simply because the benefits looked good on paper without attempting to determine that actual business value of the project. A classical case was the Iridium Project which was designed to create the 8th wonder of the world, namely a satellite rather than totally land-based telecommunications system. Investors lost over $6 billion dollars developing technology for technology's sake rather than for a valid business purpose[17]. Developing deliverables and products, and then wondering how you will find customers, is never a valid business model. The incubation phase is the first attempt to validate the relationship between benefits, value and strategic objectives. Unfortunately, companies seem to be burdening the PMO with this responsibility after the business case has been developed. While there may be some merit to have the PMO validate what is in the business case, looking at capacity planning in the Incubation Phase may be best.

"Another important characteristic of the Incubation Phase is the determination of the availability of a qualified project manager for the project at hand. Regardless of the PM's years of experience and exposure to educational opportunities, not all project managers are equal in project management capability. The size, nature and complexity of the project should be used as a first look at the qualifications needed to manage such a project. This first look must also appear in the Incubation Phase.

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[16] Harold Kerzner, **Project Management: A Systems Approach to Planning, Scheduling and Controlling**; 11th edition, John Wiley and Sons Publishers, Hoboken, 2013; pp. 427-430. To be released in March, 2013.

[17] Ibid; see Chapter 26 for a description of the Iridium Project.

Project Management practices can and should be employed prior to the Project Starting Phase

The noted project management authority **Peter Morris** (2005) states:

> Two conclusions stand out from these two studies. One, that following the *PMBOK Guide®* elements may be sufficient to deliver projects properly in process and practice terms but probably is not enough to ensure that the project is successful. Two, that to do the latter one needs to concentrate more on the managing the front-end.
>
> But it is the contention of this paper that one can take the argument a stage further: project execution is itself improved by concentrating more on the front-end; and that the project (and program) management professional has a significant role to play managing projects and programs for business success[18]. Benchmarking data in the oil and gas industry for example shows conclusively that effort spent (up to a point) on front-end definition (so-called 'Front-end Loading' – FEL) correlates positively with project outcome performance. And second, there are a number of practices which the 'project management' professional can deploy which will positively enhance the strategic value of the project to the sponsoring organization(s). It is these contentions that this paper explores."
> ….
> **Summary and conclusions:** We have come full circle. What you give out, you get back. If we position project management as an execution-only discipline[19], we will be seen as just that and cut-off from the really important parts of the project: those where value can most be created: the front-end.
>
> The reality, as shown by the results of two separate surveys, is that the overwhelming majority of practitioners polled believe that project management does apply in the pre-execution stages.
>
> The survey of seven organizations' life cycles shows that these companies expect project management practices and principles to be applied in these pre-execution phases as well in the downstream execution ones.
>
> But as the four case studies show, there is still confusion in practice, with some organizations seeing project management pre-eminently as a managerial, execution oriented activity. The *PMBOK Guide®* and *OPM3™* fully support such an interpretation. Yet it is at odds with what the literature, and many companies' experience, shows to be the case: that managing projects effectively begins in the very earliest of phases (Milestone 0). If projects, and programs, are only done for a purpose, they should be dynamically connected to the enterprise strategy. For, as the case studies show, the evolution of projects generates new information which often needs to be fed in to the enterprise's 'emergent' strategy.

[18] Note by this current paper's authors: This point is emphasized in the various PM standards, as for example the **PMI Standard for Program Management**, 2008, and the **PMI Standard for Portfolio Management,** 2008.

[19] Note by this current paper's authors: This attitude is still widely held by many practitioners in spite of the movement in recent years to include program and project portfolio management within the project management realm.

As a post script: there are some who will claim that project management is indeed about execution and it is really the responsibility of program management to be concerned with strategy and business benefit. In some cases, in some companies, it may work like this, but as a generic answer for the discipline as a whole this surely is inadequate. We need to be voicing a view of the discipline which provides a holistic approach to managing projects, and programs, from their earliest stages to their last in order to deliver business benefit. I call this 'the management of projects'. (Peter Morris 2005)

The Project Executive Sponsor and Project Manager roles exist during the Project Incubation/Feasibility Phase but are rarely formally assigned[20]

Common practice in almost all industry and government sectors today is to assign the Executive Sponsor (if indeed one is assigned) and a Project Manager only when the Project Starting Phase begins. However, both of these roles actually exist when the original idea or concept starts to be investigated as an embryo project. There is a need for a person at the executive level to take on the Executive Sponsor role at this early stage, for both commercial and transformative projects. At the same time there is a need for one person to take on the integrative role of the Project Manager, even if this does not require that person's full time, in order to apply the project manager perspective to the embryo project. The same advantages accrue from filling these roles during the Project Incubation/Feasibility Phase as accrue from assigning these roles during the Project Starting, Definition, Execution, and Close-Out Phases. Usually during the Incubation/Feasibility Phase these two roles are scattered between various people within the Business Development, Marketing, and Strategic Planning executives and managers. In the case of the Project Executive Sponsor it is very desirable for the same person to carry that responsibility throughout the entire project life cycle, but it becomes more problematic to maintain the Project Manager responsibility throughout the entire project with the same person, even though that is equally desirable.

Front End Loading (FEL) Phase in Design/Procurement/Construction Projects is an example of the importance of recognizing the Project Incubation/Feasibility Phase

Wayne Abba states "Your paper might benefit by looking at the fine 'front end' work done on project governance in Norway. In a series of conferences held every two years, the Ministry of Finance has explored and implemented new models for selecting the 'right' projects thru systematic evaluation. They've modeled for example the various 'decision gate' processes, especially out of UK…. The conference website, including presentations over the years, is at http://www.concept.ntnu.no/symposium/index.htm."

According to **Stanislaw Gasik** the main point of this front end procedure is that each proposal must be assessed by independent experts. He states:

> As stated by the **Independent Project Analysis (IPA)** group (2012):
> "Front-End Loading (FEL) of a [facilities design and construction] project can be described as the process by which a company (and project team) translates its marketing and technological

[20] **Jorge Tarazona** says: "I totally agree with this statement."

opportunities into capital projects. In other words, during the FEL phase, the questions of Why, What, When, How, Where and Who[21] are answered.

"The goal of the total FEL phase is to secure a detailed definition of a project's scope needed to satisfy the business objectives for the capital investment. By providing a detailed project definition that can be communicated and agreed upon by all project participants **prior to authorization[22] [emphasis added—**this usually means prior to authorization of the Project Start Phase**]**, the FEL phase aims to reduce the number of changes in later project stages. Thus, the project outcomes should be more predictable. The FEL phase is defined as the period from when a business opportunity is identified and to the point at which a project capitalizing on the business opportunity is authorized".

Milton Jones (2004) has this to say about FEL: "This paper has attempted to indicate the overall desirability (improved safety, enhanced operability, etc.) and the specific financial benefits available from pre-investing time and resources in project pre-planning (Front End Loading) and in the use of risk reduction techniques such as constructability studies. It has been conclusively demonstrated from a review of available industry statistics that improvements in ROI and TIC of between 6% and 23% are possible and have historically been achieved as a direct result from employing either one or (even better) a combination of these methodologies. We have also shown that it is possible (and, indeed, both practical and advisable), using established and creditable processes and systems, to employ available and industry-accepted methodologies (Project Definition Readiness Index) that measure (using easily quantifiable metrics) the relative readiness of projects to proceed through the quality "gate" to full authorization (funding)."

Darci Prado states that "FEL model was greatly improved by IPA (Independent Project Analysis[23]) and has also developed the FEL indicators to be used during the project/product life cycle and at the end of the project. On the other hand, I think that the idea of formalizing the Incubation Phase **for all kinds of projects** certainly will make the project/product life cycle more robust. To conclude, I mean, I do not look at the Incubation Phase as an innovative idea, but I think that formalizing it in the project life cycle for all kind of projects is an innovative idea. The Cognitive Constraints approach is a good contribution to how to operate the Incubation Phase."

David Pells states that "[This] is not a new phase. Otherwise known as the Project Feasibility Phase, this stage is well established in the project finance and economic development fields, and in aerospace, defense and some other sectors where the business models/financing processes drive the entire project. Of course, this phase has been generally ignored in the life cycle models advanced by professional

[21] And who will be disturbed or adversely affected is also extremely important; without these deliberations project initiation will be weak, according to **Stanislaw Gasik.**

[22] **Stanislaw Gasik** says**:** "This is misleading. In my experience when a project is sufficiently big you may not forecast its scope in detail. The current trend in contracting, especially in construction industry (led as I can see by prof. Kumarawswany from Hong Kong goes in the direction of "relational contracting", called sometimes 'Japan-style contracting'. The main point in signing a contract is not the precise definition of contract scope (leading usually to intensive litigations), which is virtually impossible, but selecting a partner who will want and be able to cooperate on constant scope refinement and re-definition. "Spend your money for constructing and not for lawyers" they suggest. So the goal of this phase is mainly to build a cooperating and collaborating team – from the contemporary point of view. The scope should be initially defined but it will continually be changed; not only are the change procedures important, but also the attitudes of project team members."

[23] As in public projects in Norway.

bodies like PMI, primarily because project managers and project management are seldom assigned/implemented until after the investment decision has been made. There are many in the PM field who have recognized and complained about this weakness for many years."

Bob Prieto says: "Your addition of an incubation or feasibility phase I think is a correct one but I am not sure that this is necessarily a new construct. In today's large capital projects, the FEL phases, linked to stage-gates, are preceded by an extensive "Conception" period during which extensive and often time consuming activities are undertaken. In some instances these will be synonymous with FEL 1 but in other instances they will include pre-FEL efforts often generically referred to as "studies". These activities typically include: a)Computer models, b) Conceptual level estimates, c) Environmental studies, d) Feasibility studies, e) Labor and wage studies, f) Master plans, g) Permitting, h) Project financing, i) Scope definition, j) Siting, k) Technology/licensor selection, l) O&M readiness reviews.

"With respect to FEL, terminology varies by owner and even by EPC firm as you can see in the following example. I discuss FEL stage focus in 'The GIGA Factor' published by CMAA[24].

Project Phase	Contractor Definition	Owner A Definition	Owner B Definition
FEL Phase 1	Business Plan	Appraise	Conceptual
FEL Phase 2	Conceptual Engineering	Select	Feasibility
FEL Phase 3	Preliminary Engineering	Define	Front-End Engineering
Phase 4	EPC	Execute	Execution
Phase 5	Startup and Operation	Operate	Operation

"A Studies Phase or as I referred to it above, a 'Conception' Phase, precedes FEL, and it is where strategy is translated into tactics that respond to an 'efficient frontier' (Project Selection in Large Engineering Construction Programs; PMWorldToday; June 2011) created by what I believe is increasingly multi-dimensional optioneering. One may argue that this Conception Phase and Strategy Phase should be grouped but I see different skills sets and focus being brought to bear."

Tarazona states: "The Project Life Cycle of my Modelo T[25] has the following phases APEO (Alignment of the project with the strategy of the organization), FORMULACIÓN and EVALUACIÓN, which contain components of your **Project Incubation/Feasibility Phase**. On the other hand, your **Project Incubation/Feasibility Phase** contains some elements of the process that some organizations call "Ex-Ante Evaluation" and which is performed before the Project Execution Phase starts."

Relationship between Corporate Strategy and the Incubation/Feasibility Phase

Prior to any important project beginning to take shape in the Project Incubation/Feasibility Phase, its genesis comes from the strategic decisions that have been made by the strategy managers of the organization. Most organizations today conduct an annual review and re-formulation of their strategies for survival, growth and improvement over the coming year, and also for three to five years in the future. The achievement of the organization's strategic goals and objectives will, in most if not all cases, occur through the formulation and execution of projects and programs.

[24] See https://online.cmaanet.org/cmaassa/ecssashop.show_product_detail?p_product_serno=214&p_mode=detail&p_cust_id=&p_session_serno=204812&p_order_serno=214233&p_promo_cd=

[25] Jorge Tarazona, "Algunas Verdades Sobre La Gerencia Moderna de Proyectos (GMDP)", Primer Congresso de Gerencia de Proyectos, PMI Bogotá Chapter, Nov. 1-3, 2012.

Bob Prieto states: "In this Strategy stage an organization, whether that is at the highest level or a major division level, begins by defining what its strategic business objectives are. The significance of this step cannot be overstated. Ed Merrow, President & CEO of IPA , highlights the importance of clearly articulated objectives in his paper presented at the European Construction Institute's[26] 23rd Annual Conference this past year. It is only when these SBO's are clearly articulated, and importantly agreed to and supported by the appropriate organizational governance regime, that a Strategy can be developed and implement utilizing what I referred to as a Strategic Program Management approach in my book of the same name. Strategy is translated into tactics (build this thing, in that place, with these characteristics) during the "Conception" phase. Optioneering is a technique of growing importance as complexity grows and trade-offs become multi-dimensional through the considerations of non-financial bottom lines in addition to more traditional optimization points such as NPV or ROI."

One of the most important dimensions of determining an organization's level of maturity in project/program management is the verification of the alignment of all projects and programs within the organization with its approved corporate strategies, as mentioned earlier in Table 1.

Cascading Strategic Business Objectives throughout the Project Life Cycle

Bob Prieto offers the following pertinent comment: "Let me reinforce one point, which is the cascading of Strategic Business Objectives (SBOs) throughout the project lifecycle. While it is appropriate, and even necessary, to translate SBOs into more specific key performance indicators (KPIs) or key results areas (KRAs), it is essential that the SBOs themselves not be lost. In effect they provide the guideposts for the alignment activities that must cascade down and outside the organization, touching all key stakeholders. In conducting lifecycle analysis it is important that achievement of ALL SBOs represent a pass/fail criterion for any strategy, set of tactics, and project or projects that are undertaken. SBO migration (to be polite) is a symptom of programs that are not well founded and are usually accompanied by delay and cost overruns. This in effect calls for the development of outcome type metrics linked to the SBOs."

The Post-Project Evaluation Phase, described in the following section, deals directly with this issue.

Part 4. Post-Project Evaluation Phase

Following the current standard Project Close-Out Phase, the Post-Project Evaluation Phase that is proposed in this paper to be added to the Comprehensive Project Life Cycle definition is devoted to the effort needed to first determining and also maintaining, improving, and even perfecting the ultimate success of:

1) The project from a project management viewpoint[27],
2) The project's products and results,[28]
3) All project stakeholders' perspectives of both the project and its results, including turnover of people both during the project and after the Project Closeout Phase, and subsequent application of lessons learned for use on future projects,
4) The overall project and its products from the cognitive constraint perspective.

[26] http://www.eci-online.org/
[27] "Managerial success" according to Turner et al 2010, p. 87.
[28] "Products and products success" and "business success of project owner(s)" according to Turner et al 2010 p.87.

This evaluation phase will also identify weaknesses and threats that can be turned into opportunities that lead to the incubation/feasibility phase for future projects for the organization.

Regarding this proposed Post-Project Evaluation Phase **Harold Kerzner** states:

“In my textbooks, I refer to this phase as the Customer Satisfaction Management Phase. Before providing my comments on this, it is important that I describe my vision of the future of project management.

“Historically, project management methodologies were heavily burdened with policies and procedures, thus limiting the freedom that project managers needed to effectively apply the methodology. All projects were often required to use the same enterprise project management methodology. This held true regardless of the number of life cycle phases used or the nature of the phases. Gate reviews were established to provide further controls on the project managers.

“When working with customers (primarily external customers), telling them that you will solve their business problem (i.e., the project) using your methodology which is based upon your company's business model can be viewed as trying to squeeze a cube into a round hole. What customers are asking for today is for the contractor to have a flexible or adaptive methodology that can solve the client's problems in the context of the client's business model or business environment.

“For this to work, the contractor's firm must have more faith in the project manager's abilities than ever before and give the project manager more freedom in how to apply the methodology to generate the business solution desired by the client. Simply stated, methodologies are being replaced with forms, guidelines, templates and checklists rather than the more rigid policies and procedures. The methodology now becomes a project management framework with built-in flexibility, and where the PM has the freedom to decide what forms, guidelines, templates and checklists should be used on this project.

“If you provide the client with a business solution to their problem, and you do it according to the client's business model rather than your firm's business model, then there is high likelihood that addition work from this client will be forthcoming. In other words, flexibility when used correctly can and will generate additional business.

“Now, we can return to Post-Project Evaluation (or Customer Satisfaction Management) Phase and address the issues from the client's perspective. Let's envision a meeting with the client after the Project Closure Phase has been completed. Sitting in the room from the contractor's organization are the project manager, the sponsor or other members of the project's governance group, members of the sale force, some of the team members and possibly a member of the PMO. And then one question is asked:

"’What changes can we make to our framework to better serve you on the next project?’

“This is the way that a contractor can build up a strategic partnering relationship with the client for future business. There is no guarantee that the customer's requests for changes will be adhered to, but it does lead to customer satisfaction.

“In this phase, we tend to focus on what we can do to benefit us internally. But we must also focus on the client and what we can do to benefit them. Successful relationships between a client and a contractor may very well induce the client to bring the project on board earlier than usual. The

contractor might even be brought on board during the client's Incubation Phase in order to assist in the evaluation of ideas. This would then be a win-win situation for everyone."

Comment by this paper's authors on Dr. Kerzner's remarks above: We certainly agree with all of these points, but wish to emphasize that Dr. Kerzner's perspective here is from that of a project-driven (contractor) company that is delivering projects to a buying organization. His comments apply equally well to project-dependent organizations who often purchase projects from project-driven organizations.

Four Dimensions for determining project success during the Post-Project Evaluation Phase

There are at least four main dimensions for measuring the overall project success:

1. **Project Management Dimension:**
   - How closely did the project achieve the original objectives as defined in the Project Charter or Project Business Case?
   - Did the project meet the specified product specifications, budget, schedule, scope?
2. **Product Dimension:**
   - How well does the product meet the functional and business objectives that were used to establish the Project Charter and Business Case?
   - How well does the product achieve its Key Performance Indicators/KPIs?
   - What are the established Critical Success Factors (CSF) and how well does the product measure up against these?
   - Does the market like and buy the product?
     - Does the public like the new motion picture that the project produced, and do they buy the number of tickets that were specified in the Project Business Case?
     - Does the new chemical plant produce the specified products at the specified costs and comply with the established regulations?
     - Do the users of the new IT system like and actually use the system, and achieve the specified benefits from using it?
3. **Stakeholder Satisfaction Dimension:** What level of satisfaction or dis-satisfaction (accomplishment, enjoyment, pleasure, anger, conflict, frustration) exists in each of the project stakeholders, which can be either positive or negative stakeholders:
   - The project manager, including their sense of perfecting their project management hard and soft skills;
   - Project core team members, including "Team Growth " in terms of self-efficacy and self-esteem in order to be able to count on a growing potential future (using the project to grow a team that is stronger and more efficient for the next project);
   - Internal project executive sponsors;
   - Functional contributors to the project and to its product;
   - Owners of the final product of the project;
   - Investors in the project and its product;
   - Users and operators of the final product, including their:
     - enthusiastic appreciation of both the project and the product enabling them to perceive an even higher level of quality and differentiation, and
     - ability to perfect their skills in using the products of the project, thereby continually improving the original project results;
   - Affected regulatory agencies;

- Communities (local, regional, and even virtual) that are affected by the project and its products or results:
    - Immediate neighbors of new construction of facilities;
    - Users of communication systems and devices.
- **Gasik** states: "I would add success as seen by stakeholders other than the project owner (after all the owner is the most important stakeholder). But we must have in mind that there are negative stakeholders for whom "project success" will be project failure. So success from the stakeholder perspective is success for positive stakeholders and converting as many negative stakeholders as possible to a positive attitude."
- And others?

High project stakeholder satisfaction thus will enable the project organization to become the leader in its market. If the project manager and the team members are not satisfied, the project will lose effectiveness and efficiency and the project results will not be the best that they could have been. Similarly, if the other key stakeholders are not well-satisfied the perceived success of both the project and the project results will be adversely affected.

4. **The Cognitive Constraint Dimension[29]:** Cognitive Constraints have always had an important impact on the success of a project as well as on the end results produced by the project. Only recently have they begun to be recognized in the project management community. The CSFs associated with this dimension include how the project manager and the project team handle:
    - High decelerations or accelerations during the project
    - Contingency factors that are hard to manage
    - The Student Syndrome
    - Parkinson's Law
    - Overloading Stress
    - Multi-tasking Stress
    - Burnout Syndrome
    - Internal conflicts that can lead to crises
    - Drastic commitment reduction
    - "Competence Borderline Syndrome" (I'm going to do just what I have to do, no more!)[30].
    - … and so on…

Achieving good success in this regard will have long-lasting impacts on all future projects and programs within the enterprise, as well as on the results of any specific project being evaluated.

Prado states: "The inclusion of the COGNITIVE CONSTRAINT DIMENSION to measure PROJECT SUCCESS… is really an innovative and revolutionary idea. I think that a lot of work should be done for the acceptation of the idea in the practical world, but this is another story …"

Gasik says: "This is a great idea; I agree with Prado's statement" [above].

Tarazona comments: "About measuring the overall project success: I would suggest to take into account something about the compliance with the agreed standards and rules of the game, and contribution of

[29] See "Cognitive Constraints: A Key Element in Project Management Metrics," Russell Archibald, Ivano Di Filippo, Daniele Di Filippo, 2012, for a discussion of this topic.
[30] We believe this statement represents the first formal recognition of this cognitive constraint.

the project to the enrichment of the Project Management Knowledge Base of the organization.

Project Success and Project Value

Some PM practitioners, including the present authors, believe that project success is not the same as project value[31]. The concept of project value is wider than project success. **Gasik** says that "The concept of 'project success' should be related only to those goals which were precisely defined in the project charter or any other 'official' document like that. The business goals achieved are the core project value, and everything which is gained outside of the initial (or officially changed during project execution) project goals should be added to the project value. So, for example, new relationships belong to the area of project value and not necessarily to the area of project success, although I can imagine a project which "official" goal was developing of relationships." We believe that the proposed four dimensions for post-project evaluation of projects will enable measurement of both the project success as well as the project value.

Comparison of the Project Close-out Phase and the Post-Project Completion Phase

The traditional Project Close-out Phase encompasses the Closing Process Group that "…consists of those processes performed to finalize all activities across all Process Management Groups to formally complete the project, phase, or contractual obligations." (PMI PMBOK 2008, p.65.) Regarding the Project Evaluation Phase in PRINCE 2: "This is the internal project evaluation. The aim here is to assess how successful the project has been, not how successful the end product is. There may be a separate external evaluation – for example, from a quality assurance group." (OGC 2002, p. 158.) These standards deal only with some aspects of Item 1 above, the Project Management Dimension, and they do not include the Product, Stakeholder, or Cognitive Constraints dimensions.

Timing and duration of the Post-Project Evaluation Phase

Measuring success of the first dimension (Project Management) can usually be done soon after the project is closed or ended. The second (Project Product/Results/Benefits Dimension) and third (Project Stakeholder Satisfaction) will usually take longer, and in some cases months after the project is closed to properly evaluate the success of the system, plant or other results created by the project. This Post-Project Evaluation Phase obviously requires a flexible amount of time depending on the type of product that the project has produced. The fourth dimension (Project Cognitive Constraints Dimension) will also require a time period after project closure to properly measure the project's final success in that regard.

Who does the Post-Project Evaluation Phase benefit?

The primary party that benefits from the Post-Project Evaluation Phase obviously is the organization that has made the major investment in creating and executing the project. Typically we refer to that organization as the "project owner." The results of the four-dimensional evaluation described above will provide the owner valuable information regarding the wisdom of initiating, creating, and authorizing the investment in the project and its products in the first place, and also how well the project was actually conducted and how well the final results achieved the initial project and product objectives.

[31] We are indebted to Stanislaw Gasik for introducing this concept.

For those project-driven organizations that only planned and executed a portion of the overall project or program this Post-Project Evaluation Phase will be of less interest and benefit. For those organizations the first 'project management' dimension will be of primary interest, but they can also benefit a great deal from the results of the other three evaluation dimensions.

David Pells states: "I very much like the discussion of the 4 'Dimensions for delivering project success' …. The expanded emphasis on the 'Post Project Evaluation Phase' is very good. As you point out, this phase has been sorely missing and inadequately addressed in PM models, standards, and the professional literature. I see this subject now strongly supported by the new emphasis on green PM and sustainability. Of course it also gets to the heart of the whole ROI set of issues – does the product of the project deliver the desired benefits?"

Bob Prieto says: "I struggle with the discussion on the post-project evaluation phase. Is the project first delivery of the asset only? If so I am driven to optimize around first cost, ease of turnover and no problems during the warranty period. If, however, lifecycle is truly that, then my optimization point is about achieving ALL the SBOs the project was to address, over the complete lifecycle of the facility. In some instances, such as those with high end of life costs, ultimate success may only be at some point in the distant future. This does not stop intermediate assessment of achievement of "outcomes" as well as refinement of business and other models to assess the likelihood of achieving the lifecycle objectives that underpinned the project in the first place. In this context, any post evaluation period must be carefully defined as well as the points of evaluation and the "scoring" methodology."On a related note, lifecycle analysis raises interesting questions with respect to:

- Assumption tracking and migration
- Risk identification, assessment, tracking and mitigation in a lifecycle context
- Event risk over extended timeframes
- Susceptibility to Black Swan risks as project (lifecycle) timeframes extend (think 100 year infrastructure)
- Valuing resilience and flexibility (optionality) in lifecycle assessments
- Multi-variant optimization in a triple bottom line context."

Jorge Tarazona comments that "The managerial subprocess TERMINAR of my Modelo T [Tarazona 2012] contains components of your **Post-Project Evaluation Phase**. On the other hand, your **Post-Project Evaluation Phase** contains some elements of the process that some organizations call "Ex-Post Evaluation" and which is performed after the product of the project has been in operation.

Part 5. The Proposed Six-Phase Comprehensive Project Life Cycle

The addition of the Project Incubation Phase and the Post-Project Evaluation Phase to the standard top-level project life cycle model produces a truly realistic and comprehensive project life cycle model that recognizes the importance of each of these phases. In fact, as mentioned earlier, these phases are not actually new in very mature project management practice. By identifying and defining them we simply recognize the good strategic project management practices that are being used today in organizations that are fully mature in the project management discipline.

Proposal for Adoption as a Standard for Important Projects

We will submit and propose this definition of the comprehensive project life cycle model to the several professional associations and organizations that have established standards related to the project management discipline for their considered evaluation for inclusion in their published standards and project management bodies of knowledge, as appropriate.

These organizations include:

- International Organization for Standards /ISO,
- Project Management Institute/PMI,
- American Society for the Advancement of Project Management/asapm (the USA member of the International Project Management Association/IPMA),
- Association for Project Management/APM (the UK member of IPMA),
- Istituto Italiano di Project Management/ISIPM,
- AACE International,
- and others, including other national member organizations within IPMA.

Prior to that submittal we will publish this paper on-line at the PM World Journal at http://pmworldjournal.net/ and request comments, criticisms, questions and other feedback from PM practitioners around the world. The authors welcome this feedback for further improve and develop the concepts presented in this paper: russell_archibald@yahoo.com, ivano.difilippo@genialsoftware.it and Daniele Di Filippo at project4001@live.com .

Appendix A

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- The University of Illinois granted Dr. Kerzner a Distinguished Recent Alumni Award for his contributions to the field of project management.
- Utah State University provided Dr. Kerzner with the 1998 Distinguished Service Award for his contributions to the field of project management.
- The Northeast Ohio Chapter of the Project Management Institute gives out the Kerzner Award once a year to one project manager in Northeast Ohio that has demonstrated excellence in project management.
- The Project Management Institute (National Organization), in conjunction with IIL, has initiated the Kerzner International Project Manager of the Year Award given to one project manager yearly anywhere in the world.
- The Project Management Institute also gives out four scholarships each year in Dr. Kerzner's name for graduate studies in project management.
- Baldwin-Wallace University has instituted the Kerzner Distinguished Lecturer Series.

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Appendix B

Illustrative List of Business Process and Project/Program/Portfolio Digital Management Systems

Some Business Process Management Systems

- **IBM WebSphere Business Modeler**: http://www-01.ibm.com/software/integration/webphere-business-modeler/advanced/features/
- **IBM Rational Process Library:** http://www-01.ibm.com/software/awdtools/rmc/library/
- **Oracle Business Process Management Suite:** http://www.oracle.com/us/technologies/bpm/029418.pdf
- **SAP Business Suite:** http://www.sap.com/lines-of-business/finance/business-suite-apps/index.epx
- **JBoss jBPM:** http://www.jboss.org/jbpm/
- **WSO2 BPS:** http://wso2.com/products/business-process-server/
- **Bonita BPM:** http://www.bonitasoft.com/products/bonita-open-solution-open-source-bpm
- **Intalio BPM:** http://bpms.intalio.com/product

Some Project/Program/Portfolio Management Systems

- Advanced Management Solutions Realtime Enterprise: http://www.amsusa.com/company/intro.htm
- CA Technologies: http://www.ca.com/us/project-portfolio-management.aspx
- Compuware Changepoint: http://www.compuware.com/business-portfolio-management/
- Dekker, Ltd: Decker Trakker: http://www.dekkerltd.com/trakker.aspx
- Planview Enterprise Portfolio Management: http://www.planview.com/
- HP Project and Portfolio Management Center: http://www8.hp.com/us/en/software-solutions/software.html?compURI=1171920#tab=TAB1
- Microsoft: MS Project and Project Server: www.microsoft.com
- Oracle Primavera P6 Enterprise Project Portfolio Management: http://www.oracle.com/us/products/applications/042373.htm
- SAP Portfolio and Project Management: http://www.sap.com/index.epx
- Spider Project: http://www.spiderproject.com/

Appendix C
Project life cycle models and references: generic and for various project categories.

Project Categories: Each having similar life cycle phases and one unique project management process	**Life Cycle Models and References**
Generic Project Models: many project categories.	**Belanger 1998, pp 62-72:** Generic, Waterfall, Parallel-Work, Evolutionary Models. **Morris 1994, pp 245-248:** Standard, Waterfall, Cyclical, Spiral Models.
1. Administrative/Management Projects	See generic models above.
2. Aerospace/Defense Projects 2.1 Systems acquisition 2.2 Space vehicle	**DOD 5000:** Defense Acquisition System **NASA** Space Flight Program and Project Management Handbook, p.20. http://nodis3.gsfc.nasa.gov/OCE_docs/OCE_8.pdf
3. Communication Systems Projects	See generic models above.
4. Event Projects	See generic models above.
5. Facilities Projects 5.1 Facility decommissioning 5.2 Facility demolition 5.3 Facility maintenance and modification 5.4 Facility design/procurement/construction Civil Environmental Industrial Commercial Residential	See generic models above.
6. Information Systems (Software) Projects	**Desaulniers and Anderson 2001:** Predictive (Waterfall, Prototyping, RAD, Incremental Build, Spiral) and Adaptive (ASD, XP, SCRUM) Models. **Highsmith** 2009 Agile Project Management: Creating Innovative Products **Lewin 2002, p 47:** "V" Software Development Model; p 50: Formula-IT Development Model.
7. International Development Projects	**World Bank Institute 2002, Module 1.**
8. Product and Service Development Projects 8.1 Industrial product 8.2 Consumer product 8.3 Pharmaceutical product 8.4 Service (financial, other)	**Cooper and Kleinschmidt 1993:** Stage-Gate ® Process Model **Kezsbom & Edward 2001, pp 108:** Stage/Gate Product Development Model. **Thamhain 2000:** Phase-Gate Process Model. **Murphy 1989:** Pharmaceutical Model.
9. Research and Development Projects 9.1 Environmental 9.2 Industrial 9.3 Economic development 9.4 Medical 9.5 Scientific	**Eskelin 2002, p 46:** Technical Acquisition: Basic Model, Phased Model, Multi-Solution Model.

Source: Adapted from Archibald 2003, pp 45-46**.**

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Definitions of Terms and Further Reading on Concepts Referenced in this Paper

1. **Business Process Management**: http://en.wikipedia.org/wiki/Business_process_management
2. **Key Performance Indicator(KPI):** http://en.wikipedia.org/wiki/Performance_indicator
   Critical Success Factors (CSF): http://en.wikipedia.org/wiki/Critical_success_factor
3. **IBM Rational Software:**
   http://www-01.ibm.com/software/rational/?lnk=mprSO-rati
4. **Cognitive psychology:** http://en.wikipedia.org/wiki/Cognitive_psychology

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