
**Systems and software engineering —
Lifecycle profiles for Very Small
Entities (VSEs) —**

Part 5-6-2:

**Systems engineering — Management
and engineering guide: Generic profile
group: Basic profile**

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*Ingénierie des systèmes et du logiciel — Profils de cycle de vie pour
très petits organismes (TPO) —*

*Partie 5-6-2: Ingénierie des systèmes — Guide d'ingénierie et de
gestion: Groupe de profil générique: Profil basique*

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Contents

Page

| | |
|--|-----------|
| Foreword | iv |
| Introduction | v |
| 1 Scope | 1 |
| 1.1 Fields of application | 1 |
| 1.2 Target Audience | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 2 |
| 4 Symbols and abbreviated terms | 4 |
| 4.1 Naming, diagramming and definition conventions | 4 |
| 4.2 Abbreviated Terms | 5 |
| 5 Systems Thinking | 5 |
| 6 Overview | 6 |
| 7 Project Management (PM) process | 7 |
| 7.1 PM purpose..... | 7 |
| 7.2 PM objectives..... | 8 |
| 7.3 PM input products..... | 8 |
| 7.4 PM output products..... | 8 |
| 7.5 PM internal products..... | 9 |
| 7.6 PM roles involved..... | 9 |
| 7.7 PM diagram..... | 9 |
| 8 System Definition and Realization (SR) process | 18 |
| 8.1 SR purpose..... | 18 |
| 8.2 SR objectives..... | 18 |
| 8.3 SR input products..... | 19 |
| 8.4 SR output products..... | 19 |
| 8.5 SR internal products..... | 19 |
| 8.6 SR roles involved..... | 20 |
| 8.7 SR diagram..... | 20 |
| 9 Roles | 34 |
| 10 Product description | 36 |
| 11 System tools requirements | 49 |
| 11.1 System tools requirements overview..... | 49 |
| 11.2 Project Management process..... | 50 |
| 11.3 System Definition and Realization process..... | 50 |
| Annex A (informative) Systems Engineering Deployment Packages | 51 |
| Annex B (informative) Mapping between the objectives of ISO/IEC TR 29110-5-6-2 and ISO/IEC 15288:2008 | 53 |
| Bibliography | 58 |

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](http://Foreword-Supplementary%20information.standards.itech.ai)

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*. [ISO/IEC TR 29110-5-6-2:2014](https://standards.itech.ai/catalog/standards/sist/be9322ff-37ef-432d-be47-)

The full list of parts of ISO/IEC 29110 is available [here](https://standards.itech.ai/catalog/standards/sist/be9322ff-37ef-432d-be47-). <https://standards.itech.ai/catalog/standards/sist/be9322ff-37ef-432d-be47->

Introduction

Very Small Entities (VSEs) around the world are contributing to valuable products and services. For the purpose of ISO/IEC 29110, a Very Small Entity (VSE) is an enterprise, an organization, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system elements and software components used in systems, or sold to be used by others, a recognition of VSEs as suppliers of high quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2005) 'Small and Medium Enterprises (SMEs) constitute the dominant form of business organization in all countries world-wide, accounting for over 95 % and up to 99 % of the business population depending on country'. The challenge facing OECD governments is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformance with these standards is difficult, if not impossible. Subsequently VSEs have no, or very limited, ways to be recognized as entities that produce quality systems/system elements including software in their domain. Therefore, VSEs are often cut off from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the application of standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, expertise, budget and time, nor do they see a net benefit in establishing systems or software lifecycle processes. To rectify some of these difficulties, a set of guides has been developed according to a set of VSE characteristics. The guides are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as Profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSEs' context; for example, processes, activities, tasks, and outcomes of ISO/IEC 12207^[2] for software; and processes, activities, tasks, and outcomes of ISO/IEC 15288^[3] for systems; and information products (documentation) of ISO/IEC/IEEE 15289^[4] for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against ISO/IEC 29110 specifications.

The ISO/IEC 29110 series of standards and technical reports can be applied at any phase of system or software development within a lifecycle. This series of standards and technical reports is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC 12207 or ISO/IEC 15288 to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC 12207 or ISO/IEC 15288 are encouraged to use those standards instead of ISO/IEC 29110.

ISO/IEC 29110 is intended to be used with any lifecycles such as: waterfall, iterative, incremental, evolutionary or agile.

ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality, and process performance. See [Table 1](#).

Table 1 — ISO/IEC 29110 target audience

| ISO/IEC 29110 | Title | Target audience |
|---------------|------------------------------------|---|
| Part 1 | Overview | VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors. |
| Part 2 | Framework | Standards producers, tool vendors and methodology vendors. Not intended for VSEs. |
| Part 3 | Certification and Assessment guide | VSEs and their customers, assessors, accreditation bodies. |
| Part 4 | Profile specifications | Standards producers, tool vendors and methodology vendors. |
| Part 5 | Management and engineering guide | VSEs and their customers. |

If a new profile is needed, ISO/IEC 29110-4 and ISO/IEC TR 29110-5 can be developed without impacting existing documents.

ISO/IEC TR 29110-1[5] defines the terms common to the Set of ISO/IEC 29110 Documents. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and requirements of a VSE, and clarifies the rationale for specific profiles, documents, standards and guides.

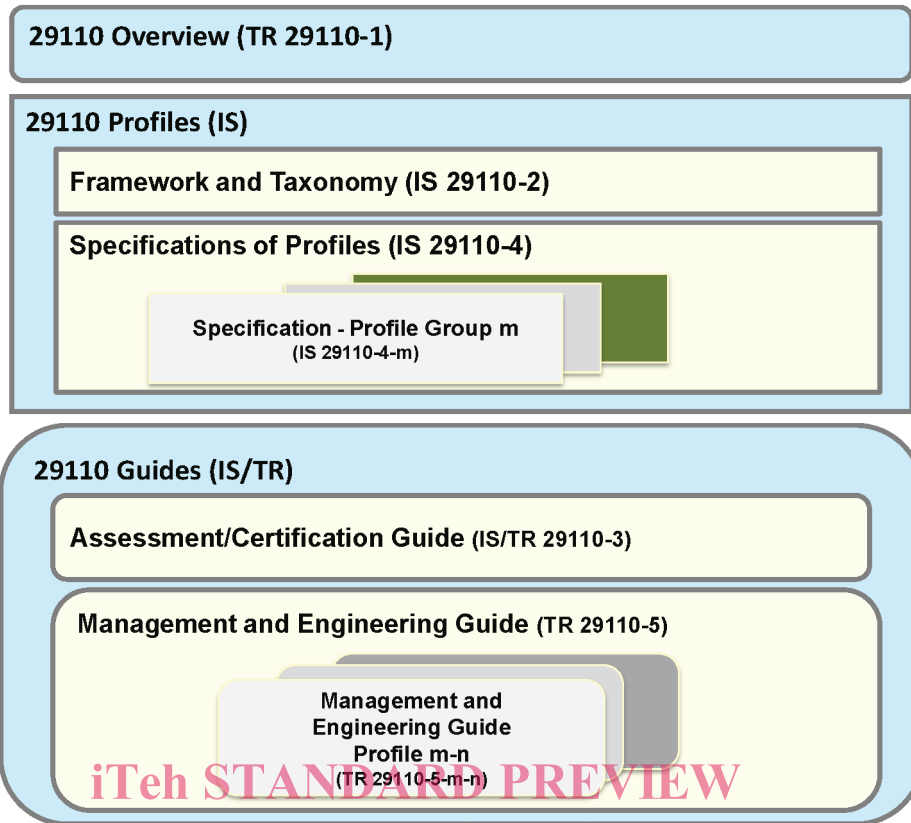
ISO/IEC 29110-2[6] introduces the concepts for systems and software engineering standardized profiles for VSEs. It establishes the logic behind the definition and application of profiles. It specifies the elements common to all profiles (structure, conformance, assessment) of ISO/IEC 29110 profiles.

ISO/IEC TR 29110-3[7] defines the process certification scheme, assessment guidelines and compliance requirements needed to meet the purpose of the defined Profiles. ISO/IEC TR 29110-3 also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC TR 29110-3 is addressed to people who have direct relation with the assessment process, e.g. the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met.

ISO/IEC 29110-4-m provides the specification for all profiles in one profile group that are based on subsets of appropriate standards elements.

This part of ISO/IEC 29110 provides a management and engineering guide for each Profile in one profile group.

Figure 1 describes the ISO/IEC 29110 International Standards (IS) and Technical Reports (TR) within the framework of reference. Overview, assessment guide, management and engineering guide are published as Technical Reports (TR). The Framework and taxonomy document, profile specifications and certification schemes are published as International Standards (IS).



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Figure 1 — ISO/IEC 29110 Series

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Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 5-6-2:

Systems engineering — Management and engineering guide: Generic profile group: Basic profile

1 Scope

1.1 Fields of application

This part of ISO/IEC 29110 is applicable to Very Small Entities (VSEs). VSEs are enterprises, organizations, departments or projects having up to 25 people. The lifecycle processes described in the set of International Standards (IS) and Technical Reports (TR) are not intended to preclude or discourage their use by organizations bigger than VSEs.

This part of ISO/IEC 29110 provides the management and engineering guide to the Basic Profile described in ISO/IEC 29110-4-6 through Project Management and System Definition and realization processes. This part of ISO/IEC 29110 is a standalone guide; it is not intended for a VSE to use the standardized profile to implement this part of ISO/IEC 29110.

This part of ISO/IEC 29110 applies for non-critical systems development projects. The system development should fulfil the project requirements and the system description.

Using this part of ISO/IEC 29110, a VSE can obtain benefits in the following aspects:

- An agreed set of project requirements (technical part of contract) and expected products are agreed by the Acquirer.
- A disciplined management process, that provides project visibility and corrective actions of project problems and deviations, is performed.
- A systematic System Definition and Realization process, that satisfies Acquirer needs and ensures quality products, is followed.

VSEs developing software that is part of a larger system, and for stand-alone software products and services, are encouraged to use the management and engineering guide of the Basic Profile (ISO/IEC 29110-5-1-2^[9]).

1.2 Target Audience

This part of ISO/IEC 29110 is targeted at VSEs who do not develop critical systems and do not have experience with SE process planning and implementation using ISO/IEC 15288.

It is intended to be used with any processes, techniques and methods that enhance the VSE's Stakeholder satisfaction and productivity.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC TR 29110-1:2011 and the following apply.

3.1 acquirer

stakeholder that acquires or procures a product or service from a supplier

Note 1 to entry: Other terms commonly used for an acquirer are buyer, customer, owner, or purchaser.

[SOURCE: ISO/IEC 15288:2008]

3.2 critical system

those items (e.g. functions, parts, software, characteristics, processes) having significant effect on the product realization and use of the product – including safety, performance, form, fit, function, producibility, service life, etc. – that require specific actions to ensure they are adequately managed

Note 1 to entry: Examples of critical items include safety critical items, fracture critical items, mission critical items, key characteristics, etc.

[SOURCE: (AS/EN/JIS Q) 9100:2009]

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3.3 disposed system

system that has been transformed (i.e. state change) by applying the disposal process

Note 1 to entry: A systems approach considers the total system and the total lifecycle of the system. This includes all aspects of the system and the system throughout its life until the day users dispose of the system and the external enterprises complete the handling of the disposed system products.

[SOURCE: ISO/IEC 15288:2008, modified]

3.4 operator

entity that performs the operations of a system

Note 1 to entry: The role of operator and the role of user may be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: An individual operator combined with knowledge, skills and procedures may be considered as an element of the system.

Note 3 to entry: In the context of this specific definition, the term entity means an individual or an organization.

[SOURCE: ISO/IEC 15288:2008]

3.5 Systems Engineering Plan SEP

top-level plan for managing the SE effort which, as such, defines how the project will be organized, structured, and conducted and how the total engineering process will be controlled to provide a product that satisfies stakeholder requirements

Note 1 to entry: Also called Systems Engineering Management Plan (SEMP).

[SOURCE: INCOSE:2010]

3.6**Small and Medium Enterprise
SME**

enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro)

[SOURCE: OECD 2005]

3.7**system**

combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: A system may be considered as a product or as the services it provides.

Note 2 to entry: In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g. aircraft system. Alternatively, the word “system” may be substituted simply by a context-dependent synonym, e.g. aircraft, though this may then obscure a system principles perspective.

[SOURCE: ISO/IEC 15288:2008]

3.8**trade-off**

decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the stakeholders

[SOURCE: ISO/IEC 15288:2008]

3.9**user**

individual or group that benefits from a system during its utilization

Note 1 to entry: The role of user and the role of operator may be vested, simultaneously or sequentially, in the same individual or organization.

[SOURCE: ISO/IEC 15288:2008]

3.10**system structure**

decomposition of a system of interest into a set of interacting systems and system elements

Note 1 to entry: The system structure is described in a System Breakdown Structure (SBS).

[SOURCE: ISO/IEC 15288:2008]

3.11**statement of work****SOW**

document used by the acquirer that includes the needs and expectations, the scope, objectives and deliverables

[SOURCE: ISO/IEC 12207:2008]

3.12**work breakdown structure****WBS**

[Output/Input] deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables

Note 1 to entry: It organizes and defines the total scope of the project.

[SOURCE: ISO/IEC/IEEE 24765:2010, modified]

4 Symbols and abbreviated terms

4.1 Naming, diagramming and definition conventions

The following process structure description and notation are used to describe the processes:

Name – process identifier, followed by its abbreviation in brackets “()”.

Purpose – general goals and results expected of the effective implementation of the process. The implementation of the process should provide tangible benefits to the stakeholders. The purpose is identified by the abbreviation of the process name.

Objectives – specific goals to ensure the accomplishment of the process purpose. The objectives are identified by the abbreviation of the process name, followed by the letter “O” and a consecutive number, for example PM.01, SR.02, etc.

Input Products – products required to perform the process and its corresponding source, which can be another process or an external entity to the project, such as the Acquirer. Identified by the abbreviation of the process name and showed as two column table of product names and sources.

Output Products – products generated by the process and its corresponding destination, which can be another process or an external entity to the project, such as Acquirer or Organizational Management. Identified by the abbreviation of the process name and showed as two column table of product names and destinations.

Internal Products – products generated and consumed by the process. Identified by the abbreviation of the process name and showed as one column table of the product names.

All products' names are printed in cursive and initiate with capital letters. Some products have one or more statuses attached to the product name surrounded by square brackets “[]” and separated by “;”. The product status may change during the process execution. See [Clause 10](#) for the alphabetical list of the products, its descriptions, possible statuses and the source of the product. The source can be another process or an external entity to the project, such as the Acquirer.

Rectangle boxes – the rectangle boxes following the description of processes objectives make the correspondence with ISO/IEC 15288:2008 standard.

Roles involved – names and abbreviation of the functions to be performed by project team members. Several roles may be played by a single person and one role may be assumed by several persons. Roles are assigned to project participants based on the characteristics of the project. The role list is identified by the abbreviation of the process name and showed as two-column table. See [Clause 9](#) for the alphabetical list of the roles, its abbreviations and required competencies description.

Diagram – graphical representation of the processes. The large round-edged rectangles indicate process or activities and the smaller square-edged rectangles indicate the products. The directional or bidirectional thick arrows indicate the major flow of information between processes or activities. The thin directional or bidirectional arrows indicate the input or output products. The notation used in the diagrams does not imply the use of any specific process lifecycle.

Activity – a set of cohesive tasks. Task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more objectives of a process. A process activity is the first level of process workflow decomposition and the second one is a task. Activities are identified by process name abbreviation followed by consecutive number and the activity name.

Activity Description – each activity description is identified by the activity name and the list of related objectives surrounded by brackets “()”. For example PM.1 Project Planning (PM.01, PM.05, PM.06, PM.07) means that the activity PM.1 Project Planning contributes to the achievement of the listed objectives: PM.01, PM.05, PM.06 and PM.07. The activity description begins with the task summary and is followed by the task descriptions table. The task description doesn't impose any technique or method to perform it. The selection of the techniques or methods is left to the VSE or project team.

Tasks description table contain four columns corresponding to:

- Role – the abbreviation of roles involved in the task execution.
- Task – description of the task to be performed. Each task is identified by activity ID and consecutive number, for example PM1.1, PM1.2, and so on.
- Input Products – products needed to execute the task.
- Output Products – products created or modified by the execution of the task.

Incorporation to *Project Repository* – list of products to be saved in *Project Repository*; the *Configuration Management Strategy* has to be applied to some of them (see [Clause 7.7.2](#) and [8.7.2](#)). It is useful as a checklist for project manager and technical leader.

NOTE Tables used in process description are for presentation purpose only.

4.2 Abbreviated Terms

The following abbreviations are used in this document:

| | |
|-------|--|
| ACQ | Acquirer |
| HW | Hardware |
| IVV | Integration, Verification, Validation |
| PO | Purchase Order |
| PM | Project Management |
| PJM | Project Manager |
| SBS | System Breakdown Structure |
| SDD | System Design Document |
| SEMP | System Engineering Management Plan |
| SEP | Systems Engineering Plan |
| SMART | Specific, Measurable, Achievable, Relevant and Traceable |
| SME | Small and Medium Enterprise |
| SBS | System Breakdown Structure |
| SOW | Statement of Work |
| SR | System Definition and Realization |
| STK | Stakeholder |
| SW | Software |
| TPM | Technical Performance Management |
| VSE | Very Small Entity |
| WBS | Work Breakdown Structure |

5 Systems Thinking

The traditional approach to solve a problem is called Cartesian. This approach focuses on dividing a problem into smaller parts and, once resolved each part, the whole problem is solved. This approach, however, has limitations because you can lose insight of the whole system. To overcome this limitation,

there is the System Thinking, which analyses and observes the system as a whole and identifies the interrelationships among the parts that compose it and also with the system environment (e.g. enabling systems).

System Thinking allows for a better understanding of the systems as a whole: System Thinking is used to broaden the perspective to larger environments by considering the entire lifecycle of the system and the different possible applications of the system. Systems can be immersed in different environments and multiple relationships will emerge. Every project has a context in which the system is embedded. Thus a system is not only composed of software and hardware, but is always part of a larger operation, often involving people and other systems. The designer must clearly understand these relationships before defining a solution.

The “system” perspective enables to design of an optimized system taking into account all needs and constraints. This perspective also helps to invent new solutions to meet existing needs or in some cases create new needs.

For the purpose of this standard, System Thinking should be considered particularly when understanding the system to be designed so that, when identifying the requirements, all the stakeholders must be considered as well as the context in which the system should operate. Following this approach, when deploying the requirements in smaller modules, it will help ensure effective integration the parts.

6 Overview

The Basic Profile Management and Engineering Guide applies to a Very Small Entity (VSE), i.e. enterprise, organization, department or project having up to 25 people, dedicated to system development of non-critical systems. The project may fulfil an external or internal contract. The internal contract between the project team and its Acquirer need not be explicit.

The Guide provides Project Management (PM) and System Definition and Realization (SR) processes which integrate practices based on the selection of ISO/IEC 15288, *Systems and software engineering — System life cycle processes* and ISO/IEC/IEEE 15289, *Systems and software engineering – Content of life-cycle information products (documentation)* standards elements. [Annex A](#) provides information about Deployment Packages which will facilitate the implementation of these processes.

This part of ISO/IEC 29110 is intended to be used by the VSE to establish processes to implement any development approach or methodology including, e.g. agile, evolutionary, incremental, test driven development, etc. based on the VSE organization or project needs.

Using the Guide, VSE can obtain benefits in the following aspects:

- A set of project requirements (technical part of the contract) and expected products are agreed with the Acquirer.
- A disciplined management process, that provides project visibility and corrective actions of project problems and deviations, is performed;
- A systematic System Definition and Realization process, that satisfies Acquirer needs and ensures quality products, is followed.

To use the Guide the VSE needs to fulfil the following entry conditions:

- Project *Needs and Expectations* are documented;
- Feasibility of the project was performed before its start;
- Project team, including project manager and system engineer, is assigned and trained; and
- Goods, services and infrastructure to start the project are available.

The purpose of the Project Management (PM) process is to establish and carry out in a systematic way the *Tasks* of the system development, which allows complying with the project's *Objectives* in the expected quality, time and cost.

The purpose of the System Definition and Realization (SR) process is the systematic performance of the analysis, design, construction, integration, verification, and validation activities for new or modified system according to the specified requirements.

Both processes are interrelated (see [Figure 2](#)).

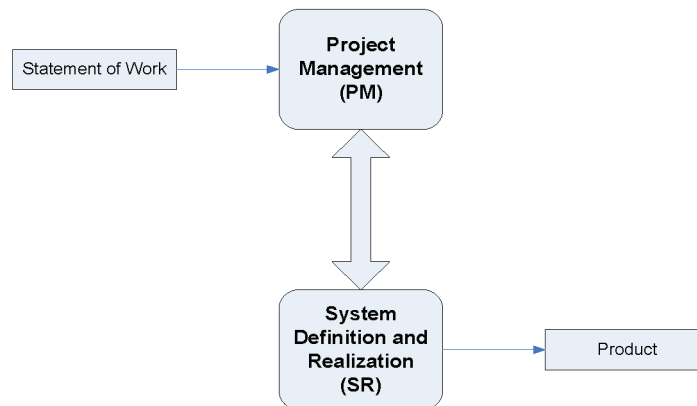


Figure 2 — Basic profile guide processes (diagram notation is explained in [section 4.1](#))

PM process uses the Acquirer's *Statement of Work* to elaborate the *Project Plan*. If there is no statement of work available from the customer, the Project Manager (PJM), in collaboration with the Work Team, has to clarify the basis to develop the statement of work. The PM project assessment and control tasks compare the project progress against the *Project Plan* and actions are taken to eliminate deviations or incorporate changes to the *Project Plan*. The PM project closure activity ensures delivery of the *product (new or modified product)*, produced by SR (System Definition and Realization) process, and gets the Acquirer's acceptance to formalize the end of the project. A *Project Repository* is established to save the work products and to control its versions during the project.

The execution of the SR process is driven by the *Systems Engineering Management Plan (SEMP)*. An early SR activity is to generate a *SEMP*. The *SEMP* will guide the execution of the requirements elicitation, analysis, system design, system construction, integration and verification, validation, product delivery, maintenance and disposal activities.

The Acquirer provides a *Statement of Work (SOW)* as an input to Project Management process and receives *Products* as a result of System Definition and Realization process execution (see [Figure 2](#)).

7 Project Management (PM) process

7.1 PM purpose

The purpose of the Project Management process is to establish and carry out in a systematic way the *Tasks* of the system development project, which allows complying with the project's *Objectives* in the expected quality, time and costs.

This part of ISO/IEC 29110 is intended to be used by the VSE to establish processes to implement any development approach or methodology including, e.g. agile, evolutionary, incremental, test driven development, etc. based on the VSE organization or project needs.