INTERNATIONAL STANDARD

ISO/IEC 26556

First edition
2018-11

Information technology — Software and systems engineering — Tools and methods for product line organizational management

Technologies de l'information — Ingénierie des systèmes et du logiciel — Outils et méthodes pour le management organisationnel d'une gamme de produits

Reference number
ISO/IEC 26556:2018(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 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 Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

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

The main purpose of this document is to deal with the capabilities of methods and tools of software and systems product line (SSPL) organizational management. This document defines how the tools and methods can support the software and systems product line-specific organizational management processes. Since product lines deal with multiple products that have similarities, product lines have an unprecedented level of organizational management complexities. This arises from several sources:

— there are inherent differences in organizational considerations because there are parallel development processes (domain and application engineering) in a product line, and the two processes are tightly related with each other around assets;

— the close relationships among domain engineering, application engineering and assets require the highly matured managerial capabilities for addressing the relationships; and

— there is a lack of tools and methods to support the product line-specific organizational management.

Organizational management addresses the orchestration of the product line organization. Introduction and institutionalization of the product line strategy in an organization requires ongoing preparation, planning, execution and improvement efforts. Organizational management provides planning, monitoring and control, and management for product line adoption, transition, operations, evolution and organizational value achievement such as reusability, reducing cost and improving quality.

There are needs for defining product line-specific organizational management processes that integrate the involved product line disciplines with those for a single product. Furthermore, support of tools and methods are required so that a product line organization can perform organizational management under the systematic control of complexities. This document addresses the product line-specific processes in organizational management by dividing those into *organizational-level product line planning, organizational product line enabling, and organizational product line management* areas with the guidance of a set of tools and methods capabilities for supporting tasks for product line organizational management.

This document is intended to benefit people who acquire, supply, develop, operate and maintain tools and methods for product line organizational management. This document can be used in one or more of the following modes:

— by an organization intended to implement product lines — to understand, adopt and enact the processes, tools and methods for product line organizational management. This also helps the organization to evaluate and select relevant tools and methods based on business and user-related criteria; and

— by a tool vendor who facilitates or leverages product line engineering practices — to provide a set of tool capabilities that should be embodied in a tool for supporting product line organizational management.

The ISO/IEC 26550 family of standards addresses both engineering and management processes and capabilities of methods and tools in terms of the key characteristics of product line development. This document provides processes and capabilities of methods and tools for product line realization. Other ISO/IEC 26550 family of standards are as follows: ISO/IEC 26550, ISO/IEC 26551, ISO/IEC 26555, ISO/IEC 26557, ISO/IEC 26558 and ISO/IEC 26559 are published. ISO/IEC 26552, ISO/IEC 26553, ISO/IEC 26554, ISO/IEC 26560, ISO/IEC 26561, ISO/IEC 26562 and ISO/IEC 26563 are planned International Standards. The following list provides an overview of the family:

— processes and capabilities of methods and tools for domain requirements engineering and application requirements engineering are provided in ISO/IEC 26551;

— processes and capabilities of methods and tools for domain design and application design are provided in ISO/IEC 26552;

— processes and capabilities of methods and tools for domain realization and application realization are provided in ISO/IEC 26553;

— processes and capabilities of methods and tools for domain testing and application testing are provided in ISO/IEC 26554;

— processes and capabilities of methods and tools for technical management are provided in ISO/IEC 26555;

— processes and capabilities of methods and tools for variability mechanisms are provided in ISO/IEC 26557;

— processes and capabilities of methods and tools for variability modelling are provided in ISO/IEC 26558;

— processes and capabilities of methods and tools for variability traceability are provided in ISO/IEC 26559;

— processes and capabilities of methods and tools for product management are provided in ISO/IEC 26560;

— processes and capabilities of methods and tools for technical probe are provided in ISO/IEC 26561;

— processes and capabilities of methods and tools for transition management are provided in ISO/IEC 26562;

— processes and capabilities of methods and tools for configuration management of asset are provided in ISO/IEC 26563; and

— others (ISO/IEC 26564 to ISO/IEC 26599) are to be developed.

Information technology — Software and systems engineering — Tools and methods for product line organizational management

1 Scope

This document, within the methods and tools of organizational management for software and systems product lines:

— enables the users of this document to holistically understand, adopt and enact the processes, tools and methods for product line organizational management;

— helps the users evaluate and select relevant tools and methods based on business and user-related criteria;

— helps make product line engineers, developers and tool vendors informed about capabilities of tools and methods that are required for supporting product line implementation from organizational aspects; and

— provides product line-specific processes and capabilities of tools and methods in organizational management.

This document concerns processes and capabilities of methods and tools for organizational management for a family of products, not for a single system.

NOTE System Architecture is a set of logical and physical principles used to achieve a mission within a given environment. Components that can be subsystems derived from System Architecture are: software products, human-based products such as crew or operators, or hardware products like mechanical structures, electronic boards and chemicals. The scope of this document spans from the system to subsystems and components. Both hardware-intensive and software-intensive systems are included, if they are part of a product family.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
organizational risk
risks that inhibit the achievement of business values and product line objectives

Note 1 to entry: Risks related to domain asset development or member product development are dealt with in the technical risk management sub process of ISO/IEC 26555.

3.2
product roadmap
timeline with high-level milestones for a product life cycle, particularly the timeline for productive deployment of the product

4 Reference model for product line organizational management

4.1 Overview

Organizational management supports an entire product line effort. Introduction and institutionalization of the product line approach is not a one-step phase, but requires preparation and planning followed by execution and implementation.

The reference model specifies the structure of supporting processes and sub processes for product line organizational management. The reference model for product line organizational management in Figure 1 is structured into three processes, organizational-level product line planning, organizational product line managing and organizational product line enabling. Each process is divided into sub processes and each sub process is described in terms of the following attributes:

— the title of the sub process;

— the purpose of the sub process;

— the inputs to produce the outcomes;

— the tasks to achieve the outcomes;

— the outcomes of the sub process; and

— the capabilities of methods and tools required for performing the tasks effectively and efficiently.

NOTE 1 The process mapping results with ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 of Annex B can be referred to differentiate this document from others.

NOTE 2 When the process, sub process, outcomes and tasks are listed or described in a sentence they are italicized in order to increase their visibility.

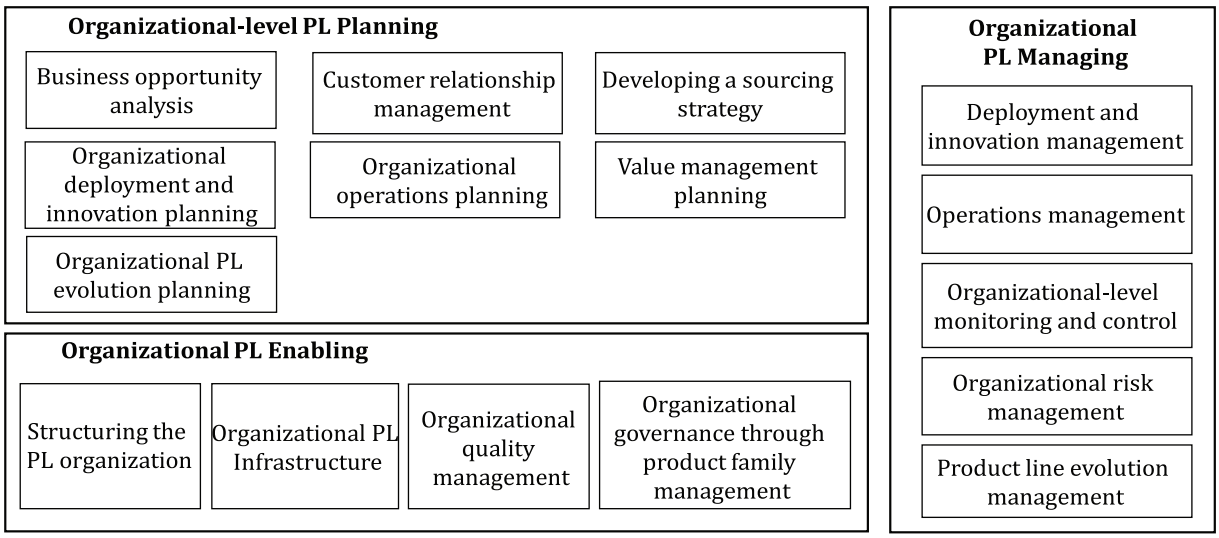

Figure 1 — Product line organizational management reference model

4.2 Organizational-level product line planning

The organizational-level product line planning justifies the effort to adopt the product line approach for developing domain assets and member products, and pertains to strategic or organizational-level planning. This process should analyse the reduced time-to-market, improved product quality, reduced costs and improved productivity achieved by adopting the product line approach. This process should establish schemes for managing the aforementioned aspects of a product line. The organizational-level product line planning shall serve to do the following:

— *Business opportunity analysis in a product line* establishes business opportunity by analysing market trends, customer's preference and technical trends for a family of products.

— *Customer relationship management for a family of products* identifies and helps ensure that customer requests conferring with product management.

— *Developing a sourcing strategy* establishes a general plan for achieving domain assets though outsourcing. Because domain assets should be reused for producing member products, development of outsourced domain assets should also be governed under the strictly defined product line plans. Even their development processes can be managed.

— *Organizational deployment and innovation planning* makes plans for deploying and innovating product line approach. The role of deployment and innovation plan is to establish a capability to populate and nurture a product line. Deployment and innovation plan includes resources (i.e. organization, people and budget) and quantified objectives by stages. This process supports the application of product line approaches. The current situation of an organization and the operating status of a product line are identified and assessed, so that the product line practices meet the individual organization's needs.

— *Organizational operations planning* establishes product line operations plans including resources, schedules, assigned responsibilities and procedure for producing domain assets and reusing them for fielding member products of a product line. Operation plan includes which and how organizational units are involved in production and evolution of a product line and how the organization develops products by using domain assets to develop their products.

— *Value management planning* integrates and manages the progress of deployment and innovation plans and the organizational-level objectives that should be achieved through product lines.

— *Organizational product line evolution planning* establishes plans for evolving a product line in accordance with the market changes such as technologies, competitors and customer preferences. A market analysis is conducted continuously to guide the evolution of a product line by introducing new products into the product line.

NOTE 1 Product family is a group of products.

NOTE 2 Member products are an identification of each product in a product family.

NOTE 3 Product line means systems view of a product family and member products.

4.3 Organizational product line enabling

The organizational product line enabling supports infrastructures required for managing and operating product lines, such as, structuring and training for the product line organization and collaboration management among relevant organization members or organizational units. Organizational product line enabling establishes a structure of authority and responsibilities for the product line and defines the infrastructure and processes required by product line engineering. The organization structures of a product line should be established and maintained before transitioning a product line. Once a product line has been launched, a product line undergoes continuous technological and organizational changes for a product line evolution. Therefore, training is a key process for both the initial time and the long-term evolution of the product line. Product lines demand a great deal of coordination across the boundaries of organizational units because a product line is installed across several organization

units of which roles for producing products within a product line are quite different. The organizational product line enabling shall serve to do the following:

— *Structuring the product line organization* establishes and maintains organizations required for product line deployment, innovation, operation and management. This process establishes and maintains the structure of product line organization such as functional groups of organization units, boundaries among them and inter-organizational unit relationships. This sub process allocates resources and assigns responsibilities to each functional group. Organizational deployments and innovations are also managed to improve organizational operations in accordance with the effectiveness of organization structure.

— *Organizational product line infrastructure* helps ensure that the organizational units responsible for creating, operating and evolving domain assets and member products have proper infrastructure for each work role. Training activities should be coordinated with other activities involved in product line adoption and evolution. The focus of training is on establishing a core competence for creating, populating and evolving domain assets in order to help ensure that the relevant organizational units have proper skills.

— *Organizational quality management* assures that product line organization adheres to the defined product line processes and helps ensure whether the qualities of member products and domain/application assets are maintained against the defined quality criteria from the organizational perspective.

— *Organizational governance through product family management* provides the framework for attaining an organization's goals and objectives of product line engineering and management by employing product family (or line) management since it performs governance responsibilities. Governance responsibilities of product family management include (but are not limited to): market definition of product family, technology scanning, technical probe, product family definition, value management of a product family, organizational deployment and innovation management from legacy system to SSPL, and product family evolution.

4.4 Organizational product line management

The organizational product line management provides managerial support for product line evolution, innovation and risk management for taking actions for internal or external environmental changes. A product line produces multiple products within the same line so the damages due to failure are greater than those of single product development. Thus, the management of the internal and external possible or occurred risks should be carefully performed. Moreover, the product line should continuously evolve in line with the changes on business opportunities, and operations should reflect these changes. Organizational product line management monitors and controls the product lines, defines and maintains a production schedule based on a product line strategy, costs and a budget plan. Organizational product line management also concerns a systematic evolution of an organization from a given state of product line sophistication. The organizational product line managing shall serve to do the following:

— *Deployment and innovation management* establishes plans for operation improvements that should be improved for achieving product line objectives and deploys the plans after pilots if necessary.

— *Operations management* provides managerial support for deploying the operations plan such as: operations plan versus actual implementation, sourcing and inconsistencies in real operations against plan.

— *Organization-level monitoring and control* measures the status of the achievement of product line objectives and takes a corrective action to make a product line organization achieve the established objectives.

— *Organizational risk management* deals with the risks that a software and systems product line organization can face because a product line requires a great deal of effort to coordinate organizational boundaries. Organizational risk management differs from technical risk management in that it manages risks that are possible across multiple organizational units involved in a product line.

— *Product line evolution management* performs evolution in line with organizational product line evolution planning.

The identification and analysis of the key differentiators between single-system engineering and management and product line engineering and management can help organizations to understand the product line and to formulate a strategy for successful implementation of product line engineering and management. The key aspects have been defined in ISO/IEC 26550 and Table 1 shows the category of the key aspects.

NOTE The following aspects have been derived on the basis of the key characteristics of product lines: reuse management, variability management, complexity management and quality management.

Table 1 — Key aspects for identifying product line-specific organizational management tasks

Category	Aspects
Reuse management	application engineering, domain assets, domain engineering, product management, platform, reusability
Variability management	binding, variability
Complexity management	collaboration, configuration, enabling technology support, reference architecture, texture, traceability
Quality management	measurement and tracking, cross functional verification and validation

The following text provides descriptions for each aspect concerning product line organizational management. The product line organizational management-relevant processes and tasks shall be identified on the basis of these aspects. The concerns specific to product line organizational management will enable an organization to understand the product line organizational management relevant processes, sub processes, tasks, methods and tools' capabilities.

— **Application engineering**. Organizational management provides organizational level supports to application engineering such as organization units for application engineering, training for platform reuse, general risk mitigation plans and so on. Most of all member products and their initial features are planned by organization management process.

— **Binding**. Operations guide binding activities for producing each member product.

— **Collaboration**. Collaborations between domain and application organizations are planned and coordinated by organization management process.

— **Configuration**. To cope with the complexity of configuration management in product line enabling environment should be considered at organizational level.

— **Domain asset**. Qualities of domain assets and the overall quality of domain artefacts are managed in organization management.

— **Domain engineering.** Organizational level product line planning and organizational product line managing processes provide main inputs to product line scoping, which is the first step of domain engineering.

— **Enabling technology support.** Technologies for supporting efficient product line evolution, organizational risk management and organizational-level monitoring and control should be supported.

— **Measurement and tracking**. Measures for monitoring and controlling the status of the overall product line progress should be defined.

— **Platform**. Organizational-level plans such as: deployment and innovation plans, product line evolution plans and value management plans can be parts of platforms. Platforms can include organizational level measures and risk mitigation plans.

— **Product management.** Organizational product line evolution planning and product line evolution support product management.

— **Reference architecture**. Along with reference architecture, sourcing strategy is implemented.

— **Reusability**. Reusability should be planned at organizational level, and its achievement should be monitored and controlled from the whole product line organization's perspective.

— **Texture**. Organizational level monitoring and control support monitoring and controlling whether domain architecture, domain realization, domain testing and application realization adhere to rules and constraints defined in architectural texture at the organizational level.

— **Traceability**. Capabilities required for managing traceability are supported by training and human resource management.

— **Cross-functional validation and verification**. Organizational quality management supports validation and verification at the organizational level.

— **Variability**. At the organizational level, product line evolution reflects variability being added or removed.

5 Organizational-level product line planning

5.1 General

Organizational-level product line planning supports the following:

— *Business opportunity analysis*;

— *Customer relationship management*;

— *Developing a sourcing strategy*;

— *Organizational deployment and innovation planning*;

— *Organizational operations planning*;

— *Value management planning*; and

— *Organizational product line evolution planning*.

5.2 Business opportunity analysis

5.2.1 Principal constituents

5.2.1.1 Purpose

The purpose of this sub process is to define business case proposals that consist of analysed market (including segmented customer groups) needs, competitors' environments, technology trends, product line objectives and products roadmap to justify a decision about whether an organization will proceed to product line execution.

NOTE Products in this document include services, systems and solutions.

5.2.1.2 Inputs

The following inputs should be available to perform the business opportunity analysis process:

— organization's business objectives (values);

— market trends;

— competitors' information;

— technical trends; and

— product information of target market.

5.2.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the business opportunity analysis process:

— *Market needs definition* is documented.

— *Competitive environments* are documented.

— *Forecasted technology trends* are documented.

— *Product line objectives (business values and measurable goals)* are specified.

— *Product roadmap definition* is produced.

— *Benefits, funding, potential risks, and measure of success of a product line* are defined.

— *Business case proposal* is developed.

— *Business case plan* is documented.

5.2.1.4 Tasks

The organization shall implement the following tasks with respect to the business opportunity analysis process:

— *Analyse market needs*: analyse target markets in order to place market-satisfiable products into a product line.

— *Examine competitive environments*: observe competitors' activity (including their strengths) to compose a product line with more competitive products.

— *Forecast technology trends*: explore emerging and future technologies with their growth and trend curves for composing a product line with products including future functions.

— *Establish product line objectives*: define main business objectives that initiate a product line adoption and evolution.

— *Define product roadmap*: outline the scope for domain requirements engineering.

— *Estimate benefits, funding and potential risks*: analyse benefits, funds and potential risks expected when a product line has been initiated as defined.

— *Quantify the measure of success*: define the quantitative success indicators.

— *Document a business case proposal*: document and maintain a business case proposal including the results of all of the above for initiating a product line.

5.2.2 Analyse market needs

The goal of this task is to analyse target market for the success of a product line in the marketplace.

The method should support analysing market needs with the following capabilities:

— collecting market data such as the latest trends in the market, general buying habits, changing technologies and so on for the candidate product members of a product line;

— balancing life cycle stages for the candidate product members of a product line;

— evaluating situations (e.g. strengths, opportunities, weaknesses and threats) for the candidate product members of a product line in the marketplace; and

— defining market needs from the summation of the results of the above activities.

A tool should support analysing market needs by allowing the user to do the following:

— access market data obtained from multiple sources for the candidate product members of a product line;

— analyse life cycle stages for the candidate product members of a product line;

— perform situation analysis for the candidate product members of a product line;

— utilize guides (e.g. worksheet) for proceeding analysis;

— visualize the analysis results; and

— document the market needs definition.

5.2.3 Examine competitive environments

The goal of this task is to observe direct and indirect competitors' activity for the success of a product line in the competitive environments.

The method should support examining competitive environments with the following capabilities:

— defining direct and indirect competitors for the candidate product members of a product line;

— analysing competitive position in the target market for the candidate product members of a product line;

— identifying competitive vulnerabilities for the candidate product members of a product line; and

— defining competitive environments that a product line will target.

A tool should support examining competitive environments by allowing the user to do the following:

— access competitive environments from multiple sources for the candidate product members of a product line;

— utilize input and collaboration environments for the analysis of competitive position and competitive vulnerabilities;

— refer guides (e.g. worksheet) for proceeding analysis;

— visualize the analysis results; and

— document the competitive environments.

5.2.4 Forecast technology trends

The goal of this task is to explore emerging and future technologies with their growth and trend curves in order to decide member products of a product line.

The method should support forecasting technology trends with the following capabilities:

— allowing access of emerging and future technologies for the candidate product members of a product line;

— assigning forecasted technologies to each candidate product member with their predicted life cycle; and

— analysing technological differences among product members (e.g. cannibalization analysis).

A tool should support forecasting technology trends by allowing the user to do the following:

— visualize technology trends for the candidate product members of a product line; and

— document technology trends.

5.2.5 Establish product line objectives

The goal of this task is to define main business objectives for product line initiatives.

The method should support establishing product line objectives with the following capabilities:

— understanding organization's product line initiatives;

— integrating market needs, competitive environments and technology trends; and

— validating the feasibility of defined product line objectives.

A tool should support establishing product line objectives by allowing the user to do the following:

— utilize input and collaboration environments for defining product line objectives.

5.2.6 Define product roadmap

The goal of this task is to outline the scope of a product line that will be delivered to domain requirements engineering.

The method should support defining a product roadmap with the following capabilities:

— screening products that will be included into a product line;

— developing, rating and choosing new ideas for products;

— analysing product interdependencies of member products within a product line;

— exploring assets for the screened and future products; and

— defining product offerings for current, near future, mid-term future and long-term future.

A tool should support defining product roadmap by allowing the user to do the following:

— access the existing products and their information; and

— document a product roadmap.

5.2.7 Estimate benefits, funding and potential risks

The goal of this task is to analyse expected benefits, potential risks and required funds to finalize a product roadmap.

The method should support estimating benefits, funding and potential risks with the following capabilities:

— analysing (expected) product life cycle stages for candidate member products of a product line;

— analysing assets that serve as a basis for estimating benefits, potential risks and required funds (assets will used as a basis for deriving domain requirements);

— estimating benefits and potential risks based on the defined product roadmap; and

— balancing and adapting the product roadmap.

A tool should support estimating benefits, funding and potential risks by allowing the user to do the following:

— access product information (e.g. current life cycle stage, relevant assets, sales and profit, etc.);

— visualize (predicted) product life cycle stages for candidate member products of a product line;

— calculate and integrate benefits, potential risks, etc.; and

— manage version or history of the product roadmap.

5.2.8 Quantify the measure of success

The goal of this task is to define the quantitative values of measures for judging success or failure.

The method should support quantifying the measure of success with the following capabilities:

— analysing potentials of a product line organization; and

— deriving the objective values of measures based on estimated benefits, potential risks and required funds (e.g. success criteria), used for judging the achievement of business objectives.

A tool should support quantifying the measure of success by allowing the user to do the following:

— access a product line organization’s potentials.

5.2.9 Document the business case proposal

The goal of this task is to document and maintain a business case proposal including the results of all of the above for initiating a product line. The business case proposal includes final adjustments and how to proceed to execution.

The method should support documenting the business case proposal with the following capabilities:

— providing a documentation template for the business case proposal;

— defining ways to execute the business case proposal; and

— adjusting the results of all of the above for initiating a product line.

A tool should support documenting the business case proposal by allowing the user to do the following:

— document the business case proposal; and

— share the business case proposal with the relevant organization units and participants.

5.3 Customer relationship management

5.3.1 Principal constituents

5.3.1.1 Purpose

The purpose of this sub process is to establish communication mechanism and thereafter collect customer requests and inform the requests to product line management for revising a product line.

5.3.1.2 Inputs

The following inputs should be available to perform the customer relationship management process:

— customer requests related to member products and their features within a product line; and

— business strategies of a product line organization.

5.3.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the customer relationship management process:

— *Communication mechanism with the customers* is defined.

— *Product line level solutions for customer requests* are defined.

— *Customer relationship management plan* is documented.

NOTE Customers in product line operations include the groups of representatives end users who use prefabricated mass products, an individual customer who uses a specific product or service or an individualized product or service, marketers, domain experts and product managers.

5.3.1.4 Tasks

The organization shall implement the following tasks with respect to the customer relationship management process:

— *Identify one or more interest groups of the customer*: categorize customer groups in accordance with their interests in product line.

— *Implement integrated communication mechanism at the product line level*: establish customer interfaces for supporting communication with customer groups.

— *Aggregate customer requests for product management and scoping*: collect requests from customer representatives so as to define or improve the scope of a product line.

— *Maintain and evolve customer relationships from a product line perspective*: make plans to improve customer relationship supports in accordance with feedback from the current and changed customer relationships.

— *Establish mutually beneficial long-term relationships*: establish and maintain plans for ensuring sustainable customer relationships by providing flexible and timely products with growing quality.

— *Document the customer relationship management plan*: specify the defined customer groups, their representatives (customer interfaces), interrelations, communication channels and management plans for all of them.

5.3.2 Identify one or more interest groups of the customer

The goal of this task is to classify customer groups for analysing customers' needs so as to determine added or deleted member products of a product line.

The method should support identifying one or more interest groups of the customer with the following capabilities:

— classifying groups of customers for a product line; and

— defining interrelations between the classified customer groups.

A tool should support identifying one or more interest groups of the customer by allowing the user to do the following:

— access information such as customers and product line organization units with their roles and responsibilities.

5.3.3 Implement integrated communication mechanism at the product line level

The goal of this task is to establish customer interfaces for communicating among a product line organization and customer representatives.

The method should support implementing an integrated communication mechanism at the product line level with the following capabilities:

— defining customer representatives for collecting customer requests (in a product line it is impossible to define the various customer products in advance, so customer representatives are those people or units who represent a particular interest of customers such as marketers, domain experts or customer relationship managers who interact with product users);

— defining interrelations among customer representatives; and

— designing communication channels with (among) customer representatives.

A tool should support implementing integrated communication mechanism at the product line level by allowing the user to do the following:

— utilize one-to-one, one-to-many or many-to-many communication channels among customer representatives.

5.3.4 Aggregate customer requests for product management and scoping

The goal of this task is to collect the request of customer representatives and thereafter to determine whether the requests of customer representatives will be included in the scope of a product line.

The method should support aggregating customer requests for product management and scoping with the following capabilities:

— negotiating with person in charge of product management about the requests of customer representatives;

— determining whether the requests of customer representatives will be included in the scope of a product line (provided in current or future product lines); and

— negotiating with customer representatives about the determination.

A tool should support aggregating customer requests for product management and scoping by allowing the user to do the following:

— utilize a communication board for negotiation; and

— access customer requests to be negotiated.

5.3.5 Maintain and evolve customer relationships from a product line perspective

The goal of this task is to modify customer group classifications and customer interfaces in accordance with changes in market needs, competitors and technical trends related to the product line domain.

The method should support maintaining and evolving customer relationships from a product line perspective with the following capabilities:

— analysing changes in customers for a product line;

— modifying customer group classifications and customer representatives; and

— adapting interrelation among customer representatives.

A tool should support maintaining and evolving customer relationships from a product line perspective by allowing the user to do the following:

— access information about changes in customers for a product line; and

— adapt communication channels among customer representatives.

5.3.6 Establish mutually beneficial long-term relationships

The goal of this task is to establish and maintain customer relationships sustainably by satisfying changing customer needs flexibly and by providing products timely with consistent quality.

The method should support establishing mutually beneficial long-term relationships with the following capabilities:

— establishing a regular channel for sharing information about member products of a product line;

— collecting changing customer needs of a product line;

— tracking whether the quality of member products of a product line satisfies customer needs regularly; and

— tracking whether member products of a product line are fielded with required functions timely.

A tool should support establishing mutually beneficial long-term relationships by allowing the user to do the following:

— establish channels for communicating with customers; and

— access channels for tracking voice of customers about quality and time-to-market satisfaction of member products.

5.3.7 Document the customer relationship management plan

The goal of this task is to document a management plan for the defined customer groups, customer interfaces, interrelations and communication channels.

The method should support documenting the customer relationship management plan with the following capability:

— providing documentation template for the customer relationship management plan.

A tool should support documenting the customer relationship management plan by allowing the user to do the following:

— perform electronic documentation for the customer relationship management plan; and

— share the customer relationship management plan with the relevant organization units and participants.

5.4 Developing a sourcing strategy

5.4.1 Principal constituents

5.4.1.1 Purpose

The purpose of this sub process is to develop an outsourcing strategy mapped flexibly with business strategies of a product line organization.

5.4.1.2 Inputs

The following inputs should be available to perform the developing a sourcing strategy process:

— product line objectives; and

— existing sourcing strategy used in the single system development.

5.4.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the developing a sourcing strategy process:

— *Sourcing strategies* are documented.

5.4.1.4 Tasks

The organization shall implement the following tasks with respect to the developing a sourcing strategy process:

— *Define primitive sourcing strategies*: define sourcing strategies including sourcing procedures, criteria and approaches for making sourcing relevant decisions and management.

— *Account for evolving product line requirements*: check whether sourcing strategies consider evolving requirements.

— *Mandate product line architecture compliance*: align sourcing strategies and the product line architecture.

— *Ensure continuity of support over the life of the product line*: improve sourcing strategies to assure continuous supports for sourcing.

— *Examine ownership and data rights*: check whether sourcing strategies consider ownership and data rights.

— *Analyse alternative contracting approaches*: analyse and determine alternative contracting approaches used when the main contracting approaches cannot be universally applied.

— *Set up evaluation criteria for choosing among competing bidders*: define evaluation criteria for deciding sourcing contractors.

— *Document the sourcing strategies*: document and maintain the sourcing strategies by integrating all of above.

5.4.2 Define primitive sourcing strategies

The goal of this task is to establish sourcing strategies including sourcing procedures, criteria for making sourcing relevant decisions and management for outsourcing and home sourcing.

The method should support defining sourcing strategies with the following capabilities:

— defining sourcing procedures for domain assets;

— defining criteria for sourcing decisions (e.g. selecting contractors) for domain assets;

— defining decision models for sourcing decisions of domain assets;

— defining management supports for outsourcing and home sourcing respectively; and

— aligning sourcing strategies with other product line development stages by considering requisite variations for sourcing in a member product.

A tool should support defining sourcing strategies by allowing the user to do the following:

— access the existing sourcing strategies for single system development;

— perform sourcing strategy definition by building sourcing relevant data especially data related to domain assets;

— make interactive sourcing decisions based on data; and

— document the defined sourcing strategies.

5.4.3 Account for evolving product line requirements

The goal of this task is to check whether domain assets that will be sourced in accordance with sourcing strategies will comply with evolving requirements and align strategies according to the results.

The method should support accounting for evolving requirements with the following capabilities:

— analysing evolving requirements that should be informed to sourcing contracts;

— confirming whether contracts for domain assets that will be sourced reflect evolving requirements;

— aligning contracts to reflect evolving requirements; and

— ensuring whether sourced domain assets evolve in accordance with evolving requirements.

A tool should support accounting for evolving product line requirements by allowing the user to do the following:

— access evolving product line requirements; and

— make decisions related to accounting for evolving product line requirements.

5.4.4 Mandate product line architecture compliance

The goal of this task is to align sourcing strategies in order that domain assets that will be sourced would surely comply with the product line architecture.

The method should support mandating product line architecture compliance with the following capabilities:

— confirming whether interface specifications of the product line architecture are well defined and stable;

— defining criteria (or principles) for confirming compliance with the product line architecture; and

— defining strategic maintenance for the sourced domain assets.

A tool should support mandating product line architecture compliance by allowing the user to do the following:

— access interface specification of the product line architecture; and

— access decision criteria (or principles) for confirming compliance with the product line architecture.

5.4.5 Ensure continuity of support over the life of the product line

The goal of this task is to provide continuous supports for sourced domain assets over the product line lifetime.

The method should support ensuring continuity of support over the life of the product line with the following capabilities:

— defining a contract to regulate continuity of support over the life of the product line;

— providing guides (or criteria) for ensuring continuity of support over the life of the product line; and

— supporting judgement for the support.

A tool should support ensuring continuity of support over the life of the product line by allowing the user to do the following:

— perform (step-by-step) access of guides (or criteria) for ensuring continuity of support over the life of the product line.

5.4.6 Examine ownership and data rights

The goal of this task is to examine ownership and data rights incorporated in products or domain assets sourced and define how the ownership and data rights will be protected.

The method should support examining ownership and data rights with the following capabilities:

— identifying products/services or domain assets sourced that include ownership and data rights;

— classifying types of ownership and data rights (e.g. open source); and

— defining ways to protect ownership and data rights.

A tool should support examining ownership and data rights by allowing the user to do the following:

— access information for products or domain assets sourced.

5.4.7 Analyse alternative contracting approaches

The goal of this task is to analyse and determine alternative contracting approaches used when the main contracting approaches cannot be universally applied.

The method should support analysing alternative contracting approaches with the following capabilities:

— analysing situations where the main contracting approaches cannot be applied;

— defining alternative contracting approaches; and

— evaluating the number of alternative contracting approaches for choosing appropriate one.

A tool should support analysing alternative contracting approaches by allowing the user to do the following:

— visualize paths for the main and alternative contracting approaches.

5.4.8 Set up evaluation criteria for choosing among competing bidders

The goal of this task is to define evaluation criteria for deciding outsourcers.

The method should support setting up evaluation criteria for choosing among competing bidders with the following capabilities:

— defining evaluation criteria used for choosing an outsourcer among competing bidders; and

— supporting judgement for choosing an outsourcer among competing bidders.

A tool should support setting up evaluation criteria for choosing among competing bidders by allowing the user to do the following:

— perform instant access of evaluation criteria; and

— perform sensitive analysis for decisions about choosing competing bidders.

5.4.9 Document the sourcing strategies

The goal of this task is to document and maintain the sourcing strategies.

The method should support documenting the sourcing strategies with the following capabilities:

— providing documentation template for the sourcing strategies; and

— documenting sourcing strategies by putting the outputs of above tasks altogether.

A tool should support documenting the sourcing strategies by allowing the user to do the following:

— document the sourcing strategies; and

— share the sourcing strategies with the relevant organization units and participants.

5.5 Organizational deployment and innovation planning

5.5.1 Principal constituents

5.5.1.1 Purpose

The purpose of this sub process is to establish product line deployment and innovation plans including resources, schedules, assigned responsibilities and quality assurance measures for evolutionary product line deployment and innovation.

5.5.1.2 Inputs

The following inputs should be available to perform the organizational deployment and innovation planning process:

— outcomes of the process management process (ISO/IEC 26555);

— outcomes of the “Business opportunity analysis” sub process; and

— outcomes of the ”Structuring the product line organization” sub process.

5.5.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the organizational deployment and innovation planning process:

— *Product line deployment and innovation plans (plans include resources, work roles, responsibilities)* is documented.

5.5.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational deployment and innovation planning process:

— *Analyse appropriate best practices of product line deployment and innovation*: analyse best practices of product line deployment and innovation approaches for deciding appropriate practices of product line deployment and innovation.

— *Identify organizational capability to nurture a product line*: analyse a product line organization's essential capabilities that should be prepared for initiating a product line.

— *Define procedures for product line deployment and innovation*: define detailed procedures for product line deployment and innovation.

— *Assign roles and responsibilities for product line deployment and innovation*: assign roles and responsibilities for product line deployment and innovation in accordance with the defined product line approach.

— *Specify schedules and resources for product line deployment and innovation*: define schedules and resources needed for product line deployment and innovation.

— *Document the organizational product line deployment and innovation plan*: document and maintain the organizational product line deployment and innovation plan by integrating all of above.

5.5.2 Analyse appropriate best practices of product line deployment and innovation

The goal of this task is to analyse best practices of product line deployment and innovation for identifying organization-specific practices of product line deployment and innovation.

The method should support analysing appropriate best practices of product line deployment and innovation with the following capabilities:

— defining characteristics of a product line organization (e.g. organization's size, product types);

— defining goals to be achieved through the practices; and

— choosing best practices appropriate to the characteristics of a product line organization and to goals to be achieved.

A tool should support analysing appropriate best practices of product line deployment and innovation by allowing the user to do the following:

— access information about a product line organization; and

— manage goals, characteristics and their appropriate practices.

5.5.3 Identify organizational capability to nurture a product line

The goal of this task is to analyse capabilities that a product line organization should have to initiate a product line and be successful.

The method should support identifying organizational capability to nurture a product line with the following capabilities:

— defining perspectives for analysing capabilities required for nurturing a product line (e.g. business, architecture, process, organizational perspectives);

— decomposing capabilities in detail from the defined perspectives; and

— defining required capability level to nurture a product line.

A tool should support identifying organizational capability to nurture a product line by allowing the user to do the following:

— specify capability determination sheet in accordance with the defined perspectives and detailed capabilities for each of them.

5.5.4 Define procedures for product line deployment and innovation

The goal of this task is to define detailed procedures for product line deployment and innovation in accordance with the capability level of a product line organization.

The method should support defining procedures for product line deployment and innovation with the following capabilities:

— tailoring best practices based on the capability level of a product line organization; and

— defining detailed activities and tasks at a level of execution.

A tool should support defining procedures for product line deployment and innovation by allowing the user to do the following:

— document the defined procedures for guiding product line deployment and innovation; and

— share the defined procedures with the appropriate units or participants of a product line organization.

5.5.5 Assign roles and responsibilities for product line deployment and innovation

The goal of this task is to assign roles and responsibilities for product line deployment and innovation based on the defined product line organization structure.

The method should support assigning roles and responsibilities for product line deployment and innovation with the following capabilities:

— defining the main roles of product line deployment and innovation (e.g. pilot project manager and its key participants, representative interfaces of existing products) and their broad responsibilities;

— aligning the main roles in accordance with the product line organizational structure and the defined deployment and innovation procedures; and

— assigning the main roles and responsibilities to the appropriate units of the product line organizational structure.

A tool should support assigning roles and responsibilities for product line deployment and innovation by allowing the user to do the following:

— define roles by bringing different views to each role; and

— share the roles and responsibilities with concerned participants.

5.5.6 Specify schedules and resources for product line deployment and innovation

The goal of this task is to establish schedules and resources that should be put and invested into the product line organization for product line deployment and innovation such as the organization, people and budget needed.

The method should support specifying schedules and resources for product line deployment and innovation with the following capabilities:

— understanding the organization's capability, procedures and roles/responsibilities to nurture the product line in order to take the best decisions for product line deployment and innovation schedules and resources;

— aligning possible resources with those needed; and

— defining schedules and resources that will be put in place and invested.

A tool should support specifying schedules and resources for product line deployment and innovation by allowing the user to do the following:

— refer information about the organization's capability, procedures and roles/responsibilities to nurture the product line;

— access an organization's possible resources; and

— specify schedules and resources that will be in place and invested.

5.5.7 Document the organizational product line deployment and innovation plan

The goal of this task is to produce and maintain a document for the product line deployment and innovation plan.

The method should support documenting the organizational product line deployment and innovation plan with the following capability:

— providing a documentation template for the organizational product line deployment and innovation plan.

A tool should support documenting the organizational product line deployment and innovation plan by allowing the user to do the following:

— document the organizational product line deployment and innovation plan; and

— share the organizational product line deployment and innovation plan with the relevant organization units and participants.

5.6 Organizational operations planning

5.6.1 Principal constituents

5.6.1.1 Purpose

The purpose of this sub process is to establish plans for producing domain assets and thereafter for fielding member products by reusing domain assets and by developing member product-specific features.

5.6.1.2 Inputs

The following inputs should be available to perform the organizational operations planning process:

— product line deployment and innovation plans;

— best practices for product line deployment and innovation;

— outcomes of the process management process (see ISO/IEC 26555);

— outcomes of the “Business opportunity analysis” sub process; and

— outcomes of the “Structuring the product line organization” sub process.

5.6.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the organizational deployment and innovation planning process:

— *Product line operation plans (plans include resources, work roles, responsibilities, quality assurance measures)* are documented.

5.6.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational operations planning process:

— *Establish organizational operations policy*: define policy for producing and evolving domain assets and member products.

— *Analyse organizational operations needs to produce domain asset and products*: define operations needs required to produce domain assets and member products.

— *Define procedures for organizational operations*: define detailed procedures for producing and evolving domain assets and member products.

— *Assign roles and responsibilities for product line operations*: assign roles and responsibilities for product line operations.

— *Specify schedules and resources for product line operations*: define schedules and required resources for product line operations.

— *Specify how to monitor, measure and control product line operations*: define plans for monitoring and measuring the effectiveness of product line operations.

— *Specify how to coordinate with product line process improvement roles*: define plans for coordinating operations with product line process improvement leads.

— *Document the organizational product line operations plan*: document and maintain the organizational operations plan.

5.6.2 Establish organizational operations policy

The goal of this task is to define how and which organization units produce and evolve domain assets based on objectives of product line adoption.

The method should support establishing organizational operations policy with the following capabilities:

— making explicit the universal values of a product line in the policy so that domain and application engineers conduct their operations under good governance and common understanding;

— defining guidelines for resolving conflicts between domain engineers and application engineers;

— making operations policy flexible so that domain and application operations facilitate their decentralized works based on common assets and outsourcing; and

— providing product line operations policy template.

A tool should support establishing organizational operations policy by allowing the user to do the following:

— document the product line operations policy; and

— share product line operations policy with participants.

5.6.3 Analyse organizational operations needs to produce domain asset and products

The goal of this task is to figure out needs from the operations perspective required to produce domain assets and member products by reusing them.

The method should support analysing organizational operations needs to produce domain asset and products with the following capabilities:

— defining necessities required for populating, nurturing and evolving domain assets so that domain engineers can carry out their work correctly;

— defining necessities required for fielding member products based on domain assets; and

— identifying necessities required for serving common understanding among domain and application engineers.

A tool should support analysing organizational operations needs to produce domain asset and products by allowing the user to do the following:

— document the analysed organizational operations needs.

5.6.4 Define procedures for organizational operations

The goal of this task is to define detailed procedures for organizational operations in accordance with the organizational operations policy and needs.

The method should support defining procedures for organizational operations with the following capabilities:

— tailoring best practices in accordance with the organizational operations policy and needs; and

— defining detailed activities and tasks at a level of execution.

A tool should support defining procedures for organizational operations by allowing the user to do the following:

— document the defined procedures for guiding operations; and

— share the defined procedures with the appropriate units or participants of a product line organization.

5.6.5 Assign roles and responsibilities for product line operations

The goal of this task is to assign roles and responsibilities for product line operations in accordance with the defined operations policy, procedures and product line organizational structure.

The method should support assigning roles and responsibilities for product line operations with the following capabilities:

— defining the main roles of product line operations (e.g. domain asset owner, domain functional architect) and their broad responsibilities;

— aligning the main roles in accordance with the product line organizational structure and the defined operations procedures; and

— assigning the main roles and responsibilities to the appropriate units of the product line organizational structure.

A tool should support assigning roles and responsibilities for product line operations by allowing the user to do the following:

— define roles by bringing different views for each role; and

— share the roles and responsibilities with concerned participants.

5.6.6 Specify schedules and resources for product line operations

The goal of this task is to establish schedules and resources that should be put in place and invested into the product line organization for product line operations such as the organization, people, tools and the budget needed.

The method should support specifying schedules and resources for product line operations with the following capabilities:

— understanding the organization's capability, procedures and roles/responsibilities for product line operations in order to take the best decisions for product line operation schedules and resources;

— aligning possible resources with those needed; and

— defining schedules and resources that will be put in place and invested.

A tool should support specifying schedules and resources for product line operations by allowing the user to do the following:

— refer information about the organization's capability, procedures and roles/responsibilities for product line operations;

— access an organization's possible resources; and

— specify schedules and resources that will be put in place and invested.

5.6.7 Specify how to monitor, measure and control product line operations

The goal of this task is to monitor and measure the effectiveness of product line operations and thereafter to define required control actions to improve operations.

The method should support specifying how to monitor, measure and control product line operations with the following capabilities:

— identifying success factors of product line operations;

— defining measures for determining the success degrees of product line operations;

— determining success degrees based on the values of measures (defining functions based on measures for determining the success degrees of product line operations);

— specifying how to report the effectiveness of operations based on the monitored results; and

— defining required control actions to improve product line operations.

A tool should support specifying how to monitor, measure and control product line operations by allowing the user to do the following:

— collect data relevant to measures;

— perform automatic calculation for the values of the defined functions;

— utilize (web-based) report board supporting for the defined ways to report the effectiveness of operations; and

— share control actions with relevant participants.

5.6.8 Specify how to coordinate with product line process improvement roles

The goal of this task is to grasp how to improve operations so those improvements are coordinated with product line process improvements.

The method should support specifying how to coordinate with product line process improvement roles with the following capabilities:

— identifying conflicts between control actions for product line operations and product line process improvement;

— determining whether operations require process improvement for enhancing their effectiveness; and

— defining the ways to coordinate operations with product line process improvement roles.

A tool should support specifying how to coordinate with product line process improvement roles by allowing the user to do the following:

— access control actions that will be taken; and

— specify the ways to coordinate with product line process improvement roles.

5.6.9 Document the organizational operations plan

The goal of this task is to produce a document for the organizational operations plan.

The method should support documenting the organizational operations plan with the following capability:

— providing documentation template for the organizational operations plan.

A tool should support documenting the organizational operations plan by allowing the user to do the following:

— document the organizational operations plan; and

— share the organizational operations plan with the relevant organization units and participants.

5.7 Value management planning

5.7.1 Principal constituents

5.7.1.1 Purpose

The purpose of this sub process is to establish value management plans including resources, schedules, assigned responsibilities and quality assurance measures for value management activities.

5.7.1.2 Inputs

The following inputs should be available to perform the value management planning process:

— organization's business objectives;

— product line objectives (defined business values and their measurable goals assumed to be achieved through the product line); and

— quality measures and their measured values defined and collected in other sub processes.

5.7.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the value management planning process:

— *Measurably defined values achieved through the product line* are obtained.

— *Plans for value management* are documented.

— *Measures for value achievement degree* are defined.

5.7.1.4 Tasks

The organization shall implement the following tasks with respect to the value management planning process:

— *Analyse measurable values achievable through the product line adoption*: decide quantitative values that should be achieved through the product line.

— *Define measures and metrics for value management*: derive measures and metrics for quantitative value management.

— *Define procedures for value management*: define detailed procedures for value management.

— *Assign roles and responsibilities for value management*: assign roles and responsibilities for value management.

— *Specify schedules and resources for value management*: define schedules and resources required for value management.

— *Document the value management plan*: document and maintain the value management plan by integrating all of the above.

5.7.2 Analyse measurable values achievable through the product line adoption

The goal of this task is to define the universal values achieved through the product line.

The method should support analysing measurable values achievable through the product line adoption with the following capabilities:

— capturing values harmonized well with organizational business values; and

— making values measurable (e.g. by decomposing them into lower levels).

A tool should support analysing measurable values achievable through the product line adoption by allowing the user to do the following:

— access organizational business values;

— document and share the defined measureable values; and

— make the defined measureable values explicit to all concerned participants.

5.7.3 Define measures and metrics for value management

The goal of this task is to derive measures and metrics that will be used to determine whether the values are achieved or not through the product line adoption.

The method should support defining measures and metrics for value management with the following capabilities:

— deriving measures and their metrics from the defined measurable values;

— defining characteristic functions that will be used to judge whether the values are achieved or not through the product line adoption; and

— assigning measures to relevant operations roles.

A tool should support defining measures and metrics for value management by allowing the user to do the following:

— share measures with relevant operational roles.

5.7.4 Define procedures for value management

The goal of this task is to define detailed procedures for value management in accordance with the defined measurable values and their measures/metrics.

The method should support defining procedures for value management with the following capabilities:

— tailoring best practices in accordance with the defined measurable values and their measures and metrics; and

— defining detailed activities and tasks at a level of execution.

A tool should support defining procedures for value management by allowing the user to do the following:

— document the defined procedures for guiding operations; and

— share the defined procedures with the appropriate units or participants of a product line organization.

5.7.5 Assign roles and responsibilities for value management

The goal of this task is to assign roles and responsibilities for value management in accordance with the defined measurable values, their measures/metrics and product line organizational structure.

The method should support assigning roles and responsibilities for value management with the following capabilities:

— defining the main roles for value management (e.g. management level such as senior level, unit level) and their broad responsibilities;

— aligning the main roles in accordance with the product line organizational structure and the defined value management procedures; and

— assigning the main roles and responsibilities to the appropriate units of the product line organizational structure.

A tool should support assigning roles and responsibilities value management by allowing the user to do the following:

— define roles by bringing different views to each role; and

— share the roles and responsibilities with concerned participants.

5.7.6 Specify schedules and resources for value management

The goal of this task is to establish schedules and resources that should be put in place and invested into the product line organization for value management such as the organization, people and the budget needed.

The method should support specifying schedules and resources for value management with the following capabilities:

— understanding the organization's capability, procedures and roles/responsibilities for value management in order to make the best decisions for product line value management schedules and resources;

— aligning possible resources with those needed; and

— defining schedules and resources that will be put in place and invested.

A tool should support specifying schedules and resources for value management by allowing the user to do the following:

— describe information about the organization's capability, procedures and roles/responsibilities for value management;

— access an organization's possible resources; and

— specify schedules and resources that will be put in place and invested.

5.7.7 Document the value management plan

The goal of this task is to document and maintain the value management plan.

The method should support documenting the value management plan with the following capability:

— providing documentation template for the value management plan.

A tool should support documenting the value management plan by allowing the user to do the following:

— document the value management plan; and

— share the value management plan with the relevant organization units and participants.

5.8 Organizational product line evolution planning

5.8.1 Principal constituents Purpose

5.8.1.1 General

The purpose of this sub process is to establish product line evolution plans including resources, schedules, assigned responsibilities and quality assurance measures for product line evolution.

5.8.1.2 Inputs

The following inputs should be available to perform the organizational product line evolution planning process:

— plans for product line deployment and innovation;

— product line deployment and innovation results; and

— status and changing trends of customer needs, key competitors, technology and other market environments.

5.8.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the organizational product line evolution planning process:

— *Plans for product line evolution* are documented.

5.8.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational product line evolution planning process:

— *Analyse changing trends of market and technology*: predict changing directions of market and technology to determine directions of product line evolution.

— *Identify organizational capabilities for product line evolution*: define essential capabilities that should be in place for continuous product line evolution.

— *Define procedures for product line evolution*: define detailed procedures for product line evolution.

— *Assign roles and responsibilities for product line evolution*: assign roles and responsibilities for product line evolution.

— *Specify schedules and resources for product line evolution*: establish schedules and resources required for product line evolution.

— *Document the organizational product line evolution plan*: document and maintain the organizational product line evolution plan.

5.8.2 Analyse changing trends of market and technology

The goal of this task is to predict directions of market and technology based on their previous and current changing trends.

The method should support analysing changing trends of market and technology with the following capabilities:

— defining major factors that determine the shape of market trends for current and future member products of a product line;

— defining major factors that determine the shape of technical trends for current and future member products of a product line;

— analysing the shape of market trends for current and future member products of a product line;

— analysing the shape of technical trends for current and future member products of a product line; and

— determining directions of market and technology current and future member products of a product line.

A tool should support analysing changing trends of market and technology by allowing the user to do the following:

— visualize the shape of market trends;

— visualize the shape of technical trends; and

— perform sensitive analysis for decision-making about directions of market and technology.

5.8.3 Identify organizational capabilities for product line evolution

The goal of this task is to analyse a product line organization's essential capabilities that should be prepared for continuous evolution of a product line.

The method should support identifying organizational capabilities for product line evolution with the following capabilities:

— defining perspectives for analysing capabilities required for product line evolution (e.g. business, architecture, process, organizational perspectives);

— decomposing capabilities in detail from the defined perspectives; and

— defining required capability level to proceed with product line evolution.

A tool should support identifying organizational capabilities for product line evolution by allowing the user to do the following:

— provide the capability determination sheets that reflect defined perspectives and detailed capabilities for each of them.

5.8.4 Define procedures for product line evolution

The goal of this task is to define detailed procedures for product line evolution in accordance with the assessed capability level of a product line organization.

The method should support defining procedures for product line evolution with the following capabilities:

— tailoring best practices in accordance with the assessed capability level of a product line organization; and

— defining detailed activities and tasks up to the level of execution.

A tool should support defining procedures for product line evolution by allowing the user to do the following:

— document the defined procedures for guiding product line evolution; and

— share the defined procedures with the appropriate units or participants of a product line organization.

5.8.5 Assign roles and responsibilities for product line evolution

The goal of this task is to assign roles and responsibilities for product line evolution in accordance with the defined product line organization structure.

The method should support assigning roles and responsibilities for product line evolution with the following capabilities:

— defining the main roles for product line evolution (e.g. domain and member product manager and key participants, representative interfaces of existing products) and their broad responsibilities;

— aligning the main roles in accordance with the product line organizational structure and the defined evolution procedures; and

— assigning the main roles and responsibilities to the appropriate units of the product line organizational structure.

A tool should support assigning roles and responsibilities for product line evolution by allowing the user to do the following:

— define roles by bringing different views to each role; and

— share the roles and responsibilities with concerned participants.

5.8.6 Specify schedules and resources for product line evolution

The goal of this task is to establish schedules and resources that should be put in place and invested into the product line organization for product line evolution, such as: the organization, people and the budget needed.

The method should support specifying schedules and resources for product line evolution with the following capabilities:

— understanding the organization's capability, procedures and roles/responsibilities for product line evolution in order to make the best decisions for product line evolution schedules and resources;

— aligning possible resources with those needed; and

— defining schedules and resources that will be put in place and invested.

A tool should support specifying schedules and resources for product line evolution by allowing the user to do the following:

— describing information about the organization's capability, procedures and roles and responsibilities for product line evolution;

— allowing access to an organization's possible resources; and

— supporting specification for schedules and resources that will be put in place and invested.

5.8.7 Document the organizational product line evolution plan

The goal of this task is to document and maintain the organizational product line evolution plan.

The method should support documenting the organizational product line evolution plan with the following capability:

— providing documentation template for the organizational product line evolution plan.

A tool should support documenting the organizational product line evolution plan by allowing the user to do the following:

— document the organizational product line evolution plan; and

— share the organizational product line evolution plan with the relevant organization units and participants.

6 Organizational product line enabling

6.1 General

Organizational product line enabling supports the following:

— *Structuring the product line organization*;

— *Organizational product line infrastructure*;

— *Organizational quality management*; and

— *Organizational governance through product family management*.

6.2 Structuring the product line organization

6.2.1 Principal constituents

6.2.1.1 Purpose

The purpose of this sub process is to establish and maintain organizations required for product line transition, deployment, operation and management.

6.2.1.2 Inputs

The following inputs should be available to perform the structuring of the product line organization process:

— organizational charter and boundaries for single software and systems development and management;

— work roles and responsibilities concerned with single software and systems development and management; and

— plans established at the product line organization.

6.2.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the structuring of the product line organization process:

— *Organizational charter and boundaries for product line engineering and management* are defined.

— *Work roles, responsibilities and required resources concerned with product line engineering and management* are designed and assigned.

— *Inter-organizational relationships and communication channels* are established.

NOTE 1 Refer to Annex A for an example of a product line organizational structure.

6.2.1.4 Tasks

The organization shall implement the following tasks with respect to the structuring of the product line organization process:

— *Define responsibilities for decision making in a product line*: establish a decision board with properly assigned responsibilities and authority for making correct decisions in a product line organization.

— *Structure the product line organization charter and boundaries*: structure a product line organization that suits the defined roles and responsibilities.

— *Assign roles, responsibilities and resources to the defined product line organization structure*: assign roles and responsibilities with required resources to the defined organizational structure.

— *Manage product line organization structure*: maintain and improve the product line organization structure.

— *Monitor product line organization effectiveness*: monitor whether organization structure is designed to achieve product line objectives with high effectiveness and efficiency.

— *Improve product line organization structure*: take corrective actions to resolve identified inconsistencies and obstacles when the origins of these problems are due to organizational structure.

6.2.2 Define responsibilities for decision-making in a product line

The goal of this task is to establish a decision board with assigned responsibilities and proper authority to make certain decisions and also to ensure the governance of decisions for product line participants.

The method should support defining responsibilities for decision-making in a product line with the following capabilities:

— analysing organizational level-, domain engineering- and application engineering-specific decisions;

— identifying key roles or organizational units related to those analysed decisions;

— defining responsibilities clearly in key roles or organizational units related to decisions; and

— providing ways to clearly express technically comprehensible or economically sound decisions.

A tool should support defining responsibilities for decision making in a product line by allowing the user to do the following:

— utilize a web-based flexible decision platform in accordance with the assigned responsibility and authority of a board member; and

— perform computerized decision process tracing (to record various indicators such as decision strategies used, decision factors and processes and their outcomes at each major decision-making stage (e.g. go/no-go decision at the product line adoption stage, product portfolio or its evolution decision stage).

6.2.3 Structure the product line organizational charter and boundaries

The goal of this task is to structure an organization by reflecting required roles and responsibilities.

The method should support structuring the product line organizational charter and boundaries with the following capabilities:

— analysing internal dependencies between the adjacent stages of domain/application engineering;

— analysing external dependencies between the stages of domain and application engineering;

— defining necessary roles and responsibilities based on responsibilities for decision-making, internal dependencies and external dependencies;

— deciding organizational structure by reflecting required roles, responsibilities and other properties such as motivated personnel, overhead time, etc.; and

— providing an organizational structure template.

A tool should support structuring the product line organizational charter and boundaries by allowing the user to do the following:

— share the organizational structure with teams; and

— create and edit an organizational structure.

6.2.4 Assign roles, responsibilities and resources to the defined organizational structure

The goal of this task is to assign roles, responsibilities and resources to a specific position of the organizational structure.

The method should support assigning roles, responsibilities and resources to the defined organizational structure with the following capabilities:

— determining certain positions of roles and responsibilities in the organizational structure reflecting the existence of both domain and application engineering; and

— establishing relation channels between inter-organization units of a product line.

A tool should support assigning roles, responsibilities and resources to the defined organizational structure by allowing the user to do the following:

— produce a participants' shifting relationship map between the stages of domain and application engineering.

6.2.5 Manage product line organization structure

The goal of this task is to maintain and manage changes in product line organization structure.

The method should support managing product line organization structure with the following capabilities:

— managing changes in responsibilities and their impacts on organizational structure reflecting domain and application engineering; and

— managing changes in relationships due to changes in responsibilities especially changes in relationships between domain and application engineering.

A tool should support managing product line organization structure by allowing the user to do the following:

— perform easy tracing changes on responsibilities in domain and application engineering; and

— perform version management over organization structure changes.

6.2.6 Monitor product line organizational effectiveness

The goal of this task is to monitor whether organizational structure is proper to pursue effective product line organization.

The method should support monitoring product line organizational effectiveness with the following capabilities:

— identifying inconsistencies between the implied responsibilities of an organization unit and the assigned responsibilities; and

— identifying parts of organization structure that reduce the effectiveness of product line works.

A tool should support monitoring product line organizational effectiveness by allowing the user to do the following:

— access the implied responsibilities of an organization unit and the assigned responsibilities; and

— express parts of organization units explicitly that tackle achieving organizational effectiveness.

6.2.7 Improve product line organizational structure

The goal of this task is to take corrective actions to resolve identified inconsistencies and obstacles of the effectiveness of product line works.

The method should support improving product line organization structure with the following capabilities:

— presenting resolutions for removing inconsistencies and obstacles of the effectiveness of product line works; and

— defining improved organizational structure.

A tool should support improving product line organization structure by allowing the user to do the following:

— perform changes on the existing organizational structure; and

— share changed organizational structure with teams.

6.3 Organizational product line infrastructure

6.3.1 Principal constituents

6.3.1.1 Purpose

The purpose of this sub process is to help ensure that the organizational units responsible for creating, operating and evolving domain assets and member products have proper infrastructure for each work role.

6.3.1.2 Inputs

The following inputs should be available to perform the organizational product line infrastructure process:

— defined work roles and responsibilities; and

— required skills and qualification for product line adoption and evolution.

6.3.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the organizational product line infrastructure process:

— *Product line infrastructure establishment plan* is documented.

6.3.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational product line infrastructure process:

— *Identify product line infrastructure needs*: collect infrastructure needs essential to product line transition, development and evolution.

— *Specify schedules and resources required for establishing product line infrastructure*: define schedules and resources for fulfilling the collected product line infrastructure needs.

— *Document product line infrastructure establishment plan*: document and maintain plans in terms of the defined product line infrastructure needs, schedules and resources to be injected.

— *Monitor and assess the effectiveness of product line infrastructure*: monitor and assess whether the collected infrastructure needs are satisfied.

— *Manage product line infrastructure for evolving needs*: deploy and manage product line infrastructures so as to be fully fulfilled the organization's product line evolving needs.

6.3.2 Identify product line infrastructure needs

The goal of this task is to analyse organizational infrastructure needs necessary to proceed with the product line transition, deployment and evolution.

The method should support identifying product line infrastructure needs with the following capabilities:

— analysing requirements for organizational product line infrastructure; and

— analysing the quality level required for proceeding with a product line transition, development and evolution.

A tool should support identifying product line infrastructure needs by allowing the user to do the following:

— access infrastructure needs.

6.3.3 Specify schedules and resources required for establishing product line infrastructure

The goal of this task is to specify schedules and resources for providing required resources such as materials, people and the budget needed.

The method should support specifying schedules and resources required for establishing product line infrastructure with the following capabilities:

— specifying schedules and resources required for infrastructure provision; and

— analysing feasibility of specified schedules and resources.

A tool should support specifying schedules and resources required for establishing product line infrastructure by allowing the user to do the following:

— specify schedules and resources required for infrastructure provision.

6.3.4 Document product line infrastructure establishment plan

The goal of this task is to document and maintain the defined organizational product line infrastructure establishment plan.

The method should support documenting product line infrastructure establishment plan with the following capability:

— providing documentation template for the organizational product line infrastructure plan.

A tool should support documenting product line infrastructure establishment plan by allowing the user to do the following:

— produce documentation for the organizational infrastructure plan; and

— share the organizational infrastructure plan with the relevant organizational units and participants.

6.3.5 Monitor and assess the effectiveness of product line infrastructure

The goal of this task is to monitor and assess whether infrastructure provided satisfy the defined infrastructure needs.

The method should support monitoring and assessing the effectiveness of product line infrastructure with the following capabilities:

— gathering and analysing provided infrastructure and it’s satisfaction level;

— assessing the infrastructure’s objectives; and

— providing ways to evaluate the achievement of infrastructure’s objectives.

A tool should support monitoring and assessing the effectiveness of product line infrastructure by allowing the user to do the following:

— store information for the provided infrastructures and their satisfaction levels; and

— produce documentation for assessment results of the effectiveness of infrastructure.

6.3.6 Manage product line infrastructure for evolving needs

The goal of this task is to manage infrastructure supporting for the evolution of a product line, domain assets and member products.

The method should support managing product line infrastructure for evolving needs with the following capabilities:

— managing changes in infrastructure required for product line transition, development and evolution;

— analysing satisfaction levels of infrastructure for evolving needs; and

— resolving deviations between required and established infrastructure.

A tool should support managing product line infrastructure for evolving needs by allowing the user to do the following:

— perform measurement for satisfaction level of established infrastructure.

6.4 Organizational product line quality management

6.4.1 Principal constituents

6.4.1.1 Purpose

The purpose of this sub process is to assure that product line platform, member products and both domain and application engineering processes meet organizational quality objectives.

6.4.1.2 Inputs

The following inputs should be available to perform the organizational quality management process:

— organizational quality objectives; and

— product line artefacts (i.e. domain assets including organization management artefacts, products, application assets).

6.4.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the organizational quality management process:

— *Organizational product line quality policy* is documented.

— *Organizational product line quality management* is designed.

— *Noncompliance issues* are resolved.

— *The effectiveness of product line quality management* is determined.

6.4.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational quality management process:

— *Establish organizational product line quality management policy*: define quality management policy for product line adoption.

— *Design product line quality management for reuse*: define procedures, responsibilities, authority and quality evaluation criteria required for organizational product line quality management.

— *Perform product line quality evaluation*: gather and analyse quality assurance results in accordance with the designed quality management for reuse.

— *Communicate and ensure resolution of noncompliance issues*: discuss the corrective/preventive actions taken to resolve quality issues.

— *Monitor and assess the effectiveness of quality management*: monitor and assess whether quality management activities support the accomplishment of the defined quality objectives.

— *Coordinate with product line process improvement roles*: work together with product line process improvement roles to achieve quality objectives.

6.4.2 Establish organizational product line quality management policy

The goal of this task is to define quality management policy including quality management objectives based on organizational value proposition and objectives of product line adoption.

The method should support establishing organizational quality management policy with the following capabilities:

— making explicit the objectives of quality management so that quality management roles conduct their operations under good governance and common understanding;

— defining guidelines for resolving conflicts between quality management roles and other domain/application engineering participants; and

— documenting organizational quality management policy with a template.

A tool should support establishing organizational quality management policy by allowing the user to do the following:

— produce documentation for the organizational quality management policy; and

— share organizational quality management policy with participants.

6.4.3 Design product line quality management for reuse

The goal of this task is to define procedures, responsibilities, authority, quality evaluation criteria etc. required for organizational quality management centred on reuse between domain and application engineering.

The method should support designing product line quality management for reuse with the following capabilities:

— defining procedures for organizational quality management that cover domain and application operations discriminately and distinctly;

— assigning responsibilities and necessary authority for implementation of organizational quality management that covers domain and application operations discriminately and distinctly;

— assigning resources for organizational quality management that covers domain and application operations discriminately and distinctly; and

— defining quality evaluation criteria.

A tool should support designing product line quality management for reuse by allowing the user to do the following:

— support documentation for organizational quality management procedures, responsibilities, authorities, resources and evaluation criteria.

6.4.4 Perform product line quality evaluation

The goal of this task is to gather and analyse quality assurance evaluation results in accordance with the designed quality management for reuse.

The method should support performing product line quality evaluation with the following capability:

— providing ways to evaluate the achievement of quality objectives.

A tool should support performing product line quality evaluation by allowing the user to do the following:

— refer to a progress guide for quality evaluation in accordance with the defined quality management procedures;

— record quality assurance evaluation results; and

— engage proper stakeholders from domain or application engineering.

6.4.5 Communicate and ensure resolution of noncompliance issues

The goal of this task is to plan corrective/preventive actions and to monitor those actions to completion.

The method should support communicating and ensuring resolution of noncompliance issues with the following capability:

— informing corrective/preventive actions to relevant stakeholders such as domain and application engineers, product management roles, etc.

A tool should support communicating and ensuring resolution of noncompliance issues by allowing the user to do the following:

— engage proper stakeholders from domain or application engineering.

6.4.6 Monitor and assess the effectiveness of quality management

The goal of this task is to monitor and assess whether quality management satisfies the defined quality management objectives.

The method should support monitoring and assessing the effectiveness of quality management with the following capabilities:

— gathering and analysing performed quality management activities and results;

— assessing quality objectives; and

— providing ways to evaluate the achievement of quality management objectives.

A tool should support monitoring and assessing the effectiveness of quality management by allowing the user to do the following:

— store performed quality management activities and their results; and

— document the assessment results of the effectiveness of quality management.

6.4.7 Coordinate with product line process improvement roles

The goal of this task is to work together with product line process improvement roles based on the findings from quality assessment evaluation.

The method should support coordinating with product line process improvement roles with the following capabilities:

— analysing causes of quality problems related to product line processes among others; and

— finding process improvement items together with product line process improvement roles.

A tool should support coordinating with product line process improvement roles by allowing the user to do the following:

— access analysed quality problems and their relevant processes in domain and application engineering; and

— work together with quality management and product improvement roles.

6.5 Organizational strategy and policy for product family management

6.5.1 Principal constituents

6.5.1.1 Purpose

The purpose of this sub process is to provide the framework for attaining an organization's goals and objectives of product line engineering and management by employing product family (or line) management.

6.5.1.2 Inputs

The following inputs should be available to develop organizational strategy and policy for product family management process:

— market data;

— existing customers;

— existing products; and

— business strategies.

6.5.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the organizational strategy and policy for product family management process:

— *Strategic markets of product family* are defined.

— *Strategic technological trends of product family* are structured.

— *The results of technical probe* are compiled.

— *The values achieved through product line engineering* are assessed and computed.

6.5.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational strategy and policy for product family management process:

— *Define markets of a family of products*: define strategic markets that product line engineering will address and support.

— *Structure product family relevant technology trends*: take into account technical aspects from strategic view impacting the success of product family.

— *Perform technical probe*: assess a product line organization's capabilities based on the assessment framework.

— *Define strategic product family*: define product definition strategy and form the initial product portfolio;

— *Monitor and assess value achievement of a product family*: manage the status of values achieved through a product family;

— *Coordinate with product line transition management roles*: manage the works and status of transition management;

— *Coordinate with product line evolution management roles*: manage the works and status of evolution management; and

— *Manage organization-wide product line engineering*: manage the whole works and status of the product line engineering and management.

6.5.2 Define markets for a family of products

The goal of this task is to produce a market definition for determining member products of a product line.

The method should support defining markets for a family of products with the following capabilities:

— establishing a product definition strategy (e.g. customer-driven and producer-driven) of a product family;

— defining existing and future customers or forming market segments based on the established product definition strategy for a product family;

— categorizing market strategy (e.g. cost leadership, differentiation and focusing) for a product family; and

— defining strategies used to address the defined customers or markets by combining the strategies above.

A tool should support defining markets for a family of products by allowing the user to do the following:

— access market data related to a product family from the strategic point-of-view;

— perform situation analysis based on the defined strategies of a product family;

— coordinate the defined strategies; and

— produce documentation for the defined strategic markets of a product family.

6.5.3 Structure technology trends

The goal of this task is to integrate current and future technologies related to a product family from strategic point-of-view.

The method should support structuring technology trends with the following capabilities:

— analysing current and future technological opportunities related to a product family's aspects from a strategic point-of-view; and

— categorizing the analysed strategic technological opportunities.

A tool should support structuring technology trends by allowing the user to do the following:

— access past and current technology trends for analysing future trends and technological opportunities; and

— produce documentation for the defined strategic technology trends.

6.5.4 Perform technical probe

The goal of this task is to assess a product line organization's capabilities based on the assessment framework and thereafter a product line organization establishes strategic plans for adopting or improving product line engineering. The assessment framework can be defined from the software engineering, technical management and business management dimension or from the business, architecture, process and organization dimension.

The method should support performing the technical probe with the following capabilities:

— collecting and analysing data of a product line organization;

— examining an organization's ability to adopt or improve product line engineering;

— analysing gaps between the required and actual capabilities; and

— reporting findings that characterize the product line organization's strengths and challenges.

A tool should support performing technical probe by allowing the user to do the following:

— access data of a product line organization;

— utilize electrical workbooks for recording examination results of a product line organization; and

— produce a findings report that characterizes the product line organization's strengths and challenges.

6.5.5 Define strategic product family

The goal of this task is to define family members of a product line based on a strategic market definition, strategic technical trends and the results of technical probe.

The method should support defining strategic product family with the following capabilities:

— selecting suitable products for targeting strategic markets;

— removing or adding suitable or unsuitable products for the defined technical trends; and

— evaluating products from a product line organization's capability for adopting or improving product line engineering.

A tool should support defining strategic product family by allowing the user to do the following:

— refer to the defined strategic market definition, strategic technical trends and the results of technical probe; and

— produce documentations for the decided product family.

6.5.6 Monitor and assess value achievement of a product family

The goal of this task is to assess and compute achieved values through the product line engineering.

The method should support monitoring and assessing value achievement of a product family with the following capabilities:

— monitoring value achievement of a product family in accordance with the defined procedures, measures and metrics;

— calculating the value of measures; and

— assessing the achieved values of a product family.

A tool should support monitoring and assessing the value achievement of a product family by allowing the user to do the following:

— manage the status of value achievement by using value management procedures; and

— perform automatic data collection for the computing value achievement of a product line.

6.5.7 Coordinate with deployment and innovation management roles

The goal of this task is to organize deployment and innovation management roles within the governance structure to adopt product line engineering.

The method should support coordinating with deployment and innovation management roles with the following capabilities:

— defining abilities and responsibilities that should be embodied in deployment and innovation management; and

— coordinating the defined deployment and innovation management roles with governance responsibilities.

A tool should support coordinating with deployment and innovation management roles by allowing the user to do the following:

— access a product line organizational structure.

6.5.8 Coordinate with evolution management roles

The goal of this task is to organize evolution management roles within the governance structure to improve product line engineering.

The method should support coordinating with evolution management roles with the following capabilities:

— defining abilities and responsibilities that should be embodied in evolution management; and

— coordinating the defined evolution management roles with governance responsibilities.

A tool should support coordinating with evolution management roles by allowing the user to do the following:

— access a product line organizational structure.

6.5.9 Manage organization-wide product line engineering

The goal of this task is to manage all product line engineering activities and artefacts.

The method should support organization-wide product line engineering and management with the following capabilities:

— defining the management structure for organization-wide product line engineering;

— providing guidance and policies for managing organization-wide product line engineering;

— defining roles and responsibilities for organization-wide product line engineering;

— facilitating collaboration for organization-wide product line engineering; and

— controlling the execution of organization-wide product line engineering.

A tool should support organization-wide product line engineering and management by allowing the user to do the following:

— perform transparent access to information; and

— automate workflows of the defined governance and management structure and collaboration.

7 Organizational product line management

7.1 General

Organizational product line managing supports the following:

— *Product line deployment and innovation management*;

— *Product line operation management*;

— *Product line organizational risk management*;

— *Product line organization-level monitoring and control*; and

— *Product line evolution management*.

7.2 Product line deployment and innovation management

7.2.1 Principal constituents

7.2.1.1 Purpose

The purpose of this sub process is to facilitate the successful implementation of the product line approach through effective assessment, improvement and activation of the product line plans.

7.2.1.2 Inputs

The following inputs should be available to perform the deployment and innovation management process:

— process assessment results (ISO/IEC 26555);

— business (market) environments-relevant practices and artefacts;

— architecture-relevant practices and artefacts; and

— organizational management-relevant practices and artefacts.

7.2.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the deployment and innovation management process:

— *Tailored organizational deployment and innovation plan* is obtained.

— *Pilot results* are obtained.

— *Monitoring results of direction and performance* are obtained.

— *Evaluation results for deployment and innovation* are obtained.

7.2.1.4 Tasks

The organization shall implement the following tasks with respect to the deployment and innovation management process:

— *Tailor the organizational product line deployment and innovation plan*: modify the defined organizational deployment and innovation plan to align the plan with product line organization's readiness.

— *Build an awareness and advocacy for a product line*: define a champion group who leads product line deployment and innovation.

— *Conduct a pilot project for a product line*: perform a pilot for ensuring the feasibilities of product line deployment and innovation.

— *Monitor direction and performance of a product line*: check the directions and performance of product line deployment and innovation.

— *Perform product line tuning and improvement*: align the directions and performance of product line deployment and innovation with plan.

— *Promote product line institutionalization*: encourage product line participants so they continuously use product line practice.

— *Evaluate product line deployment and innovation*: evaluate deployment and innovation results against the tailored deployment and innovation plan.

7.2.2 Tailor the organizational deployment and innovation plan

The goal of this task is to modify a defined organizational product line deployment and innovation plan in alignment with other plans of a product line organization.

The method should support tailoring the organizational deployment and innovation plan with the following capabilities:

— defining product line deployment plan including deployment guide, methods and tools;

— defining product line innovation plan including innovation charter;

— aligning product line deployment and innovation plan with other plans of a product line organization; and

— building and sustaining management commitment for product line deployment and innovation.

A tool should support tailoring the organizational deployment and innovation plan by allowing the user to do the following:

— produce documentation for product line deployment and innovation plans;

— access organizational product line deployment and innovation plan;

— produce documentation for the tailored product line deployment and innovation plan; and

— share commitment and leadership with relevant organizational units.

7.2.3 Build an awareness and advocacy

The goal of this task is to establish a champion group who will perform key roles for deployment and innovation of a product line.

The method should support building an awareness and advocacy with the following capabilities:

— defining awareness and advocacy necessary for deploying and innovating a product line;

— structuring a champion group suitable to define necessities; and

— providing the correct authority.

A tool should support building an awareness and advocacy by allowing the user to do the following:

— perform authorized communication among the champion group members; and

— establish formal communication channels between the champion group and product line participants.

7.2.4 Conduct a pilot project

The goal of this task is to conduct a pilot for ensuring the feasibility of deploying or innovating a product line.

The method should support conducting a pilot project with the following capabilities:

— selecting a pilot project that represents the whole product line and that is enough to confirm the feasibility of deploying or innovating a product line;

— defining plans for conducting a pilot project (a plan for a pilot should include the key contents defined in those plans for a product line);

— defining measures for confirming the feasibility and for predicting returns of a product line from the measurement results;

— monitoring the progress of a pilot project; and

— predicting returns of a product line based on the results of a pilot project (e.g. prediction model).

A tool should support conducting a pilot project by allowing the user to do the following:

— perform data collection for the defined measures;

— visualize the progress of a pilot project; and

— perform automatic prediction based on the values of the predefined measures.

7.2.5 Monitor direction and performance

The goal of this task is to check the progress of a product line, to monitor whether it heads to the correct direction and to check whether its current performance is enough to achieve the established final goals.

The method should support monitoring direction and performance with the following capabilities:

— monitoring the directions of a product line against the established product line goals at the planned time and points; and

— monitoring the performance of a product line against the established product line goals at the planned time and points.

A tool should support monitoring direction and performance by allowing the user to do the following:

— draw a progress and achievement graph for product line goals at the planned time and points.

7.2.6 Perform tuning and improvement

The goal of this task is to take proactive actions for aligning the directions and performances towards achieving the established product line goals.

The method should support performing tuning and improvement with the following capabilities:

— identifying what qualifications are required for a deployment and innovation of a product line;

— analysing deviations from required performance/capability of a product line organization necessary to achieve the established product line goals;

— developing ways to distribute responsibilities and decision-making among separated domain/application engineers to achieve product line goals in a single system development organization;

— defining tuning and improvement activities for achieving the product line goal; and

— defining concepts for the structuring of tuning and improvement activities to achieve the product line goal.

A tool should support performing tuning and improvement by allowing the user to do the following:

— share structured tuning and improvement activities among stakeholders; and

— refer to guides to perform tuning and improvement.

7.2.7 Promote product line institutionalization

The goal of this task is to encourage participants of a product line to be focused and to have confidence that every participant do their best effort to institutionalize the product line approach.

The method should support promoting product line institutionalization with the following capabilities:

— encouraging participants of a product line to contribute their efforts to institutionalize the product line approach;

— setting up reward systems by roles in domain or application engineering;

— allowing common understanding about the deployment and innovation of a product line; and

— clearing up the initiative for the adoption of a product line approach.

A tool should support promoting product line institutionalization by allowing the user to do the following:

— share roles and responsibilities of product line participants so that participants understand well their roles and responsibilities in a product line; and

— make participants of a product line focus and have confidence for their roles and responsibilities in a product line.

7.2.8 Evaluate product line deployment and innovation

The goal of this task is to evaluate product line deployment and innovation results against the transition plan and value management plan.

The method should support evaluating product line deployment and innovation with the following capabilities:

— defining success factors (e.g. process improvement, cost saving, efficiency gains, productivity improvements) to evaluate deployment and innovation in a product line organization;

— measuring the level of institutionalization; and

— analysing tuning and improvement requirements based on evaluation results.

A tool should support evaluating product line deployment and innovation by allowing the user to do the following:

— access records for exploited deployment and innovation toward a product line organization;

— measure the level of product line institutionalization; and

— share evaluation results with tuning and improvement roles.

7.3 Operations management

7.3.1 Principal constituents

7.3.1.1 Purpose

The purpose of this sub process is to support managerial supports on how particular organizational units produce and evolve domain assets, define and evolve the production plans, and use the domain assets and the production plans to field products.

7.3.1.2 Inputs

The following inputs should be available to perform the operations management process:

— product line operations plan (including production plan);

— sourcing strategy; and

— product line organizational structures including shared responsibilities.

NOTE Operations include plans, processes, strategies, policies and constraints that will be carried out by domain engineers and application engineers.

7.3.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the operations management process:

— *Tailored organizational operations plan* is documented.

— *Guidance for shared responsibilities in product line engineering and management* is specified.

— *Inconsistencies between plans and actual status* are identified.

— *Feedback to product line operations planning roles* is informed.

7.3.1.4 Tasks

The organization shall implement the following tasks with respect to the operations management process:

— *Tailor the operations management portion of organizational product line operations plan*: modify the operations plan from a managerial supports perspective.

— *Specify guidance for shared responsibilities in product line engineering and management*: define guidance for shared responsibilities so that redundant managerial activities are reduced and responsibilities can be reassigned.

— *Manage operations against product line operations plan*: provide managerial supports for the correct execution of operations plan.

— *Manage sourcing operations against sourcing strategy*: provide managerial supports for the correct execution of sourcing strategies.

— *Identify inconsistencies between plans and actual status*: identify and resolve inconsistencies between the operations plan and actual execution.

— *Provide appropriate feedback to product line operations planning roles*: provide feedback about how the organization develops domain assets and reuses them for improving the existing operations plan.

7.3.2 Tailor the operations management portion of the organizational operations plan

The goal of this task is to define the detailed plans for the operations management based on the operations management portion of the organizational product line operations plan.

The method should support tailoring the operations management portion of organizational operations plan with the following capabilities:

— understanding operations plan for key operations (i.e. those for developing domain assets, member products, sourcing and so on) of a product line to be managed;

— extracting management portions to be tailored for providing proactive managerial supports to product line operations;

— defining detailed management plans enough to take appropriate managerial actions to product line operations; and

— building and sustaining management commitment for product line operations.

A tool should support tailoring the operations management portion of organizational operations plan by allowing the user to do the following:

— access the organizational operations plan;

— produce documentation for the tailored operations management portion of the organizational operations plan; and

— share commitment and leadership with relevant organizational units.

7.3.3 Specify guidance for shared responsibilities in product line engineering and management

The goal of this task is to define guidance for dealing with problems that can occur because of shared responsibilities such as lead redundant managerial activities or shift responsibilities on each other's shoulder.

The method should support specifying guidance for shared responsibilities in product line engineering and management with the following capabilities:

— extracting types of shared responsibilities in product line engineering and management;

— defining principles to classify the portions of shared responsibilities in product line engineering and management, especially for domain, application and organizational levels of management;

— defining ways to cooperate/coordinate among shared responsibilities to determine correct managerial actions.

A tool should support specifying guidance for shared responsibilities in product line engineering and management by allowing the user to do the following:

— access the organizational product line structure for extracting shared responsibilities; and

— document guidance for shared responsibilities in product line engineering and management.

7.3.4 Manage operations against operations plan

The goal of this task is to provide managerial supports for the correct execution of operational concepts.

The method should support managing operations against operations plan with the following capabilities:

— understanding executed operations for producing domain assets;

— understanding executed operations for reusing domain assets for producing a member product;

— ensuring alignment between approaches or between organizational units for producing domain assets and a member product; and

— maintaining the product line operational concepts.

A tool should support managing operations against the operations plan by allowing the user to do the following:

— access processes, approaches, artefacts and organizational units put into product line operations;

— access the product line operational concepts; and

— manage relations among processes, approaches, artefacts and organizational units.

7.3.5 Manage sourcing operations against sourcing strategy

The goal of this task is to provide managerial supports for the correct execution of sourcing operations in accordance with the defined sourcing strategy.

The method should support managing sourcing operations against sourcing strategy with the following capabilities:

— understanding executed operations for sourcing;

— ensuring alignment between approaches or between organizational units for sourcing; and

— maintaining sourcing operation parts of the product line operational concepts.

A tool should support managing sourcing operations against sourcing strategy by allowing the user to do the following:

— access processes, approaches, artefacts and organizational units put into sourcing operations; and

— access sourcing operation related to the product line operational concepts.

7.3.6 Identify inconsistencies between plans and actual status

The goal of this task is to identify and resolve inconsistencies between the operations plan and actual execution.

The method should support identifying inconsistencies between plans and actual status with the following capabilities:

— identifying inconsistencies in commitment and leadership;

— identifying lack of necessities required for executing product line operations;

— taking corrective actions to resolve identified inconsistencies; and

— identifying required updates on the product line operational concepts.

A tool should support identifying inconsistencies between plans and actual status by allowing the user to do the following:

— access the fulfilment levels of management commitment;

— access the deployed necessities for executing product line operations; and

— share corrective actions to be taken with relevant participants.

7.3.7 Provide appropriate feedback to product line operations planning roles

The goal of this task is to provide feedback about product line operations plan for updating operations plan including product line operation concepts.

The method should support providing appropriate feedback to product line operations planning roles with the following capability:

— summarizing feedback that is provided to product line operations planning roles.

A tool should support providing appropriate feedback to product line operations planning roles by allowing the user to do the following:

— send feedback to appropriate product line operations planning roles; and

— utilize control boards for sharing the status of feedback.

7.4 Organization-level product line monitoring and control

7.4.1 Principal constituents

7.4.1.1 Purpose

The purpose of this sub process is to measure the actual progress of sourcing operations, operations for producing and evolving domain assets and operations for producing products by using domain assets.

7.4.1.2 Inputs

The following inputs should be available to perform the organization-level monitoring and control process:

— product line operations plan;

— actual executions of operations for producing and evolving domain assets;

— actual executions of products production by using domain assets; and

— actual executions of sourcing operations.

7.4.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the organization-level monitoring and control process:

— *Measures for monitoring the operations* are designed.

— *Integration functions for monitoring the shared responsibilities* are designed.

— *Exact points that tackles the achievement of product line objectives* are identified.

— *Corrective actions and their status* are traced.

7.4.1.4 Tasks

The organization shall implement the following tasks with respect to the organization-level monitoring and control process:

— *Tailor the monitoring and control portion of organizational product line operations plan*: modify the monitoring and control portion of operations plan to the next level down.

— *Monitor operations for producing domain asset against planning*: monitor the progress and outcomes of product management and domain engineering relevant operations.

— *Monitor operations for producing member products against planning*: monitor the progress and outcomes of application engineering relevant operations.

— *Monitor sourcing against sourcing strategy*: monitor the progress and outcomes of sourcing operations.

— *Take corrective actions*: take corrective actions to resolve the issues found operations of a product line.

— *Measure monitoring and control plan versus actual status*: support quantitative measurement for the level of implementation for monitoring and control plan.

— *Provide appropriate feedback to product line operations planning roles*: provide feedback including improvement items so as to refer to establish the next step operations plan.

7.4.2 Tailor the monitoring and control portion of organizational operations plan

The goal of this task is to define the detailed plans for operations-monitoring and controls, based on the monitoring and control portion of the organizational operations plan.

The method should support tailoring the monitoring and control portion of the organizational operations plan with the following capabilities:

— understanding the operations plan to classify the monitoring and control portion of the organizational operations plan;

— extracting monitoring and control portions from the operations plan; and

— defining detailed plans to a sufficient degree so as to conduct appropriate monitoring and control actions of operations.

A tool should support tailoring the monitoring and control portion of organizational operations plan by allowing the user to do the following:

— access the organizational operations plan;

— produce documentation for the tailored monitoring and control portion of organizational operations plan; and

— integrate the tailored monitoring and control portion into the organizational operations plan.

7.4.3 Monitor operations for producing domain asset against planning

The goal of this task is to check the progress and outcomes to determine whether organization units produce domain assets in accordance with the defined operations plan.

The method should support monitoring operations for producing domain asset against planning with the following capabilities:

— monitoring the planning parameters (e.g. progress, schedule, cost, effort, resources, expected reusability of domain assets, flexibility of domain architecture, complexity, extendability and modifiability of variability mechanisms used etc.) related to domain assets;

— monitoring cooperation among the roles and responsibilities assigned to different organization units for producing and using domain assets;

— conducting progress reviews based on the measurement results of the planning parameters; and

— performing milestone reviews at a meaningful point (e.g., at the completion of each domain engineering stage, detailed design and implementation artefact reviews against domain architecture and texture).

A tool should support monitoring operations for producing domain asset against planning by allowing the user to do the following:

— perform value-tracking for the planning parameters related to domain assets;

— visualize the progress of operations;

— collaborate among shared responsibilities for measurement and monitoring operations; and

— let participants concentrate on key deliverables of product line operations.

7.4.4 Monitor operations for producing member products against planning

The goal of this task is to check the progress and outcomes of organization units that produce member products by using domain assets in accordance with the defined operations plan.

The method should support monitoring operations for producing member products against planning with the following capabilities:

— monitoring the planning parameters (e.g. progress, schedule, produced application assets, domain asset reusability, modification rates, modification costs, expended efforts vs. expected efforts reduction for member product offering) related to member products;

— monitoring cooperation with organizational units for producing domain assets and product management;

— conducting progress reviews based on the measurement results of the planning parameters; and

— performing regular milestone reviews at a meaningful point (e.g., at the completion of each application engineering stage).

A tool should support monitoring operations for producing member products against planning by allowing the user to do the following:

— perform value-tracking for the planning parameters;

— visualize the progress of operations; and

— collaborate among shared responsibilities for measurement and monitoring operations.

7.4.5 Monitor sourcing against sourcing strategy

The goal of this task is to check the progress and outcomes of sourcing against sourcing strategy.

The method should support monitoring sourcing against sourcing strategy with the following capabilities:

— monitoring the planning parameters (e.g. progress, schedule, produced application assets, domain asset reusability, modification rates, modification costs, expended efforts vs. expected efforts reduction in member products) related to sourcing;

— monitoring cooperation between subcontractor and ordering body;

— conducting progress reviews based on the measurement results of the planning parameters; and

— performing regular milestone reviews at a meaningful point (e.g., at the completion of each sourcing stage).

A tool should support monitoring sourcing against sourcing strategy by allowing the user to do the following:

— perform value-tracking for the planning parameters;

— visualize the progress of operations; and

— collaborate among shared responsibilities for measurement and monitoring operations.

7.4.6 Take corrective actions

The goal of this task is to take corrective actions to resolve issues found.

The method should support taking corrective actions with the following capabilities:

— analysing issues;

— identifying deviations;

— defining corrective actions for resolving deviations; and

— ensuring that corrected operations are well-aligned for domain assets and the member product reusing them.

A tool should support taking corrective actions by allowing the user to do the following:

— support visualization for deviations with the threshold for identifying deviations to be managed;

— support documentation for corrective actions taken to resolve deviations;

— provide traces for interrelated domain assets and parts of a member product with sourcing operations; and

— recode status of corrective actions.

7.4.7 Measure monitoring and control plan versus actual status

The goal of this task is to monitor the level of implementation for the monitoring and control plan.

The method should support measuring monitoring and control plan vs. actual status with the following capabilities:

— tracking status to check for the effectiveness of the monitoring and control plan;

— tracking control action items; and

— collecting measurement values on controlling activities.

A tool should support measuring the monitoring and control plan vs. the actual by allowing the user to do the following:

— collect measurement values; and

— visualize status (e.g. threshold graph).

7.4.8 Provide appropriate feedback to product line operations planning roles

The goal of this task is to provide feedback about operations plan so as to refer to establish the next step operations plan.

The method should support providing appropriate feedback to product line operations planning roles with the following capabilities:

— analysing actions taken to reduce or control deviations; and

— determining problems in actions taken to reduce or control deviations.

A tool should support providing appropriate feedback to product line operations planning roles by allowing the user to do the following:

— utilize feedback channels.

7.5 Organizational product line risk management

7.5.1 Principal constituents

7.5.1.1 Purpose

The purpose of this sub process is to manage risks within and across multiple organizational units, functions and products.

7.5.1.2 Inputs

The following inputs should be available to perform the organizational risk management process:

— probable risk sources (e.g. domain engineering, application engineering, management);and

— organizational-level product line plans (i.e. sourcing strategy, transition plan, operations plan, product line evolution plan, value management plan, operations plan).

7.5.1.3 Outcomes

The following outcome shall be available as a result of the successful implementation of the organizational risk management process:

— *Organizational risks for the product line engineering and management with their priorities and mitigation plans for the most important risk areas* are documented.

7.5.1.4 Tasks

The organization shall implement the following tasks with respect to the organizational risk management process:

— *Identify risks for organizational implementation of product line engineering and management*: identify risks managed at the product line organization level.

— *Assess the identified risks*: evaluate the identified risks in accordance with their probability and their consequences.

— *Develop organizational risk mitigation plans*: prepare risk mitigation or contingency plans.

— *Execute the mitigation plan*: implement the mitigation plan for organizational risks.

— *Measure mitigation plan versus actual status*: monitor risk status after executing mitigation plans.

— *Provide appropriate feedback to organizational risk mitigation planning roles*: provide feedback about actions taken to reduce or control risks to improve the effectiveness of a future risk mitigation plan.

7.5.2 Identify risks for organizational implementation of product line engineering and management

The goal of this task is to identify severe risks for organizational implementation of product line engineering and management.

The method should support identifying risks for organizational implementation of product line engineering and management with the following capabilities:

— identifying organizational common risks possible to happen for carrying out each process of overall product line process areas;

— identifying organizational risks associated with reusability goal achievement;

— analysing risks for determining probability of occurrence and impact from overall product line, domain engineering and application engineering perspectives (risks related to domain engineering have a ripple effect throughout the product line so they should be analysed with particular care); and

— analysing interrelationships between risks for later collaboration among the different teams.

A tool should support identifying risks for organizational implementation of product line engineering and management by allowing the user to do the following:

— access domain artefacts by providing interfaces with domain development tools;

— share risk sources; and

— accumulate historical data for capturing and assessing risks.

7.5.3 Assess the identified risks

The goal of this task is to assess the organizational risks by analysing risk likelihoods and its consequences.

The method should support assessing the identified risks with the following capabilities:

— analysing the causes and consequences of risk;

— evaluating the risks as to likelihood and consequences;

— assessing the options for accommodating the risks;

— analysing relations among organizational risks identified from domain and application engineering respectively;

— prioritizing mitigation actions needed; and

— establishing a risk baseline and mitigation plans.

A tool should support assessing the identified risks by allowing the user to do the following:

— share organizational risks related to core asset development and variability management with the geographically distributed stakeholders; and

— produce documentation of organizational risks' assessment results including their priorities.

7.5.4 Develop organizational risk mitigation plans

The goal of this task is to prepare risk mitigation or contingency plans.

The method should support developing organizational risk mitigation plans with the following capabilities:

— determining the organizational risk mitigation efforts;

— developing organizational risk mitigation plans;

— aligning collaboration among different organization units; and

— tracking the organizational risk mitigation efforts.

A tool should support developing organizational risk mitigation plans by allowing the user to do the following:

— utilize collaboration environments for parallel management of risks.

7.5.5 Execute the mitigation plan

The goal of this task is to implement the mitigation plan for organizational risks.

The method should support executing the mitigation plan with the following capabilities:

— initiating the mitigation plan execution;

— monitoring organizational risk status for the product lines; and

— tracking organizational risk mitigation action items.

A tool should support executing the mitigation plan by allowing the user to do the following:

— show the organizational risk mitigation status; and

— trace organizational risk mitigation action items.

7.5.6 Measure mitigation plan versus actual status

The goal of this task is to monitor risk status after executing mitigation plans.

The method should support measuring mitigation plan versus actual status with the following capabilities:

— tracking risk status to check for the effectiveness of mitigation plan (e.g. a periodic mechanism);

— tracking risk handling action items; and

— collecting measurement values on the risk handling activities.

A tool should support measuring mitigation plan versus actual status by allowing the user to do the following:

— collect measurement values; and

— visualize risk status (e.g. threshold graph).

7.5.7 Provide appropriate feedback to organizational risk mitigation planning roles

The goal of this task is to provide feedback about actions taken to reduce or control risks.

The method should support providing appropriate feedback to organizational risk mitigation planning roles with the following capabilities:

— analysing actions taken to reduce or control risks; and

— determining problems in actions taken to reduce or control risks.

A tool should support providing appropriate feedback to organizational risk mitigation planning roles by allowing the user to do the following:

— utilize feedback channels.

7.6 Product line evolution management

7.6.1 Principal constituents

7.6.1.1 Purpose

The purpose of this sub process is to manage product line evolutions and their consequential evolution of product line platform and member products.

7.6.1.2 Inputs

The following inputs should be available to perform the product line evolution management process:

— plans for product line evolution.

7.6.1.3 Outcomes

The following outcomes shall be available as a result of the successful implementation of the product line evolution management process:

— *Changes in product line platform* that will be managed are monitored and controlled.

— *Changes in member products* that will be managed are monitored and controlled.

— *Status and control actions of product line evolution* are traced.

7.6.1.4 Tasks

The organization shall implement the following tasks with respect to the product line evolution management process:

— *Tailor the organizational product line evolution plan*: modify the product line evolution management portion of the organizational product line evolution plan.

— *Produce the defined evolution outcomes*: check whether the defined evolution outcomes conform to the planned outcomes.

— *Achieve the defined evolution goals*: check whether the defined evolution goals are achieved through the product line evolution.

— *Measure evolution plan versus actual status*: support quantitative measurement for the product line evolution.

— *Manage the evolution procedures*: provide managerial supports for the correct execution of product line evolution plan.

— *Provide appropriate feedback to product line evolution planning roles*: provide feedback for recommendations to product line evolution planning roles so as to establish a more accurate plan.

7.6.2 Tailor the organizational product line evolution plan

The goal of this task is to define the detailed plans for product line evolution based on the organizational product line evolution plan.

The method should support tailoring the organizational product line evolution plan with the following capabilities:

— understanding product line evolution plan for classifying monitoring and control portion of organizational product line evolution plan;

— extracting monitoring and control portions from product line evolution plan; and

— defining plans detailed enough to take appropriate monitoring and control actions to product line evolution.

A tool should support tailoring the organizational product line evolution plan by allowing the user to do the following:

— access organizational product line evolution plan;

— produce documentation for the tailored monitoring and control portion of organizational product line evolution plan; and

— integrate the tailored monitoring and control portion into organizational product line evolution plan.

7.6.3 Produce the defined evolution outcomes

The goal of this task is to check whether the defined evolution outcomes are produced through execution of the product line evolution plan.

The method should support producing the defined evolution outcomes with the following capabilities:

— understanding the produced evolution outcomes; and

— mitigating gaps between the defined and produced evolution outcomes.

A tool should support producing the defined evolution outcomes by allowing the user to do the following:

— access the produced outcomes during the product line evolution; and

— share mitigation policy with relevant product line evolution roles.

7.6.4 Achieve the defined evolution goals

The goal of this task is to check whether the defined evolution goals are achieved through execution of the product line evolution plan.

The method should support achieving the defined evolution goals with the following capabilities:

— determining the achievement against the defined evolution goals; and

— mitigating gaps between the defined and achieved evolution goals.

A tool should support achieving the defined evolution goals by allowing the user to do the following:

— access the achieved goals during the product line evolution; and

— share mitigation policy with relevant product line evolution roles.

7.6.5 Measure evolution plan versus actual status

The goal of this task is to measure and monitor the actual execution results of a product line evolution against the organizational product line evolution plan.

The method should support measuring evolution plan vs. actual status with the following capabilities:

— defining and measuring the planning parameters (e.g. progress, schedule, cost, effort, resources, expected reusability improvement through the planned evolution and so on) related to a product line evolution;

— monitoring cooperation among the roles and responsibilities assigned to different organization units for producing and using domain assets in accordance with the product line evolution plan;

— conducting progress reviews based on the measurement results of the planning parameters; and

— performing regular milestone reviews at meaningful points, such as at the completion time of each domain engineering stage or after reviewing detailed design and implementation artefact against domain architecture and texture.

A tool should support measuring evolution plan vs. actual status by allowing the user to do the following:

— trace the planning parameters related to a product line evolution;

— visualize the progress of a product line evolution;

— collaborate among shared responsibilities measurement and monitoring a product line evolution; and

— let participants concentrate on the key deliverables of a product line evolution.

7.6.6 Manage the evolution procedures

The goal of this task is to provide managerial supports for the correct execution of product line evolution in accordance with the organizational product line evolution plan.

The method should support managing the evolution procedures with the following capabilities:

— construing executed product line evolution;

— ensuring alignment between approaches used during the evolution procedures or alignment between organizational units related to each evolution procedure; and

— coordinating the evolution procedures towards producing the defined evolution outcomes and achieving the defined evolution goals directions.

A tool should support managing the evolution procedures by allowing the user to do the following:

— access procedures, approaches, outcomes and organizational units used or involved in the evolution of a product line; and

— perform change management for the changes of the evolution procedures.

7.6.7 Provide appropriate feedback to product line evolution planning roles

The goal of this task is to provide feedback for corrective/proactive actions or recommendations to product line evolution planning roles.

The method should support providing appropriate feedback to product line evolution planning roles with the following capabilities:

— construing measurement results for making feedback to product line evolution planning roles; and

— making feedback for each product line evolution planning role.

A tool should support providing appropriate feedback to product line evolution planning roles by allowing the user to do the following:

— access measurement results; and

— share feedback with relevant product line evolution planning roles.

Annex A
(informative)

Exemplar product line organizational structure

The structure for product line engineering can be organized as follows:

— hierarchical organization structure with distributed domain engineering in project groups: domain engineering roles are distributed over project units at a project-oriented organization with the hierarchical organization structure;

— hierarchical organization structure with centralized domain engineering: domain engineering roles are separated from other project groups at an organization with the hierarchical structure;

— hierarchical organization structure with several domain engineering units: several separated domain engineering roles are organized in a hierarchy at an organization with the hierarchical structure;

— matrix organization with domain engineering as functional unit: domain engineering is distributed over projects as a functional unit;

— matrix organization with domain engineering as project unit: domain engineering is distributed over functions and domain engineering is one of projects; and

— matrix organisation with separate domain engineering: domain engineering role is located outside of matrix.

Annex B
(informative)

Mapping from ISO/IEC 26556 to ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207

Table B.1 — Mapping among ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207 and ISO/IEC 26556

Area	ISO/IEC 26556		ISO/IEC/IEEE 15288		ISO/IEC/IEEE 12207	
	Clause #	**Clause name**	**Clause #**	**Clause name**	**Clause #**	**Clause name**
Organizational-level product line planning	5.2	Business opportunity analysis			6.4.1	Business or mission analysis
	5.2.6	Define product roadmap	6.2.3	Portfolio management process	6.2.3	Portfolio management process
	5.3	Customer relationship management	6.1.2	Supply process	6.1.2	Supply process
	5.4	Developing a sourcing strategy	6.1.1	Acquisition process	6.1.1	Acquisition process
	5.5	Organizational deployment and innovation planning			6.2.3	Portfolio management process
	5.6	Organizational operations planning			6.4.12	Operations process
	5.7	Value management planning			6.2.3	Portfolio management process
	5.8	Organizational product line evolution planning			6.2.3	Portfolio management process
Organizational product line enabling	6.2	Structuring the product line organization			6.2.3	Portfolio management process
	6.3	Organizational product line infrastructure	6.2.2	Infrastructure management process	6.2.2	Infrastructure management process
	6.4	Organizational quality management	6.2.5	Quality management process	6.2.5	Quality management process
	6.5	Organizational governance through product family management			6.2.3	Portfolio management process
Organizational product line managing	7.2	Deployment and innovation management			6.2.3	Portfolio management process
	7.3	Operations management			6.4.12	Operation process

Table B.1 *(continued)*

Area	ISO/IEC 26556		ISO/IEC/IEEE 15288		ISO/IEC/IEEE 12207	
	Clause #	**Clause name**	**Clause #**	**Clause name**	**Clause #**	**Clause name**
	7.4	Organization-level monitoring and control			6.2.3	Portfolio management process
	7.5	Organizational risk management			6.3.4	Risk management process
	7.6	Product line evolution management			6.2.3	Portfolio management process

Bibliography

[1] ISO/IEC/IEEE 12207, *Systems and software engineering — Software life cycle processes*

[2] ISO/IEC 14102, *Information technology — Guideline for the evaluation and selection of CASE tools*

[3] ISO/IEC/IEEE 15288, *Systems and software engineering — Systems life cycle processes*

[4] ISO/IEC 15940, *Systems and software engineering — Software Engineering Environment Services*

[5] ISO/IEC/TR 19759, *Software Engineering — Guide to the software engineering body of knowledge (SWEBOK)*

[6] ISO/IEC 25000, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

[7] ISO/IEC 26550, *Software and systems engineering — Reference model for product line engineering and management*

[8] ISO/IEC 26551, *Software and systems engineering — Tools and methods for product line requirements engineering*

[9] ISO/IEC 26552[1)], *Software and systems engineering — Tools and methods for product line architecture design*

[10] ISO/IEC 26553[2)], *Software and systems engineering — Tools and methods for product line realization*

[11] ISO/IEC 26554[3)], *Software and systems engineering — Tools and methods for product line testing*

[12] ISO/IEC 26555, *Software and systems engineering — Tools and methods for product line technical management*

[13] ISO/IEC 26557, *Software and systems engineering — Methods and tools for variability mechanisms in software and systems product line*

[14] ISO/IEC 26558, *Software and systems engineering — Methods and tools for variability modelling in software and systems product line*

[15] ISO/IEC 26559, *Software and systems engineering — Methods and tools for variability traceability in software and systems product line*

[16] ISO/IEC 26560[4)], *Software and systems engineering — Tools and methods for product line product management*

[17] ISO/IEC 26561[5)], *Software and systems engineering — Methods and tools for product line technical probe*

[18] ISO/IEC 26562[6)], *Software and systems engineering — Methods and tools for product line transition management*

1) Under preparation.

2) Under preparation.

3) Under preparation.

4) Under preparation.

5) Under preparation.

6) Under preparation.

[19] ISO/IEC 26563[7)], *Software and systems engineering — Methods and tools for configuration management of product line assets*

[20] ISO/IEC 38500, *Information technology — Governance of IT for the organization*

[21] Pohl Klaus, Böckle Günter, van der Linden Frank J. *Software Product Line Engineering: Foundations, Principles and Techniques.* Springer 2005

[22] Northrop Linda M., & Clements Paul C. A Framework for Software Product Line Practice, Version 5.0. Software Engineering Institute, Carnegie Mellon University, July 2007

7) Under preparation.

ICS 35.080

Price based on 65 pages