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Systems and software engineering — Life cycle processes — Project management

Ingénierie du logiciel — Processus de cycle de vie — Gestion de projet



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Documents

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1. ~~Red Text~~ - Red strikethrough text denotes deletions.
2. Blue Text - Blue underlined text denotes modifications and additions.

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Systems and software engineering*, in cooperation with the Software & Systems Engineering Standards Committee of the IEEE Computer Society, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

This second edition cancels and replaces the first edition (ISO/IEC/IEEE 16326:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- a) re-ordered the original [Clauses 2](#) and [4](#), and added a new [Clause 2](#) to comply with the new ISO document fixed structure requirements;
- b) moved the process guidelines up in front of the project management plan content requirements to put more emphasis on the process rather than the “product;”
- c) changed the citation tables in the new [Clause 6](#) to a single column so that the corresponding content is identical to both ISO/IEC/IEEE 15288:2015 and ISO/IEC/IEEE 12207:2017;
- d) added references in the applicable guidance portions of the new [Clause 6](#) that point to the more detailed process guidance information in ISO/IEC/IEEE 24748-4:2016 and ISO/IEC/IEEE 24748-5:2017;

- e) removed the PMP format requirements from the new [Clause 7](#);
- f) re-ordered the Bibliography to list the citations in numerical order.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document provides normative content specifications for project management plans concerned with systems, and software systems.

This document also provides detailed discussion and advice on applying a set of technical management processes that are common to both the system and software life cycles as covered by ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 respectively. The discussion and advice are intended to aid in the preparation of the normative content of project management plans.

Systems and software engineering — Life cycle processes — Project management

1 Scope

1.1 Purpose

This [document](#) ~~International Standard~~ is intended to aid project managers in managing to successful conclusion those projects concerned with [systems, including](#) software ~~intensive~~ systems ~~and software products~~.

This [document](#) ~~International Standard~~ specifies the required content of the project management plan (PMP). This [document](#) ~~International Standard~~ also quotes the extracted purpose and outcome statements from the [technical management](#) ~~project~~ processes of ISO/IEC/~~12207:2008~~ (IEEE [15288 Std 12207-2008](#)) and ISO/IEC/~~15288:2008~~ (IEEE [12207, Std 15288-2008](#)), and adds detailed guidance for managing projects that use these processes for [systems, including](#) software ~~products and software-intensive~~ systems.

1.2 Field of application

This [document](#) ~~International Standard~~ is written for those who use or plan to use ISO/IEC/[IEEE 15288:2008](#) (IEEE Std 15288-2008) and ISO/IEC/[IEEE 12207:2008](#) (IEEE Std 12207-2008) on projects dealing with [systems, including](#) software ~~intensive~~ systems ~~and software products~~, regardless of project scope, [products](#) ~~product~~, methodology, size or complexity. The field of application of this [document](#) ~~International Standard~~ spans the whole ~~software or system~~ [or software](#) life cycle, and addresses [all](#) ~~everybody who plays a role in~~ project management [roles](#) ~~project managers and others~~, specifically:

- those responsible for establishing and continuously improving [their organization's policies for implementing ISO/IEC/12207:2008 \(IEEE 15288 Std 12207-2008\) software life cycle processes and ISO/IEC 15288:2008 \(IEEE Std 15288-2008\) system life cycle processes and ISO/IEC/IEEE 12207 software life cycle processes](#);
- those responsible for executing any ISO/IEC/12207:2008 (IEEE 15288 Std 12207-2008) software life cycle process or ISO/IEC 15288:2008 (IEEE Std 15288-2008) system life cycle process or ISO/IEC/IEEE 12207 software life cycle process at a project level;
- organizations or individuals subcontracting a project management effort.

In many organizations, the various responsibilities of project management are assigned to more than one person. Where the term "project manager" is used in this [document International Standard](#), the guidance, advice or normative requirement [is taken as applying applies](#) to the applicable role within the organization.

This [document International Standard](#) is intended to provide guidance for two-party situations and [can may](#) be equally applied where the two parties are from the same organization. This [International document Standard](#) can also be used by a single party as self-imposed tasks.

This [document International Standard](#) can also serve as guidance in multi-party situations, where high risks are inherent in the supply and integration of complex software-based systems, and procurement can involve several vendors, organizations or contracting parties.

1.3 Limitations

The normative content specifications for [PMPs project management plans](#) and the guidance for [application management](#) of the [technical management project](#) processes [have general application across the scope of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207, but are developed with a focus on are limited to](#) projects dealing with [systems with a significant software element, intensive systems](#) and software [systems products](#).

2 Normative References

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO, IEC and IEEE maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <http://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

— IEEE Standards Dictionary Online: available at <http://ieeexplore.ieee.org/xpls/dictionary>

3.2 Abbreviated terms

~~3 Symbols and abbreviations~~

~~The following symbols and abbreviations are used in this International Standard:~~

~~ANSI — American National Standards Institute~~

~~CCB — Configuration/Change Control Board~~

CDRL contract data requirements list

~~GATES — Stage Gate methodology~~

~~IBM — International Business Machines~~

ICWG interface control working group

~~IEC~~	~~International Electrotechnical Commission~~
~~IEEE~~	~~Institute of Electrical and Electronics Engineers~~
~~ISO~~	~~International Organization for Standardization~~
~~OGC~~	~~Office of Government Commerce (UK)~~
PERT	program evaluation review technique
PM	project management (or project manager)
~~PMBOK®~~	~~Project Management Body of Knowledge~~
~~PMI~~	~~Project Management Institute~~
PMP	project management plan
PPL	product parts list
~~PRINCE2~~	~~Projects In Controlled Environments (version 2)~~
~~RUP~~	~~Rational Unified Process® (registered trademark of IBM)~~
SDP	software development plan
~~SE~~	~~Software Engineering~~
SEE	software engineering environment
SEMP	systems engineering management plan
SWEBoK	software engineering body of knowledge
~~UK~~	~~United Kingdom~~
~~USA~~	~~United States of America~~
WBS	work breakdown structure

4 Conformance

4.1 General

This [document](#) ~~International Standard~~ provides normative definition of the content of the ~~project management plan (PMP)~~ and provides guidance for the execution of the [technical management project](#) processes of ISO/IEC/~~15288:2008 (IEEE Std 15288-2008)~~ and ISO/IEC/~~12207:2008 (IEEE Std 12207-2008)~~. Users of this [document](#) ~~International Standard~~ can claim conformance to the normative documentation content, to the process provisions, or both.

4.2 Conformance to [the](#) normative documentation content

A claim of conformance to the documentation provisions of this [document](#) ~~International Standard~~ means that the user demonstrates that the content of a PMP conforms to the content requirements specified in Clause [7](#) ~~5 of this International Standard~~.

4.3 Conformance to processes

A claim of conformance to the process provisions of this [document](#) ~~International Standard~~ is equivalent to claiming conformance to the [technical management project](#) processes from ISO/IEC/~~IEEE 15288:2008 (IEEE Std 15288-2008)~~ and ISO/IEC/~~IEEE 12207:2008 (IEEE Std 12207-2008)~~ cited in Clause ~~6 of this International Standard~~.

4.4 Full conformance

A claim of full conformance to this [document](#) ~~International Standard~~ is equivalent to claiming conformance to the PMP content requirements cited in Clause [7](#) ~~5~~ and the [technical management project](#) processes of ISO/IEC/~~15288:2008 (IEEE Std 15288-2008)~~ and ISO/IEC/~~12207:2008 (IEEE Std 12207-2008)~~ cited in Clause ~~6 of this International Standard~~.

5 Application of this document ~~International Standard~~

This document ~~International Standard~~ specifies the required content of the PMP ~~a Project Management Plan (PMP)~~ such that the overall content of the plan, when executed successfully, fulfils the purposes and desired outcomes which are specified by the technical management ~~project~~ processes of ISO/IEC/IEEE 15288:~~2008 (IEEE Std 15288-2008)~~ and ISO/IEC/IEEE 12207:~~2008 (IEEE Std 12207-2008)~~.

The technical management ~~project~~ processes of ISO/IEC/IEEE 15288:~~2008 (IEEE Std 15288-2008)~~ and of ISO/IEC/IEEE 12207:~~2008 (IEEE Std 12207-2008)~~ contain the generic activities and tasks, which can ~~may~~ be employed by any party that has to manage a project dealing with systems, including ~~software-intensive systems or software products~~. This document ~~International Standard~~ provides additional detailed guidance in Clause 6 ~~5~~ to assist managers of these projects as they prepare and execute ~~produce~~ the PMP for a specific project.

NOTE 1 In the general case, any specific project exists within an organization's business program areas and project portfolios. The organization can have additional processes that are not directly related to project management, but that are essential to a project's successful execution. The organizational project-enabling processes in ISO/IEC/IEEE 15288 and the guidance in ISO 21500 provide useful information and guidance on how a project's technical management processes fit into the overall organization's process structure.

NOTE 2 Reference [2] also provides important information about managing projects.

The responsible people listed as actors for which guidance applies are those most often tasked with the listed preparation actions, but users of this document may agree to assign the actions to different people or organizations depending on a given program's organizational structure.

~~ANSI/PMI 99-001:2004, A Guide to the Project Management Body of Knowledge [1] provides important information about managing projects, and ISO 10006:2003, Quality management systems — Guidelines for quality management in projects [2] provides guidance on the application of quality management in projects. Managers of projects dealing with software products or software-intensive systems may find the contents of the PMBOK®¹ Guide [1] and ISO 10006:2003 [2] helpful, along with the guidance in this International Standard, in managing their projects to a successful conclusion.~~

Project managers should also apply the guidance in this [document](#) ~~International Standard~~ in an iterative manner to consider any systemic impact when undertaking an action;⁷ e.g., an action⁷ or failure to act⁷ in one area can affect other areas.

6 [Technical management](#) ~~Project~~ processes

[6.1 General](#)

This clause examines the [eight technical management](#) ~~seven project~~ processes of ISO/IEC/~~12207:2008~~ (IEEE [15288](#) ~~Std 12207-2008~~) and ISO/IEC/[IEEE 12207](#) i.e.:~~15288:2008~~

- [— Project planning process;](#)
- [— Project assessment and control process;](#)
- [— Decision management process;](#)
- [— Risk management process;](#)
- [— Configuration management process;](#)
- [— Information management process;](#)
- [— Measurement process;](#)

¹~~PMBOK® is a registered trademark of the Project Management Institute, Incorporated. This information is given for the convenience of users of this standard and does not constitute an endorsement by ISO/IEC or the IEEE of these products. Equivalent products may be used if they can be shown to lead to the same results.~~

– Quality assurance process.

NOTE ISO/IEC/IEEE 15288 uses the identical process model for process purposes and outcomes as ISO/IEC/IEEE 12207, but its tasks and activities differ.

This clause provides ~~(IEEE Std 15288-2008), providing~~ detailed discussion and application advice as it applies to the management of projects dealing with systems, including software-~~intensive~~ systems ~~and software products~~. The discussion and advice are intended to aid project managers in managing ~~producing the normative content of the project management plan (PMP) for~~ a specific project (e.g., direct management and control of the work, management of the scope, management of the schedule, management of the budget and costs, management of resources, management of stakeholders, risk management, and procurement management). ~~as specified in clause 5 of this International Standard.~~

Normative project process portions from both ISO/IEC/~~12207:2008 (IEEE 15288 Std 12207-2008)~~ and ISO/IEC/~~15288:2008 (IEEE 12207 Std 15288-2008)~~ are contained in boxed text, with discussion and advice for that portion immediately following. The purposes and outcomes from ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 are essentially the same, but may have minor editorial differences in verb tense and punctuation.

The advice given for ~~software-intensive~~ systems projects also applies to projects undertaken to produce software systems ~~products~~. Any advice given specifically for software systems ~~products~~ is further segregated below the advice for ~~software-intensive~~ systems. The guidance provided for each process section in this document is designed to treat the combined purpose and outcome statements for that section from both ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207.

The normative text from the corresponding portions of the ISO/IEC 12207:2008 (IEEE Std 12207-2008) and ISO/IEC 15288:2008 (IEEE Std 15288-2008) project processes cited in this International Standard highlights the fact that in some cases the text of a particular section is different between the citations from the two International Standards. In some cases this is due to the differing fields of application of the two international standards; e.g., whereas the life cycle process context of ISO/IEC 12207:2008 (IEEE Std 12207-2008) is focused on software products and services, the life cycle process focus of ISO/IEC 15288:2008 (IEEE Std 15288-2008) is on the broader treatment of complete systems. In other cases the differences may be due to certain purpose or outcome statements in ISO/IEC 15288:2008 (IEEE Std 15288-2008) assuming that a given specific item stated in ISO/IEC 12207:2008 (IEEE Std 12207-2008) must have occurred in order for the statement in ISO/IEC 15288:2008 (IEEE Std 15288-2008) to occur. However, the differences are not significant for the purposes of this standard. The guidance provided for each process section in this International Standard is designed to treat the combined purpose and outcome statements for that section from both ISO/IEC 12207:2008 (IEEE Std 12207-2008) and ISO/IEC 15288:2008 (IEEE Std 15288-2008).

There are several prescriptive PM methodologies that support life cycle processes in the field of systems and software engineering, used in both government and the private sector. The PMBOK® Guide [1] contains a comprehensive set of generic project management processes. OGC PRINCE2® Guide [17] provides guidance on PM processes for government information systems projects. RUP® [18] has been mapped [19] to PMBOK®, and applies PM and software development processes iteratively. (Each iteration occurs in any one of the phases of RUP, namely inception, elaboration, construction, transition. An iteration cannot span more than one phase, and an iteration covers the six core and three supporting disciplines of RUP). GATES methodology [20] supports PM governance by enforcing a Stage-Gate approach to control processes through inspection, review, approval, and sign off of project baselines, artefacts and designated work products (or project deliverables), to ensure readiness for advancement to the next phase, stage, process, activity or task.

The ~~identified~~ processes, and activities ~~and tasks~~ for ~~a any~~ given project ~~can may~~ require ~~an~~ iterative action to accomplish the requirements/~~goals~~ of a project. For instance, based upon the ~~software~~-life cycle model being used, processes, activities and tasks ~~can may~~ be employed at the same time; they ~~can may~~ be interdependent; or they ~~can may~~ be coordinated in an organized series of work breakdown structure (WBS) dependencies throughout a project life cycle. In addition, other more modern project development processes such as agile development can combine these processes and activities in different ways.

The project manager should communicate applicable project plans, deliverables and schedules to the organization's affected stakeholders. The project manager should enlist their commitment to support the technical management ~~project~~ processes with the organization's project-enabling processes. ISO/IEC/~~12207:2008~~ (IEEE 15288:2015, ~~Std 12207-2008~~), 6.2 and ISO/IEC/~~15288:2008~~ (IEEE 12207:2017 ~~Std 15288-2008~~), 6.2 provide guidance for the following organizational project-enabling processes:

- Life Cycle Model Management process;
- Infrastructure Management process;
- ~~Project~~ Portfolio Management process;
- Human Resource management process;
- Quality Management process;
- Knowledge Management process.

6.2 Project planning process

6.2.1 General

ISO/IEC/IEEE 15288:2015 and ISO/IEC/IEEE 12207:2017

6.3.1 Project planning process

6.3.1.1 Purpose

The purpose of the Project Planning process is to produce and coordinate effective and workable plans.

This process determines the scope of the project management and technical activities, identifies process outputs, tasks and deliverables, establishes schedules for task conduct, including achievement criteria, and required resources to accomplish tasks. This is an on-going process that continues throughout a project, with regular revisions to plans.

6.3.1.2 Outcomes

As a result of the successful implementation of the Project Planning process:

- a) Objectives and plans are defined.
- b) Roles, responsibilities, accountabilities, authorities are defined.
- c) Resources and services necessary to achieve the objectives are formally requested and committed.
- d) Plans for the execution of the project are activated.

ISO/IEC 12207	ISO/IEC 15288
6.3.1 Project Planning Process 6.3.1.1 Purpose The purpose of the Project Planning Process is to produce and communicate effective and workable project plans. This process determines the scope of the project management and technical activities, identifies process outputs, project tasks and deliverables, establishes schedules for project task conduct, including achievement criteria, and required resources to accomplish project tasks. 6.3.1.2 Outcomes As a result of successful implementation of the Project Planning Process: a) the scope of the work for the project is defined; b) the feasibility of achieving the goals of the project with available resources and constraints are evaluated; c) the tasks and resources necessary to complete the work are sized and estimated; d) interfaces between elements in the project, and with other project and organizational units, are identified; e) plans for the execution of the project are developed; and f) plans for the execution of the project are activated.	6.3.1 Project Planning Process 6.3.1.1 Purpose The purpose of the Project Planning Process is to produce and communicate effective and workable project plans. This process determines the scope of the project management and technical activities, identifies process outputs, project tasks and deliverables, establishes schedules for project task conduct, including achievement criteria, and required resources to accomplish project tasks. 6.3.1.2 Outcomes As a result of the successful implementation of the Project Planning Process: a) Project plans are available. b) Roles, responsibilities, accountabilities, and authorities are defined. c) Resources and services necessary to achieve the project objectives are formally requested and committed. d) Project staff are directed in accordance with the project plans. e) Plans for the execution of the project are activated.

(Deleted)

6.2.2 Guidance

NOTE 1 [ISO/IEC/IEEE 24748-4 and ISO/IEC/IEEE 24748-5 provide detailed guidance on the processes required for successful planning, execution and management of a project's systems and software engineering efforts, respectively.](#)

a) [The strategies defined in the guidance sections of each of the other Technical Management processes in this clause provide inputs and are integrated in the Project Planning process. The Project Assessment and Control process is used to assess whether the plans are integrated, aligned and feasible.](#)

b) The responsibility for preparing and approving plans should be assigned and documented.

- c) The project manager should plan the management of ~~ensure that all~~ project requirements including their elicitation, documentation and analysis. ~~are elicited, documented, analyzed and managed.~~
- d) Project planning should include ~~ensure~~ the following activities ~~are included~~:
1. involving all stakeholders in the requirements definition of a project;
 2. establishing a baseline of project requirements;
 3. establishing a sequence of activities and events at a suitable level of detail that represents the full scope of work for the project;
 4. managing change to the scope and requirements throughout a project's life cycle; ~~all~~ changes in scope and requirements should be carefully evaluated and documented; ~~for the impact on cost, schedule, risk, current scope and quality.~~
 5. reviewing the selection of processes made from a previously successful project when the scope and requirements are changed, to help ensure ~~assure~~ that the selected processes are still applicable after the changes in scope and requirements; ~~this review~~ is iterative and occurs whenever changes in scope and requirements occur;
 6. defining who is responsible for obtaining stakeholder agreement on project requirements;
 7. establishing and maintaining traceability between ~~system and software~~ requirements, between ~~software~~ requirements and design, and between ~~software~~ requirements and tests.
- NOTE 2 "project requirements" can include process requirements (for the project activities) as well as product requirements (for the product of interest or enabling products).
- e) Systems ~~Critical software~~ engineering efforts should be conducted with the required systems engineering resources and skills.

- f) Software ~~Critical system~~ engineering efforts should be conducted with the required software engineering resources and skills.
- g) Project planning ~~The project manager~~ should identify and document ~~describe~~ the activities required to translate stakeholder requirements into project deliverables and /or activities to be carried out that will ensure products are delivered as specified in a contract, i.e., ensure a project includes all the work required, and only the work required, to complete the project and product successfully.
- h) Project planning ~~The project manager~~ should include ~~ensure that~~ all aspects of process tailoring to ~~and project planning~~ account for the type of project: a new development, embedding in or integration with a larger system, modification of off-the-shelf software product, porting to different operating systems, etc. Process tailoring is fundamental for consistency of a project's activities within the organization, and includes tailoring of various levels of standardized processes from the organization's enterprise level down to the specific project level.

NOTE 3 Refer to ~~Annex A of ISO/IEC/12207:2008 (IEEE 15288:2015, Annex A Std 12207-2008)~~ and/or ISO/IEC/~~15288:2008 (IEEE 12207:2017, Annex A Std 15288-2008)~~ for details of the tailoring process.

- i) For iterative life cycle models, the scope development of the project can be revised as understanding of requirements evolves, with ~~scope statement should allow for an iterative agreement of the acquirer and supplier process to be employed throughout the project life cycle.~~ An initial scope statement is usually based on stated or elicited customer/user requirements, but risks, changes in stakeholder requirements, environment, project budget and schedule, and an evolving design make it necessary to continually reassess and reaffirm agreements and commitments, and make appropriate changes to the project scope statement, as required. ~~The~~ Project managers ~~manager~~ should also determine the feasibility of the planned technical management ~~project~~ processes to help ensure personnel, materials, facilities, Systems ~~System~~/Software Engineering Environment, and technology required to execute and manage a project are available, adequate and appropriate; and the predetermined times for completion are achievable, timely and economical. The results of this feasibility analysis could cause an adjustment to the initial project scope statement. Multiple iterations can ~~may~~ be required to achieve a good fit between the project scope statement and the internal project plans and processes.
- j) Planning the scope of the project can ~~may~~ be difficult when a new project has unprecedented elements. For such a project, care should be taken to ensure it is properly scoped and monitored. The organization's risk management process should identify detailed mitigation plans, if it is determined that additional risk exists due to the unfamiliar project.

NOTE 4 ISO/IEC 10006:2003 [2] provides guidelines for project management ~~managers~~ to help ensure proper quality of their project's products and services.

- k) ~~The~~ Project managers ~~manager~~ should select ~~ensure that~~ a life cycle model appropriate to the project being undertaken. Incremental is selected. In general, incremental and evolutionary types of life cycle models typically have advantages ~~should be chosen. Some type of evolutionary model is appropriate when the requirements are not well understood at project initiation. Even when the requirements are relatively well understood, an incremental life cycle model (with more than one iteration) is preferred~~ over a waterfall or 'Big Bang' models and can be less risky than other life cycle models, particularly for software systems ~~life-cycle model.~~