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1 Subject matter, objective, and purpose

This CI process description contains

- the IT Product/Service/Solution Excellence Process (IT PEP), aiming for the satisfaction of customers' business needs by provision of new or improved IT products/services/solutions (IT P/S/S). It includes the engineering of IT P/S/S, their rollout/rollin, and the stabilization of their operation. The process uses synergy potentials by close co-operation between GE and CI.
- further regulations completing the Program & Project Management Process (U5) of CI.

The objectives are

- provision of cost-effective state-of-the-art IT P/S/S with best in class quality and in short time
- security and reliability by conformity to the Bosch IT architecture
- satisfaction of user needs and positive user experience
- utilization of efficient, controllable and transparent processes
- implementation of RB central directives [lit 17].

This shape denotes an information box. These boxes may contain background related to individual specifications for the standards (e.g. risk assessments), additional explanations, examples, notes, and FAQs. Information boxes do not contain additional standards and are not part of the controlled document.

2 Scope

IT PEP applies to all GE for collaborative activities with CI regarding creation or change of IT P/S/S, i.e. engineering, deployment or stabilization of operation. It applies to CI internal activities as well. It does not apply to IT P/S/S, which are engineered, operated, and used within a single department.

For execution of standard service requests which are predefined as part of an existing IT P/S/S, the CI business process "Request Fulfilment (L3)" [lit 31] is to be used instead of IT PEP.

For changes of infrastructure IT P/S/S without software engineering/customization within the limit of small IT activities, it is sufficient to use CI business process "Change Management (O3)" [lit 22] instead of IT PEP. A list of such IT P/S/S has to be controlled or approved by the responsible SLT QSM.

This version of the process description is valid for all activities started after its release.

3 Definitions of terms

The following terms are fundamental for this process description.

3.1 External market relevance

IT P/S/S, which are part of a "Bosch Product" provided to "Bosch Customers" [lit 29] are denoted as "IT products/services/solutions with external market relevance". IT P/S/S, which (only) support a development, marketing or sale of a "Bosch Product", e.g. software build tools, websites, portals or web shops, are not included in this category.

Examples for IT P/S/S with external market relevance are

- backend systems for a Bosch product, e.g. eScooter Cloud
- mobile applications as part of a Bosch product, e.g. the app that acts as a key to the eStroller
- integrated products for Bosch customers, e.g. InTrack
- digital services for Bosch customers, e.g. TrackMyTools.

For all IT P/S/S with external market relevance, additional requirements have to be fulfilled, e.g. related to safety and liability topics. If an IT P/S/S changes during its lifetime and becomes an IT P/S/S with external market relevance, all additional requirements must be fulfilled before it is provided.

Please be aware that IT P/S/S with external market relevance are also SEP relevant. However, IT P/S/S without external market relevance can be SEP relevant as well. To determine the SEP relevance, use the Security Relevance Assessment in the attachment "IT PEP – Subprocesses and Roles" (tab "Characteristics").

4 IT Product/Service/Solution Excellence Process (IT PEP) overall

In IT PEP, various CI business processes are combined in order to achieve its purpose. The relation between IT PEP and CI business processes is depicted in Figure 1, with details in Table 1.

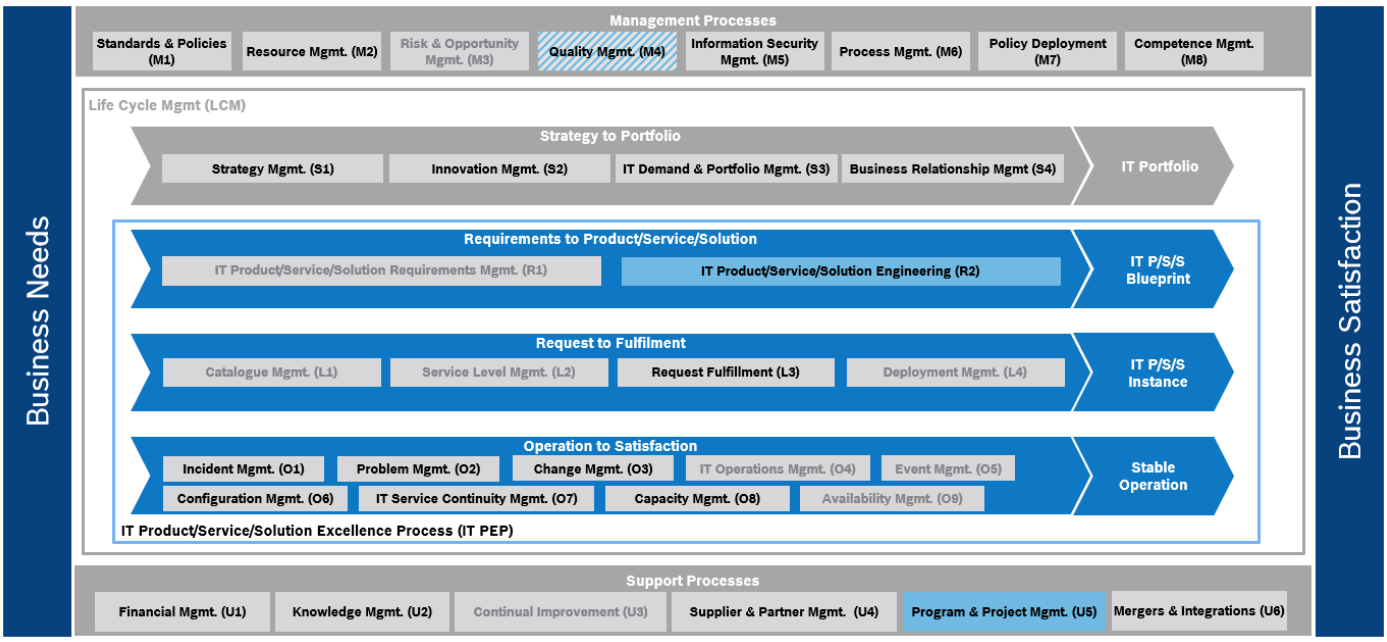

Figure 1: IT PEP in CI Business Process Map [lit 20]

CI business process / value stream	Process description
Quality Mgmt. (M4)	Chapter 7 + attachment - IT PEP relevant subprocesses only
IT Product/Service/Solution Engineering (R2)	Chapter 5 + attachment
Program & Project Mgmt. (U5)	Chapter 6 + attachment
Request to Fulfillment	• Descriptions of value stream processes in inside.Docupedia "CI Business Processes" [lit 20] • Additional obligations in attachment
Operation to Satisfaction	

Table 1: Relation between IT PEP and CI business processes in detail

Chapters named in this table comprise process specific common regulations each, while the attachment "IT PEP - Subprocesses and Roles" comprises subprocesses, tasks, templates, roles, and critical role combinations.

4.1 Process Start

An IT activity (chapt. "6.2 Activity Types in CI") starts by an agreement between the sponsor(s) and the IT activity manager(s).

For IT activities with planned budget exceeding EUR 200k this agreement is included in the Readiness Assessment (RA) at the end of the IT Demand & Portfolio Management Process (S3) [lit 21].

4.2 Standard Process Flows

For IT projects and small IT activities (chapt. "6.2 Activity Types in CI"), standard process flows have been defined:

- phased flow (see Figure 2)
- agile flow (see Figure 3).

Entries starting with a bullet point indicate subprocesses, which are detailed in the attachment "IT PEP - Subprocesses and Roles".

The phases of IT projects and small IT activities, the quality gates, and the milestones of activity management correspond as

- End of Activity Preparation: QG0 / start execution
- End of Conception: QG1
- End of Realization: QG2/3
- End of Production Preparation: QG4 / IT P/S/S acceptance
- End of Stabilization & Closing: QG5 / close activity.

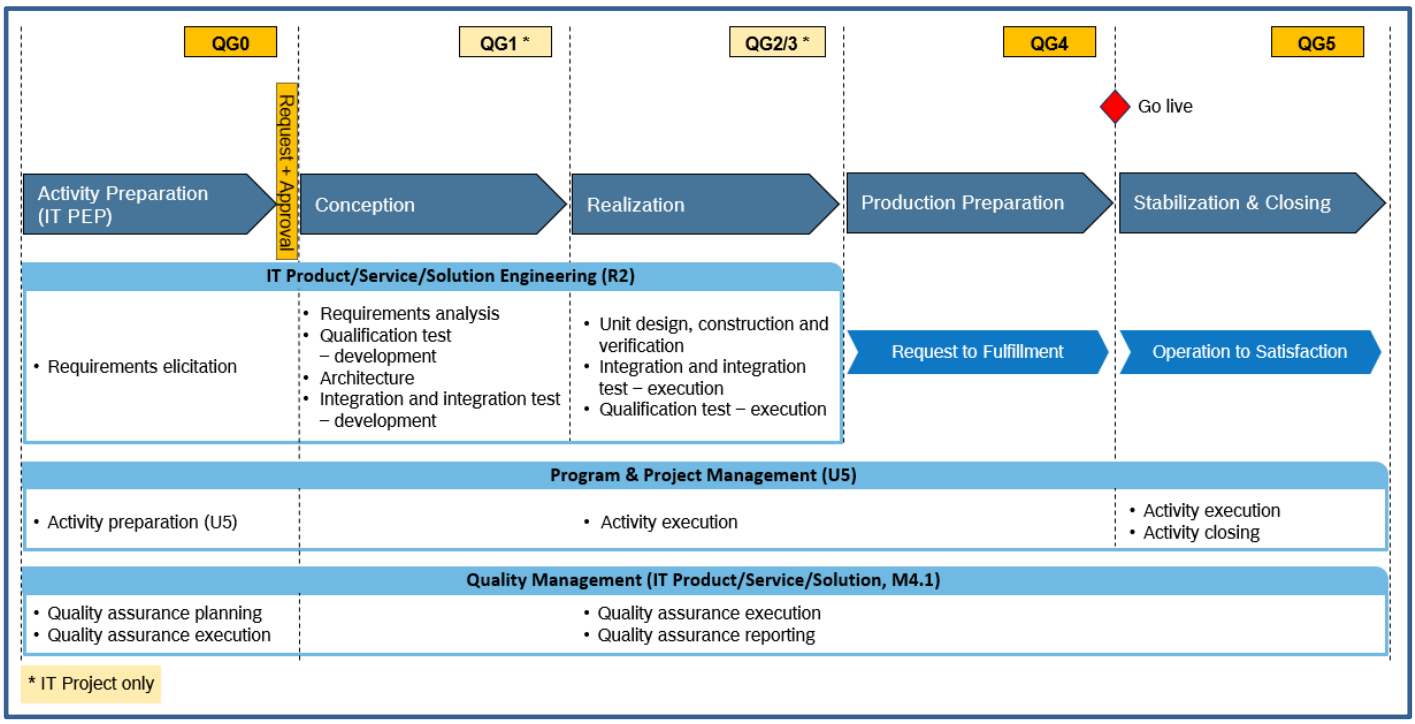

Figure 2: IT PEP - phased flow

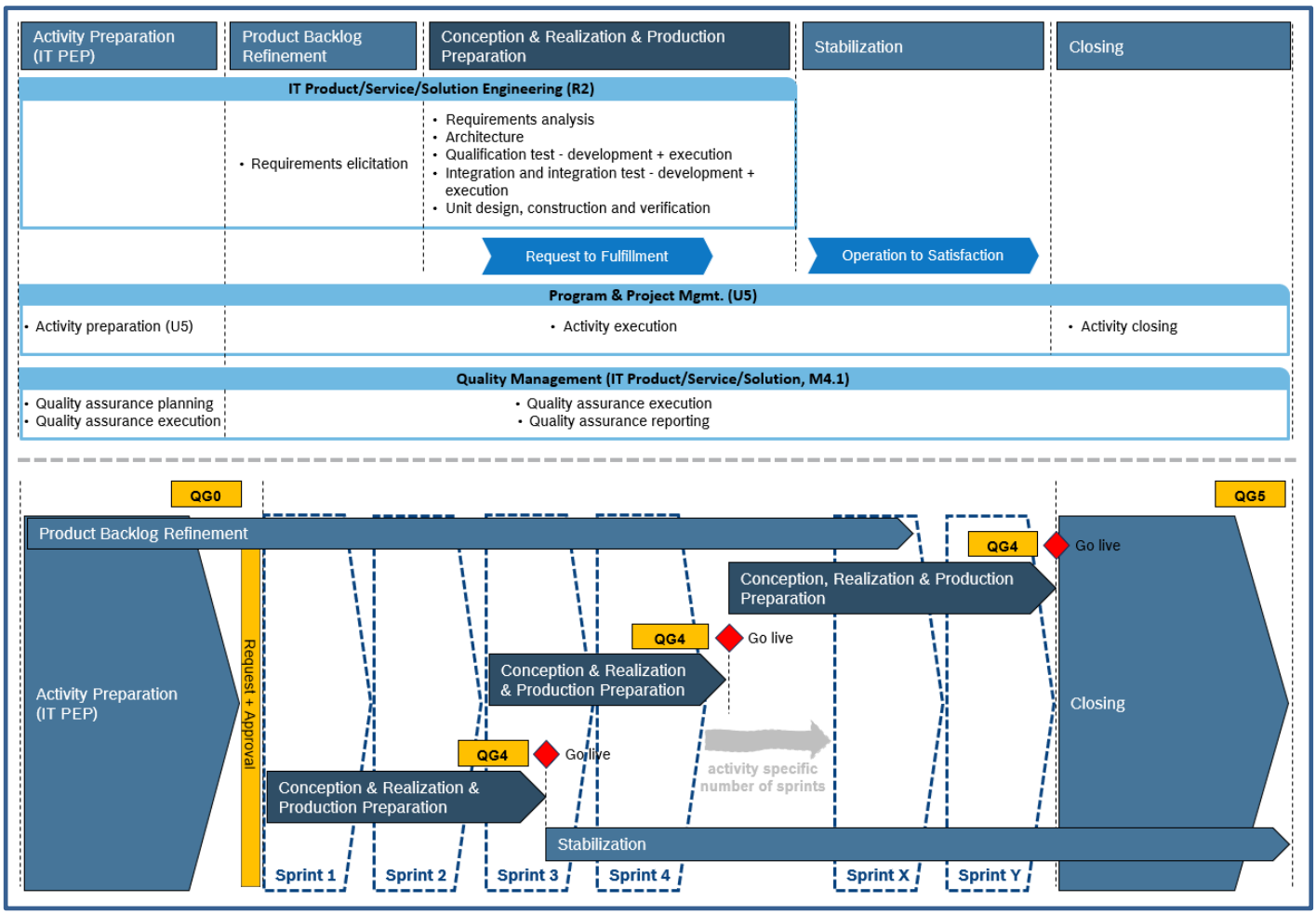

Figure 3: IT PEP - agile flow

The agile flow builds on the Scrum methodology. Its application is recommended in complex environments where requirements are unclear or likely to change and many technological aspects are still unknown.

4.2.1 Changes and defect repair / bug fixing within IT Activities

Changes within IT activities with respect to requirements or work products have to be elicited and analysed and typically lead to changes in scope, time and budget (chapt. “6.4.1.4 Change Management”) as well as a re-iteration of conception, realization and production preparation.

Defect repair / bug fixing within IT activities denotes changes, that can be fixed by a meaningful re-iteration of realization and production preparation; i.e. no changes of requirements or architecture. Defect repair / bug fixing requires no additional QG2/3 or QG4.

4.2.2 Process flow variants

4.2.2.1 Beforehand Realization (phased flow)

In case appropriate experience from previous IT projects is available, certain parts of the IT project (chapt. “6.2 Activity Types in CI”) deliverables can already be realized during conception phase. Dependencies, opportunities and risks of such beforehand realization have to be assessed and documented.

4.2.2.2 Prototyping (phased flow)

To ensure feasibility of critical elements in IT projects with high uncertainty, the creation of a prototype is allowed before QG1.

A prototype serves exclusively for evaluation and must not to be released to production.

> A prototype is provisional software, which is created during the definition of requirements or during the concept to clarify questions concerning the requirements, to demonstrate requirements or to simulate solution principles.

4.2.2.3 Multiple independent work streams

It is possible to structure IT projects into several independent work streams (phased flows, agile flows or both combined as hybrid flow) with specific QGs. In such scenarios, QG0 and QG5 are the joint starting or end points for all work streams (see Figure 4 below). The approach must be defined and documented in the project management plan (PMP), requires an opportunity and risk management, and has to be agreed with the sponsors and the Quality Manager in IT Activities (PjQM).

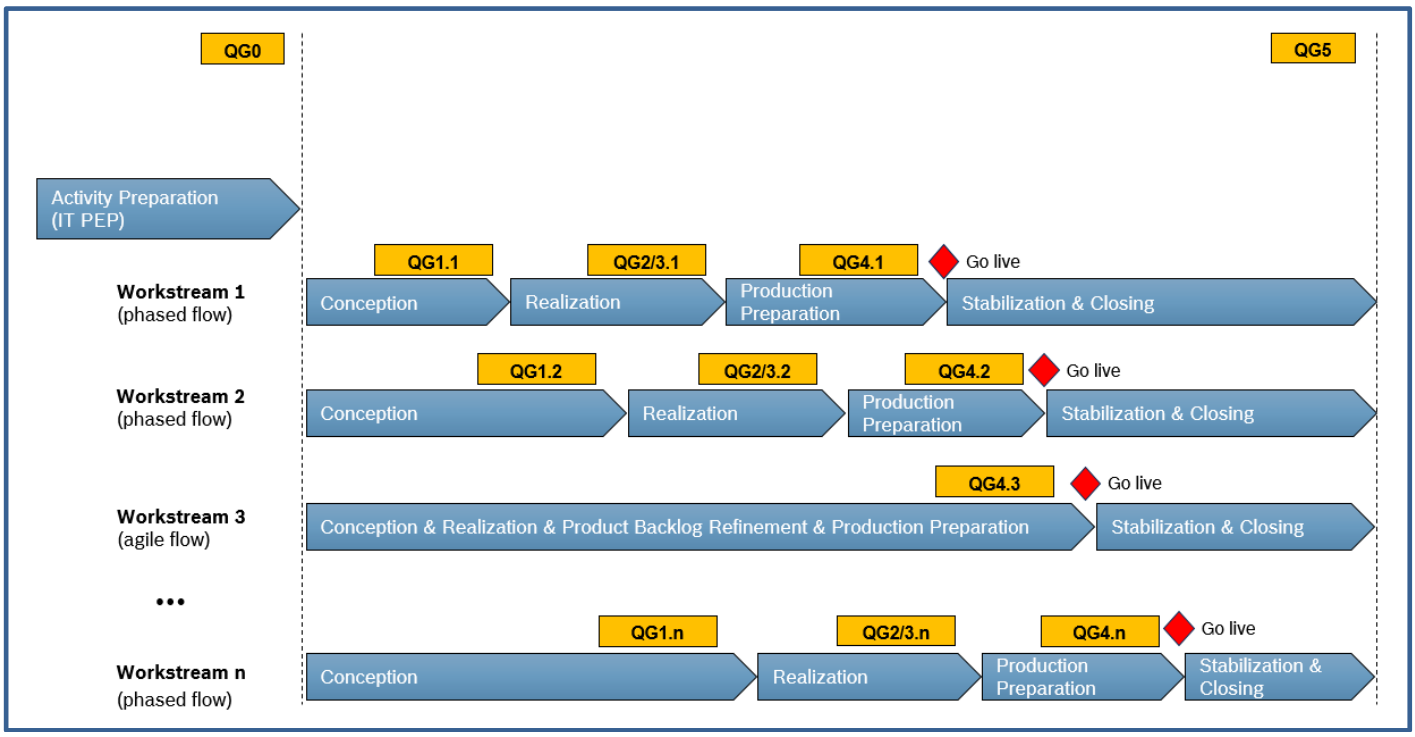

Figure 4: Example for multiple independent work streams

4.2.2.4 Collective Activity

Several small IT activities and studies can be bundled and managed within a collective activity. The purpose is to reduce the overall effort by consolidation of tasks and deliverables on the level of the collective activity.

Details and requirements are described in chapt. “6.6.6 Collective Activities” and in the attachment “Subprocesses & Roles, Program & Project Management (U5)”.

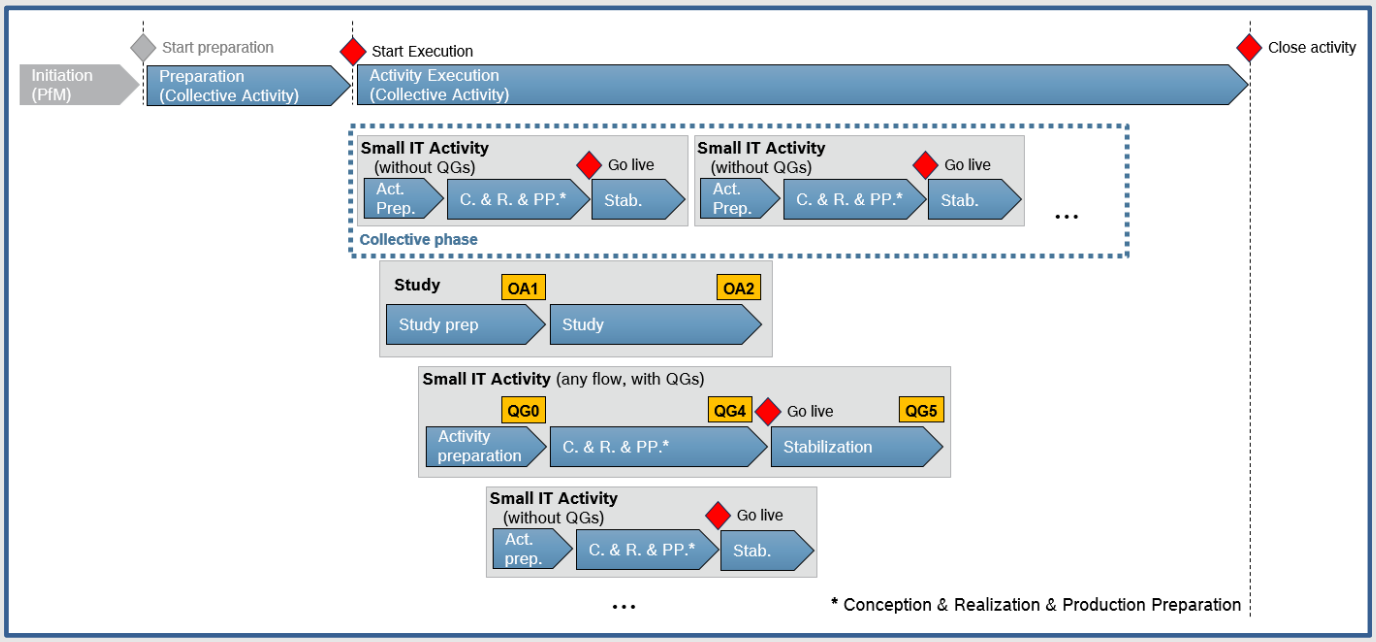

Figure 5: Example for a Collective Activity

4.3 Framework for Continuous Development Flows

4.3.1 Purpose

The framework for continuous development flows provides the basis for the definition and long-term execution of specific agile development flows for IT P/S/S. Mature agile teams take over the responsibility to define and continuously improve their approach within their context, in order to maximize overall effectiveness and efficiency.

4.3.2 Core values and principles

Continuous development relies on self-organization and acceptance of responsibility by the respective teams. The following values and principles are therefore considered essential for the teams when describing their approach and in their daily work.

The Scrum values commitment, courage, focus, openness, and respect [lit 26] serve as the basis for the team members' cooperation among themselves and with their environment. Furthermore, the Agile Manifesto including its principles [lit 27] are considered fundamental to the design, implementation, and continuous improvement of each team's approach.

Continuous development is based on empirical process control. This means that improvements to the IT P/S/S and the development flow are based on what is known. While transparency is the prerequisite, regular inspections of both, the process and the resulting IT P/S/S, enable a continuous increase in the team's performance.

The following additional principles need to be applied in specific flow definitions.

- The fundamental key to the creation of excellent IT P/S/S is a functioning team.
- The one who is best suited to describe how the team should work is the team itself.
- Creating quality is effort and motivation of the whole team.
- The skills required to develop an IT P/S/S are identified by the team.
- Teams preferably develop the skills needed for the development of the IT P/S/S rather than adding part-time experts to the team. This does explicitly not include the consulting of experts, which is highly encouraged in case of missing expertise.
- Chances and risks are weighed against each other to maximize value for the customer.

4.3.3 Preconditions

Continuous development is based on acceptance of full responsibility by the team for the resulting IT P/S/S and their approach on how to get there. At the same time, the team must be empowered and granted enough freedom in its decision making. It is therefore crucial that the sponsors of the activity understand the approach and consciously endorse its application.

The following additional preconditions apply.

- The activity must be set out to last for the entire lifespan of the IT P/S/S, based on what is known today, at least for three years.
- It is expected that activities share their experiences with other continuous development activities to enable continuous learning.
- CI process managers are welcome to conduct spot checks on the application of the continuous development framework to learn on how it is applied, to provide consulting and to further improve its definition.

Furthermore, the following preconditions apply to the setup of the teams to enable them to take over full responsibility for the IT P/S/S and the approach.

- Team members are allocated with at least 70% of their capacity.
- The implementation team is set up in a cross-functional way, having all skills available to implement customer requirements.
- The implementation team has at least four members.
- Work within overlapping time zones is assured (recommended: the team is co-located).
- Team members are well familiar with agile working.

- The majority of team members are Bosch employees.

4.3.4 Business Value Factors

The continuous development framework is described by “Business Value Factors”, which are covering all aspects that add value to the IT P/S/S, either by

- improving the quality and compatibility of the IT P/S/S itself,
- assuring compliance with safety, security, and legal requirements,
- improving maintainability and support ability in the long-run, or
- risk considerations that also improve the quality of the IT P/S/S and that lower activity and IT P/S/S risks.

The business value factors bundle related topics to allow teams to describe their specific approach in a coherent and comprehensive manner, similar to the PMI knowledge areas. Each business value factor contains minimum objectives (the “What”) that the team’s approach (the “How”) must meet. As support, a growing collection of good practices is provided to enable teams to benefit from industry knowledge and Bosch internal success stories.

4.3.5 Definition and approval of continuous development flows

The team is expected to elaborate its own specific continuous development flow, considering the business value factors, the team setup and the activity management requirements as listed in the attachment “IT PEP - Subprocesses and Roles”, Sheet “Continuous Development”.

After its initial description, the continuous development flow has to be aligned with and finally be approved by the IT PEP process managers (via CI/RXP Process Mgmt Mailbox (CI/RXP)). The description must be published Bosch internally.

> Inside.Docupedia is recommended as a tool for the description, and a corresponding good practice is provided. This allows quick access by the team, enables external comparison with other continuous development activities, and gives experts an opportunity to suggest further improvements.

In the execution of the continuous development, it is the responsibility of the team to regularly review, adjust, and optimize the approach to accommodate changing conditions and to continuously increase the performance of the team. In case of changes in the IT PEP concerning the continuous development framework, the continuous development flow has to be updated accordingly.

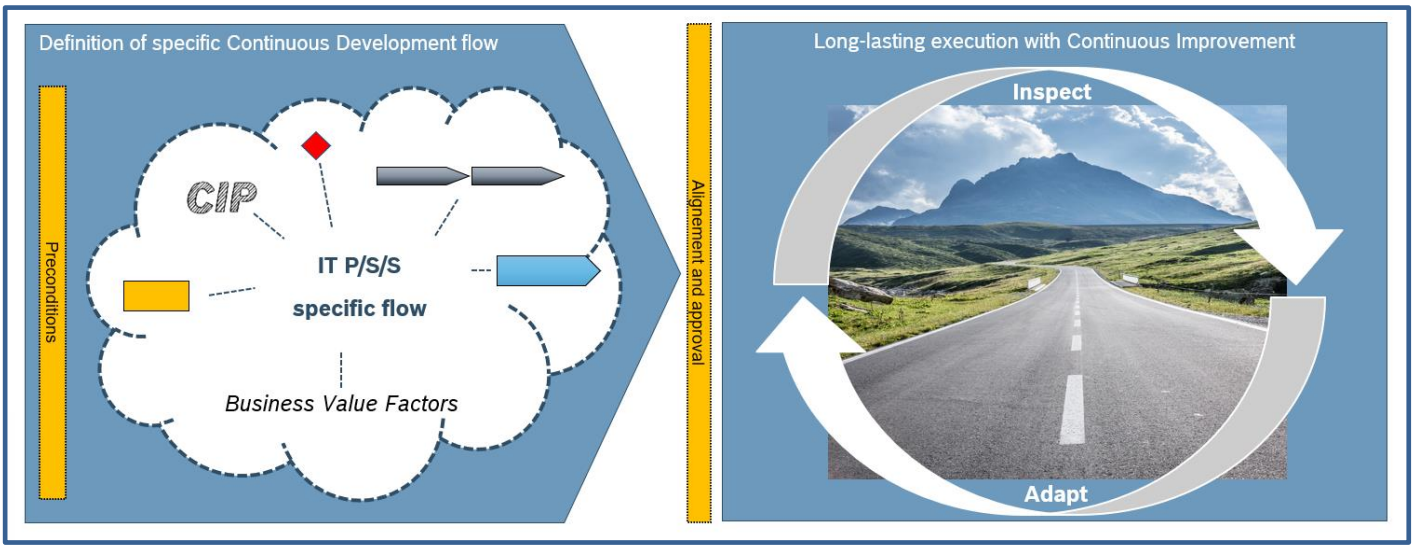

Figure 6: Definition and approval of specific continuous development flow

Inspection and Adaption: “The Scrum artifacts and the progress toward agreed goals must be inspected frequently and diligently to detect potentially undesirable variances or problems. To help with inspection, Scrum provides cadence in the form of its five events. (...) If any aspects of a process deviate outside acceptable limits or if the resulting product is unacceptable, the process being applied or the materials being produced must be adjusted. (...)”; Scrum Guide [lit 26]

4.4 Tailoring of milestones, tasks, requirements and templates

Some milestones, tasks, requirements and templates are tailored, depending on special characteristics of the IT P/S/S or of the activity. The characteristics that are used for this tailoring are:

Characteristic name	Options for tailoring described in
Activity type	chapt. “6.2 Activity Types in CI”
Business critical IT solution	IT Service Continuity Management Process (O7) [lit 18]
External market relevance	chapt. “3.1 External market relevance”
Process flow	chapt. “4.2 Standard Process Flows”
Product safety & liability relevance	See “Characteristics” in attachment “IT PEP - Subprocesses and Roles”
Project impact category	chapt. “6.6.1.1 Project Impact Categories at CI”
Security relevance	See “Characteristics” in attachment “IT PEP - Subprocesses and Roles”
SEP relevance	See “Characteristics” in attachment “IT PEP - Subprocesses and Roles”
Total budget	chapt. “6.4.3 Cost und Benefit Management”
UX relevance	See “Characteristics” in attachment “IT PEP - Subprocesses and Roles”
FOSS usage in high risk areas	CI Free- and Open Source Software Policy (CI-VA 75) [lit 19]
FOSS license fulfilment scenario is given	CI Free- and Open Source Software Policy (CI-VA 75) [lit 19]

Table 2: Characteristics for tailoring

For any IT P/S/S, the context including the relevant characteristics has to be defined and documented e.g. as part of the IT P/S/S description.

4.5 Deliverables and templates

To facilitate the creation of deliverables, several templates are provided. Their content and structure represent good practices; their standardized form increases the ease of processing for the respective target groups (workers council, tax department etc.). Deliverables and templates are listed as part of subprocess descriptions in the attachment “IT PEP - Subprocesses and Roles”.

Deliverables may be updated/created by reasonable re-use of deliverables from previous activities. For mandatory templates, deliverables based on outdated template versions have to be adapted to cover the requirements of any template version that is valid during the life cycle of the activity.

4.6 Deviations from IT Product/Service/Solution Excellence Process

If regulations, tasks or process flows of IT PEP are not suitable for an activity, a request for a process deviation has to be raised using the process deviation template well before the deviation occurs.

5 IT Product/Service/Solution Engineering Process (R2)

5.1 IT Product/Service/Solution Engineering Subprocesses

The tasks for the engineering of an IT P/S/S can be grouped into the following subprocesses (based on [lit 1])

- Requirements elicitation
- Requirements analysis
- Qualification test – development
- Architecture
- Integration and integration test – development
- Unit design, construction and verification
- Integration and integration test – execution
- Qualification test – execution.

Their content and causal chain is independent of the process flow.

The required architectural levels and the respective elements are defined by the IT Lead Architect together with the IT Activity Team. Correspondingly, the subprocesses are applied to the whole system, as well as to all subsequent elements as depicted in Figure 7.

> A system is a number of elements, which are correlated and interact to each other, so that they can be considered as an entity with regards to objective, meaning and purpose. These elements are separated in that way against the environment. [lit 2]
>
> Elements are all structural objects on architecture level. Such elements can be further decomposed into more fine-grained sub-elements of the architecture or design across appropriate hierarchical levels. Elements on the lowest level of the architecture consist of one or more units. (based on [lit 1])
>
> Units are parts of an element that are not further subdivided. (based on [lit 1])

For the standard process flows (chapt. “4.2 Standard Process Flows”), all tasks and deliverables for the engineering subprocesses are detailed in the attachment “IT PEP - Subprocesses and Roles”. For continuous development flows, a similar implementation is recommended.

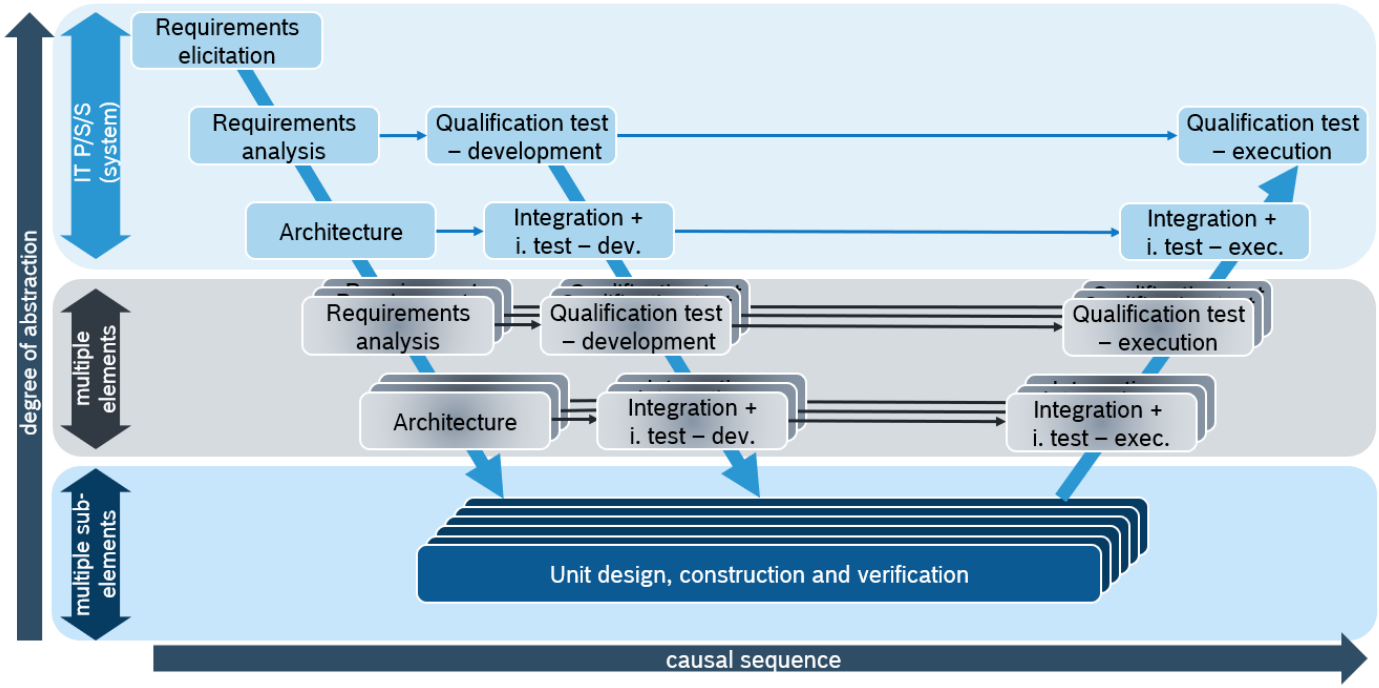

Figure 7: Example for application of engineering subprocesses (two levels)

5.2 Key Performance Indicators (KPI)

The quality of the process is measured by following KPI

- Requirements verification rate: ratio of requirements successfully verified
- SSL requirements verification rate: ratio of SSL requirements successfully verified (cf. [lit 4]).

5.3 Re-use

In case of re-use (of IT P/S/S, IT components, 3rd party software, or parts thereof), differences between the originally defined context and the extended context have to be analysed thoroughly. The quality of re-used items has to be reviewed thoroughly and adjusted where needed.

Each IT P/S/S has a defined context (e.g. defined responsibilities, technical or legal constraints, intended use, target market, security relevance, external market relevance). If Joint Ventures are affected, the IT P/S/S might also be relevant in terms of antitrust laws.

6 Program & Project Management Process (U5)

The purpose of this section is to describe an overall program and project management process for CI, fulfilling the requirements of CD02500 and provide a frame for activity managers to …

> ***…"Be dedicated, courageous, bold, creative, passionate, and open for new developments. And more than before contribute your ideas…"***
>
> *Volkmar Denner, Chairman of the Board of Management, Robert Bosch GmbH, Information about business developments in 2012 and outlook for 2013*

6.1 Project Management Organization within CI

6.1.1 Promotor for Project Management at CI

The role of promotor for project management in CI is with CI/EF.

6.1.2 Process Owner for Project Management at CI

The role of process owner for Project Management at CI is with CI/RXP CI/PMO.

6.1.3 Project Management Office (PMO) at CI

The Project Management Office at CI is CI/PMO. It is responsible for all project types defined in this regulation. Its Service Portfolio is:

- Define Project Management (PM) Process, methods and tools
- Facilitate knowledge exchange with other GEs
- Promote PM awareness throughout the organization
- Enable agile working and organizational transformation through methods, consulting, and community building
- Facilitate project knowledge sharing (lessons learned, retrospectives)
- Setting owner for CI PM curricula
- Conduct PM maturity assessment
- Conduct quarterly reviews of randomly selected projects to support continuous improvement
- Conduct health checks for projects
- Consulting of projects concerning compliance, project setup, good practices or in case of problems
- Coordinate PM related topics within CI
- Provide reports, assessments and analysis on project management to support continuous improvement

6.1.4 Project Management Tool at CI

Planisware is the mandatory PM tool for all activity types. At a minimum, resource demands, cost plan, and schedule have to be maintained in the tool.

6.2 Activity Types in CI

An activity is a temporary endeavour undertaken to create or change a unique IT product/service/solution or result. This section specifies different activity types and distinguishes between projects and other activity types for CI.

<table>
<tr><th colspan="3">Activity type</th><th colspan="2">Description</th></tr>
<tr><td colspan="2">Project
according CD 02500
(chapt. “6.6.1 Projects”)</td><td></td><td colspan="2">An activity that
- has a beginning and an end
- contains sufficient uncertainty (risk) associated with the projects outcome to require its management
- has a total budget of more than or equal to EUR 200k, or requires effort of more than or equal to 250 person days</td></tr>
<tr><td></td><td>Organisational Project
(chapt. “6.6.1.4 Organizational Projects”)</td><td></td><td colspan="2">A project that is either
- reorganising corporate structures with impact on more than one department
- changing locations of departments and persons with effect on more than one department, a plant- or construction project (investment)
- a commercial project with considerable organizational impact</td></tr>
<tr><td></td><td>IT Project</td><td rowspan="3">IT Activity</td><td>A project for development of IT P/S/S</td></tr>
<tr><td colspan="2">Small IT Activity
(SIA)</td><td>An activity for development of IT P/S/S, with total budget below the threshold of a project</td></tr>
<tr><td colspan="2">Continuous Development</td><td>An activity for long-term development with an IT product/service/solution-specific flow. The annual volume of this activity can increase or decrease over time.</td></tr>
<tr><td colspan="3">Study
(chapt. “6.6.4 Study”)</td><td>An activity to gain information that does not directly lead to a new or changed product or service.</td></tr>
<tr><td colspan="3">Program
(chapt. “6.6.5 Programs”)</td><td>A program is a group of related projects or activities, subsidiary programs, and program activities that are managed in a coordinated manner to obtain benefits not available from managing them individually. As soon as these benefits have been attained the program ends. [lit 6] Programs can include program related work outside the scope of discrete projects, like additional management and organizational efforts, or work that is operational in nature.</td></tr>
<tr><td colspan="3">Collective activity
(chapt. “6.6.6 Collective Activities“)</td><td>An activity to collect several Small IT Activities and studies with budget below EUR 200k in one activity in order to simplify the administration of many small activities.</td></tr>
</table>

Table 3: Activity types

The splitting up of a project to avoid necessary tasks or undermine value limits is prohibited.

6.3 Activity Life Cycle at CI

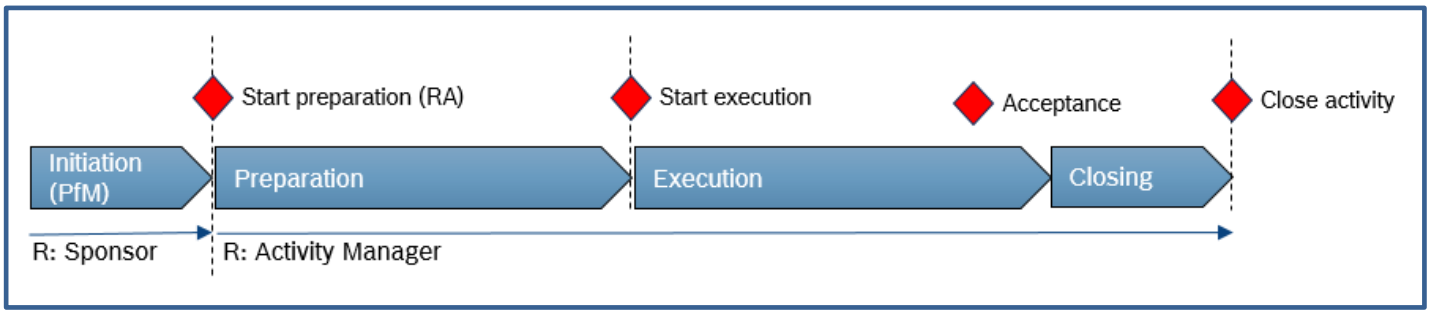

Figure 8: Activity life cycle

The lifecycle is applicable for all activity types described in this process.

6.3.1 Activity Request and Approval

For all activities, the approval process for the activity application has to be started in WorkON (RBITPJAPP) immediately after completion of the milestone releasing the execution phase (e.g. QG0 or OA1). The approval process and steps are determined by value limits; see Table 4:

Approval path for activities and major changes (chapt. "6.4.1.4 Change Management")				
Responsible role in WorkON ((X) only part of the approval if role filled)		Total effort[1] for the activity		
	≥ EUR 10k	≥ EUR 50k	≥ EUR 200k or ≥ 250 person days	≥ EUR 2,5M
Requestor (Activity Responsible)	Start request	Start request	Start request	Start request
In case of IT Solution: **Project manager (UD)**			X	X
IT Product/Service Owner or IT Solution Manager	X	X	X	X
In case of IT Solution: **Sponsor (Customer)** (e.g. Business CDO, GB/ICO, central dpt.)	(X)	(X)	X	X
In case of IT Solution: Approval path as defined in GB, RG	X	X	X	X
Commercial Manager[2]	X	X	X	X
In case of IT Solution: **Business Team Manager** In case of IT Product/Service: **IT P/S Family Owner**	cc	X	in case of C/D project	
In case of IT Solution: **Business Team Lead** In case of IT Product/Service: **Responsible Vice President**			in case of A/B projects	
CI/FC cc for IT Products/Services: CI/EC, CI/ET cc for IT Solutions: CI/EC, CI/EF				X

Table 4: Approval path for activities and major changes

[1] annual effort for collective activities and continuous development

[2] the Commercial Manager is addressed via the CI/CTG mailbox in the predefined WorkON template

For activities with budget exceeding EUR 200k, the approval process for the Readiness Assessment (RA) enables the charging of costs being accrued during the preparation phase based on the estimation during the phases that led to the RA (PfM process). The RA approval can be used to justify a purchase requisition for external services needed during the preparation phase of the activity.

6.3.2 Activity status

The following definitions for activity status apply.

Status	Meaning
Green	Activity is on track. Objective will be achieved.
Yellow	Activity is not on track. Achievement of objectives might not be secured but further escalation is not necessary.
Red	Activity is not on track. Achievement of objectives threatened and escalation beyond sponsor level is necessary.

Table 5: Activity status

6.4 Knowledge Areas

The following Knowledge Areas, based on the definitions from PMI, are relevant for activities in CI. This chapter describes requirements for CI. Corresponding tasks are detailed in the attachment “IT PEP - Subprocesses and Roles”.

6.4.1 Integration Management

“Integration Management includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities” which includes the update/creation of a Project Charter and a Project Management Plan.” [lit.6]

6.4.1.1 Project Charter

The charter is the “document issued by the activities sponsor that formally authorizes the existence of an activity and provides the activity manager with the authority to apply organizational resources to the activity.” [lit6]

Each activity must have a document called charter latest at start of execution phase.

“The charter needs to be updated if a new activity manager is assigned or the activity direction is changed and no project management plan is available.” [lit.6]

6.4.1.2 Project Management Plan (PMP)

The Project Management Plan is the “document that describes how the activity will be executed, monitored and controlled, and closed” [lit6].

It consolidates the subsidiary plans from all knowledge areas and must provide at least plans for:

- Integration Management
- Charter and Impact Category Matrix
- Project Organization (e.g. staffing of mandatory roles)
- Process flow (agile, phased)
- Configuration and Change Management
- Tools
- Scope Management
- Schedule Management
- Cost and Benefit Management
- Quality Management
- Resource Management
- Opportunity and Risk Management
- Procurement Management
- Communication and Stakeholder Management

“If for parts of the project (e.g. a phase) different processes (e.g. agile) shall be applied, these need to be specified, additional roles be defined, and role holders named.” [lit6]

6.4.1.3 Configuration Management

Each activity shall have a repository containing its documentation.

All documents relevant for a milestone (e.g. QG) have to be collected in a milestone-specific baseline in their latest valid version. The documents in a baseline shall not be altered anymore.

Versions for documents shall be created to trace changes of the documents. Sponsor approve the changed documents latest during milestone meetings.

The documentation of activities follows control of documents (CI-VA 53, e.g. retention periods, change of documents).

The configuration management plan must contain:

- link to the repository containing the documents of the activity
- tools used
- list of artefacts to be managed exceeding the deliverables in the subprocess description.

Consider the IT P/S/S configuration management plan, R2-11 [IT Product/Service/Solution Engineering R2, Requirements Analysis].

It is recommended to use SharePoint DMS (NGW) as repository for activities. The function "baseline" of SharePoint can be used to create baselines. The freeze of document versions can be handled via the function revision.

Support on how to manage project documents with SharePoint using advanced ILM features are to be found in the Next Generation Workplace Docupedia [lit 8].

6.4.1.4 Change Management

A change of the activity is an alteration to the approved project management plan (schedule, costs, and scope) or the cancellation of the activity.

For activities with a budget of at least EUR 200k, changes of up to 5% of the activity's budget AND up to EUR 250k AND up to 2 weeks delay of the activity's delivery (e.g. QG4, approved release plan) are regarded as minor changes and can be decided by the activity manager.

For activities with a budget of less than EUR 200k, changes of up to EUR 10k AND up to 2 weeks delay of the activity's delivery (e.g. QG4, approved release plan) are regarded as minor changes and can be decided by the activity manager.

Changes beyond one of these limits are regarded as major change and have to be approved by means of a change request using WorkON (RBITPJAPP) following the approval path used for the activity itself (chapt. "6.3.1 Activity Request and Approval").

The change of the activity type during the life cycle of the activity is regarded a change of the activity and must be approved by means of a change request.

The most common examples are the change of a small IT activity or study to an IT project. Depending on when the change happens, it might be necessary to approve the project management plan by means of a deviation request in addition to the change request.

6.4.1.5 Events in agile IT activities

The following re-occurring events (meetings) are required when applying the standard agile flow or any continuous development flow.

6.4.1.5.1 Sprint Planning

At the beginning of each sprint, a sprint planning meeting must take place to plan the work to be performed in the upcoming sprint. Required participants are the product owner, the agile master, and the implementation team.

It is recommended to split the meeting into two parts. In the first part, the scope of the sprint is determined as the implementation team selects an appropriate number of items from the Product Backlog. In the second part, the implementation team decomposes the selected Product Backlog items into tasks that can be worked on.

The result of the sprint planning meeting, i.e. the scope to be accomplished within the upcoming sprint plus the work needed to implement the scope, are documented in the sprint backlog.

To enable proper sprint planning, estimation and backlog maintenance, everyone among the project team needs to have a shared understanding of when a Product Backlog item is “done”.

6.4.1.5.2 Sprint Review

At the end of each sprint, a sprint review meeting must take place to inspect the completed (“done”) work and to discuss changes to the Product Backlog. Required participants are the product owner, the agile master, the implementation team, and relevant stakeholders.

Major elements of the sprint review are a review and demonstration of the work completed in the sprint, the collection of feedback from the team and from stakeholders.

Based on the achievements of this and previous sprints the product owner plans likely target and delivery dates and reviews the scope of these deliveries including timeline and budget.

6.4.1.5.3 Sprint Retrospective

After each sprint review, a sprint retrospective meeting must take place to identify and plan improvements to the agile approach. If agreed upon by product owner, implementation team, and agile master experienced teams with a smoothly running process may switch to larger intervals.

Required participants of the sprint retrospective are the agile master and the implementation team. The product owner may attend if deemed helpful by the implementation team and the agile master.

As a result of the sprint retrospective, the agile team should have identified concrete improvement measures to be implemented within the next sprint.

6.4.2 Scope Management

The activities scope describes all the work required, and only the work required, to attain the objectives that the activity was undertaken to achieve.

6.4.2.1 Scope management in agile IT activities

In order to cope with planning uncertainty, the sponsor and the activity manager agree on a fixed budget and timeframe and describe overall business goals that allow for flexible project scope details.

The management of the scope in agile IT activities is a continuous process in which existing requirements are discussed and detailed, new requirements are captured, and obsolete requirements get deleted. Ongoing customer engagement is required in this process to maximize business value. This also includes the inspection of implemented items so that the feedback can be incorporated into the requirements.

All requirements are captured in a (Product) Backlog, in which the items have the attributes: description, order, estimate, and value. At the beginning of a sprint, the team determines how many of the highest-priority items can be delivered in the next sprint.

6.4.3 Cost und Benefit Management

Each activity must have a budget based on a cost plan approved in its latest version by the sponsor**.**

The cost plan details the estimated costs per categories below both for CI and User Department:

- internal capacity
- RBEI (e.g. RBEI Support)
- external capacity (e.g. third-party contractors)
- contingency reserve
- travel costs
- other costs. (e.g. rental costs or depreciation and capital cost during activities run-time)

The cost for infrastructure services (e.g. server) used for and during the activity's runtime must be evaluated.

The integration of such cost into the activities budget must be evaluated case by case.

Planning has to be done in a breakdown per year.

The cost plan / budget must be maintained in the PM Tool.

The budget must be reviewed at least quarterly to ensure correctness for the higher level planning processes. In case of changes to the budget, see chapt. "6.4.1.4 Change Management".

More details concerning cost planning are described in the Planisware User Guide [lit 15].

6.4.4 Resource Management

Each activity must be staffed for its entire lifecycle before start of the execution phase, and the staffing must be documented in the PM Tool.

Activities that continually extend their lifecycle initial staffing must be done up to the first planned end date.

Continuous development activities initially plan for 3 years.

Collective activities initially plan for 3 years.

6.4.5 Opportunity and Risk Management

The opportunity and risk management plan as part of the project management plan must detail:

- Actual schedule of opportunity and risk analysis and review
- Procedure for opportunity and risk review (who needs to review, etc.)
- Agreement on definition of significance and probability for the project
- Communication strategy concerning significant opportunities and risks
- Method to estimate cost-impact and calculate reserves, if applied

The opportunities and risks shall be analyzed based on impact and probability of occurrence. Monetary estimation of a project-risk needs to be performed once the risk has materialized. This is necessary to evaluate if the impact on the project-constraints justifies a change request. When building a risk-related contingency buffer, quantified risk-management has to be applied. All identified opportunities and risks shall be documented during the activity (including IT P/S/S risks, see Quality Management (IT Product/Service/Solution, M4.1) subprocess description). Safety risks shall be marked as such.

For each opportunity and risk, a response strategy - independent from its assessment- shall be defined and depending on that, measures shall be chosen. It is possible to accept a risk. In this case, it must be documented why the risk has to be accepted. In case of high / significant risks, an activity plan with schedule is mandatory. It must show actions to reduce the respective risks. The implementation has to be tracked. Significant opportunities and risks have to be communicated to the sponsor and if available the steering committee latest at the milestone meetings. Latest before the final closure of the corresponding measure the risk shall be re-evaluated.

The review must be done in form of a (virtual) meeting. In agile activities, opportunities and risks can be discussed as part of the recurring meetings (e.g. refinements, retrospectives).

As a minimum, the activity manager and if assigned the Quality Manager in IT Activities (PjQM) and in agile activities the product owner shall attend.To evaluate a risk for potential effects and to support assessment of impact and probability a subject matter expert needs to be involved. This can be done separately outside of the risk review meeting to allow for greater flexibility of the recurring risk review.

Further information concerning project risk management is available in the Bosch GlobalNet (BGN) [lit 9].

In addition to the Excel-based Risk-Register, an implementation for Track & Release is available. Usage of this solution is highly recommended for all projects using Track & Release. Baselining-requirements as of CI-VA 53 still apply and require a manual export of all risk as e.g. PDF latest for each milestone.

6.4.6 Procurement Management

Within the CI process Supplier and Partner Management (U4) the supporting document "Quality assurance in external procurement" details the CI related tasks according to CD Bosch Procurement Management (CD80006).

6.5 User Experience (UX) and User-Centered Design Process

The UX relevant tasks in the Program & Project Management process and the role of the UX Advocate are detailed in the attachment “IT PEP - Subprocesses and Roles”.

User Experience (UX) includes all aspects of the user’s perception regarding an offering, including the solution itself, its functionalities and Human-Machine-Interface (HMI), as well as related products/services and accessories along the whole customer journey.

In order to achieve a positive user experience, user requirements are considered throughout the Program & Project Management process as well related processes.

Information about user goals and tasks, needs, preferences as well as specific information about functions and user interface solutions that are desirable and efficient are all part of the user requirements.

For the elicitation of user requirements users have to be involved to get detailed information about the user activity in the respective context of use. A number of UX methods aim to systematically identify user needs and contextual conditions, often by a combination of user interviews and observation. Further Information: Bosch UX Toolbox [lit 7].

On IT P/S/S level, the following aspects are relevant: usability (Usefulness, Ease-of-Use), Joy-of-Use, Aesthetics as well as the Image associated with the product/service/solution.

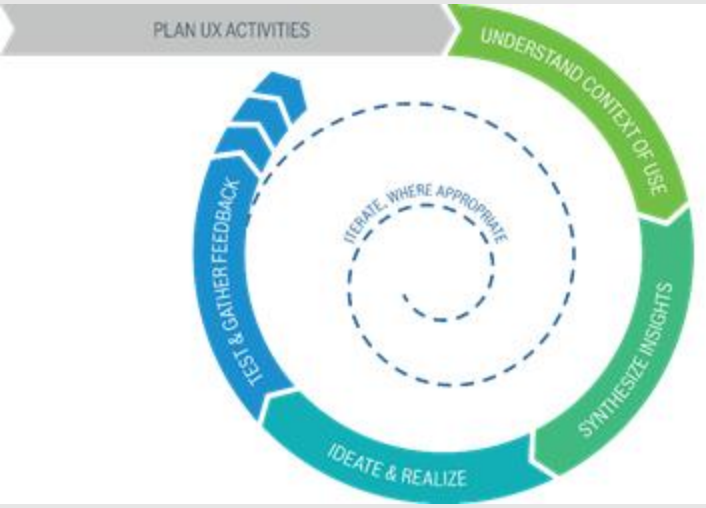

Figure 9: User-Centered Design Process (UX)

To cover activities prior to QG0 (e.g. user research), a study can be conducted.

6.6 Characteristics of Activities Types in CI

This chapter defines specific amendments and deviations per activity type.

6.6.1 Projects

6.6.1.1 Project Impact Categories at CI

As required by the Central Directive Project Management at Bosch (CD02500) applicable project impact categories for CI are defined in Table 6.

Project type	Project Impact Categories
IT Project	A, B, C, D
Organizational Project	A, B, C

Table 6: Project types and impact categories

The project impact category must be agreed between Sponsor and Project Manager no later than at "start of the preparation phase". The evaluation must be done using the template "Project impact category matrix". The impact category must be re-evaluated with every change request of the project. In case of difference in opinion, CI/PMO decides the project impact category.

With each staffing of an A/B project with a project manager not holding the RK PMQ certificate or not meeting the respective leadership competency requirements, "Project Management & Supporting Business Excellence (CI/XPX)" coordinates to staff a qualified advisor.

6.6.1.2 Key performance indicators

On time Delivery: Measures the timely delivery of the project thus the adherence to the project schedule.

In Budget: Measures the adherence to the planned budget at the end of the project.

In Scope: Measures the extent to which the agreed project scope was delivered

Further details on how the measurements are calculated and aggregated can be found in the Planisware User Guide [lit 10].

6.6.1.3 IT Projects

6.6.1.3.1 Large agile IT projects

Agile projects that exceed an implementation team size of nine people need to apply an appropriate scaling mechanism. This may have an impact on how the scope is managed and the number and types of roles required, among others.

Examples for scaling frameworks are LeSS [lit 11], Scrum@Scale [lit 12], and Nexus [lit 13].

6.6.1.4 Organizational Projects

This chapter describes the implementation of Organizational Projects (OrgProjects) at CI. It is valid for activities supporting organizational changes outside of CI and organizational changes within CI.

The decision to handle organizational changes within CI in form of a project has to be made by CI/GL or responsible Senior Leader.

6.6.1.4.1 Life cycle for organizational projects

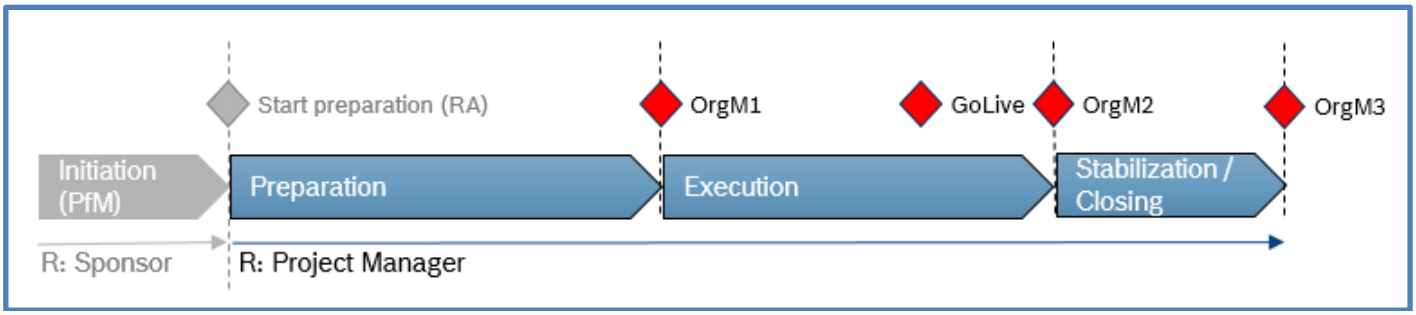

Figure 10: Organizational project life cycle

Each OrgProject consists at least of the phases for preparation, execution and closing of the project. It starts with a Readiness Assessment (as part of the PfM).

Each OrgProjects' phases end by passing a milestone (OrgM).

- OrgM1: End of Preparation (start execution)
- Go live: Customer Acceptance and start of technical transition
- OrgM2: Start of Stabilization
- OrgM3: Close activity

The OrgM1 Milestone starts the execution phase of the project. It must be held as a formal meeting. The procedure for the stabilization phase must be documented in the project management plan and agreed latest during the OrgM1 meeting detailing the responsibilities for potential rework and corrections.

The OrgM2 Milestone serves as formal evaluation of the status of the change and starts the stabilization phase including potentially necessary rework. It must be held as a formal meeting.

The project manager amends the milestone checklist with additional items that are essential to achieving the OrgProjects targets for each milestone.

6.6.1.4.2 Technical support for organizational changes

One purpose of organizational activities in CI can be the support of the technical transition of a larger organizational change. If this change concerns more than 500 associates, the activity in CI must be run as an organisational project.

The GoLive milestone then serves as starting point for the mass changes in the identified systems. Prior to this, the collection of respective approvals (e.g. WorkON) from the concerned systems must be available. A formal meeting is not required.

In case the organisational project is part of an overarching program/project (e.g. at a GB) a transfer of parts of the project management scope into the parent activity is possible. A decision about the implementation of the following topics must be documented in the project management plan:

- Communication management
- Document repository
- Benefits management
- Risk management

These projects are usually characterized by a high risk concerning the availability of necessary specialists and a strong need for timely delivery. Thus, it is a good practice to put strong emphasize on scheduling of the tasks and ensure staffing as early as possible. It is also recommended to have short escalation paths with resource providers ensuring timely re-staffing in case of need.

6.6.1.4.3 Roles in organizational Projects

The mandatory roles of an organizational project are Sponsor, Project manager and Project team.

6.6.2 Small IT Activity

6.6.2.1 Project Management Plan

The project management plan is not required as minimum requirements are covered by the project charter template.

6.6.3 Continuous Development

6.6.3.1 General Conventions

The initial life cycle of a continuous development activity is at least 3 years. Subsequent, annual extensions of resources and costs must be maintained via change request in WorkON (RBITPJAPP) and documented in the PM tool.

The evaluation of the activity impact category is to be made analogous to IT Projects. In case the initial evaluation changes, the activity category and the staffing need to be adjusted accordingly.

The roles of Product Owner and Agile Master should be staffed in alignment with the impact category, e.g. with high competencies in case of a high impact category (similar to the required competencies for the role project manager in an IT project).

6.6.4 Study

6.6.4.1 Life Cycle for a Study

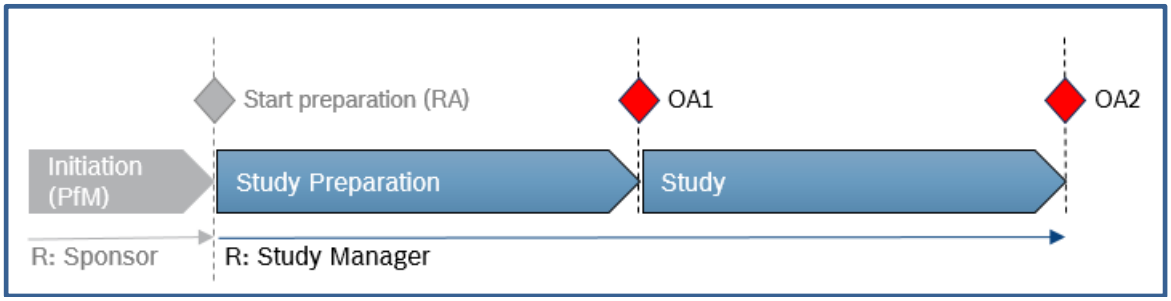

Figure 11: Study life cycle

Each study consists at least of phases for study preparation and study execution. A study will be started through the Demand und Portfolio Management process (PfM). In case the budget threshold of EUR 200k is exceeded, it starts with a Readiness Assessment (part of the PfM).

Each study phase ends by passing a milestone (Opportunity Assessments (OA)):

- OA1: End of Study Preparation (start execution)
- OA2: End of Study (customer acceptance, Close activity)

The Study Manager amends the Milestone Checklist with additional items that are essential to achieving the study's goals for each milestone.

A study is an activity with the sole purpose to gain knowledge. Possible reasons for conducting a study are e.g. feasibility study, market analysis, prototyping or project-related preparation activities.

6.6.4.2 Roles in Studies

Mandatory roles in studies are Study Manager and Sponsor

In case the study is used to prepare an IT Project, it is best practice and strongly recommended to staff the study according to this IT Project and to consider the competencies needed for the IT project.

6.6.5 Programs

This chapter describes the implementation of programs (Pg) at CI.

6.6.5.1 Definition of Terms

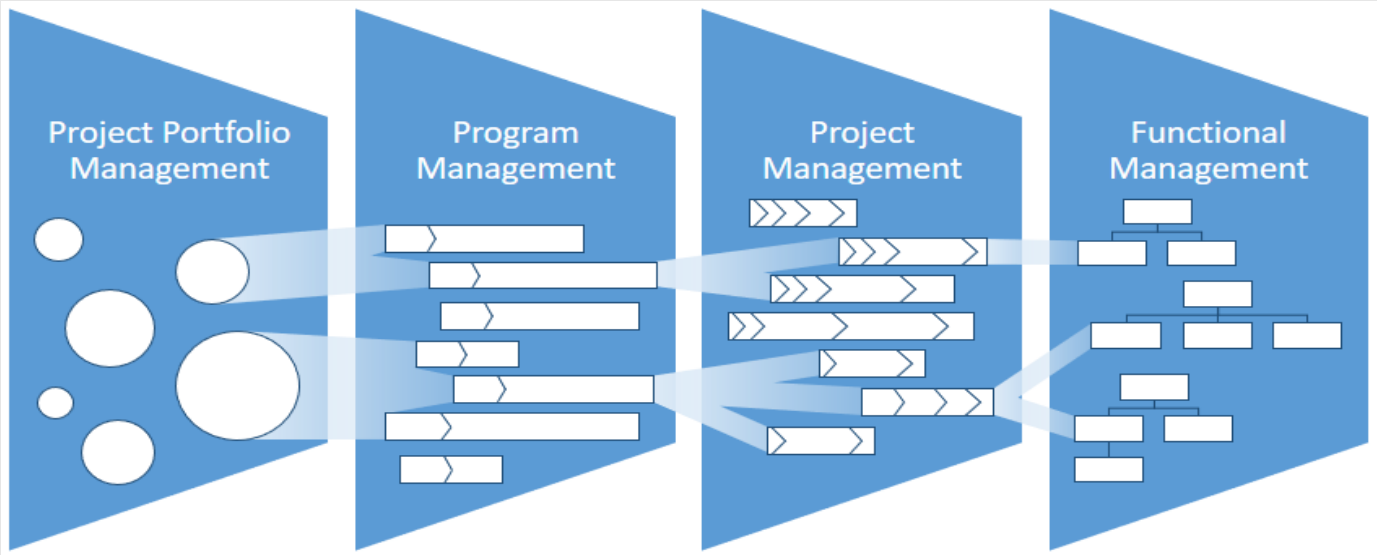

Figure 12: Integration of Portfolio Management, Program Management and Project Management

According to CD 02500 (Project Management at Bosch), a project portfolio (at CI also referenced to as Portfolio-Share) is a collection of projects, programs, or other sub-project portfolios within a defined area of responsibility (e.g. business governance) for the purpose of permanent planning and prioritization. It can be structured using criteria like business capabilities or products. A project portfolio selects and prioritizes ongoing projects and programs or initializes new ones to effectively achieve strategic goals. Project portfolios can contain projects, programs, or other activities that are not related.

Project portfolio management is a permanent effort and consists of the entirety of management tasks, organization, techniques and resources for comprehensive planning and controlling of project portfolios of an organization or part of an organization. Details are regulated within the Demand and Portfolio Management Process.

6.6.5.2 Program Life Cycle

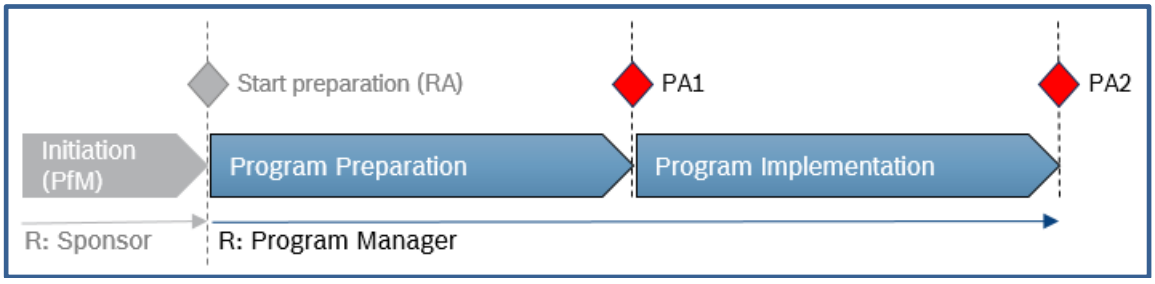

Figure 13: Program life cycle

Each program consists at least of phases for Program Preparation and Program Implementation. It starts with a Readiness Assessment (part of the PfM)

Each program phase ends by passing a milestone (Program Assessments (PA)):

- PA1: End of Program Preparation (start execution)
- PA2: End of Program Implementation (Acceptance, Close of Activity)

The program manager amends the Program Assessment (PA) checklist with additional items that are essential to achieving the programs targets for each milestone.

6.6.5.3 Roles in programs

The mandatory roles of a program are sponsor and program manager (PgM).

Role combinations between roles on program level and roles on sub activity level are possible as long as conflicts of interests (e.g. indicated through critical role combinations) are avoided.

6.6.5.4 Program Budget

A programs budget (and its corresponding approval levels) consists of the estimated sum of all sub activities of the program, including efforts of the program itself.

6.6.5.5 Program Management Plan

A Program Management Plan is required for all programs. The Program Management Plan amends the Project Management plan described in chapt. “6.4.1 Integration Management” in the following Knowledge Areas

- Integration Management Plan: including a definition of the program structure (sub activities) and the Program Managers authority
- Schedule Management Plan: including timeline of Program Assessments (PA) and additional program-milestones
- Cost and Benefit Management Plan: including cost- and recharging agreements for program efforts and post-implementation (operational) cost
- Human Resource Management Plan: including staffing of program roles and potential training requirements
- Opportunity and Risk Management Plan: including how risks and opportunities across sub activities will be identified and tracked
- Stakeholder and Communication Management Plan: including escalation agreements with the programs sponsor and a communication model with sub activities

The program management plan must document synergies between the program and its sub activities, but also amongst sub activities themselves. It must document the agreed authorities of the program manager, concerning the handling of changes within the program and deviations from this regulation. It must be agreed by means of a deviation request before the start of execution phase (PA1).

Synergies can be shared tasks, roles or common objectives. Especially topics like quality management, opportunity and risk management, architecture, requirements management, change management, communication management, purchasing, migration, test management, user experience (UX) and qualification are potential areas to leverage such synergies.

The program manager could be authorized to approve project managers for activities in the program that do not fulfil the qualification requirements. Another option could be the approval of changes to budget or schedule for the sub activities.

CI/PMO offers consulting for program managers on how to structure the setup of programs efficiently. The program manager should request this at the beginning of the program preparation phase.

6.6.5.6 Documentation in programs

All sub activities of a program can use the programs document repository to store their individual activities documentation. A structure that allows to clearly separate files between sub activities is required for such scenarios.

Additional recommendations, explanations and good practices are part of the Program Handbook [lit 14], and the Lessons-Learned database.

6.6.6 Collective Activities

6.6.6.1 Life Cycle for Collective Activities

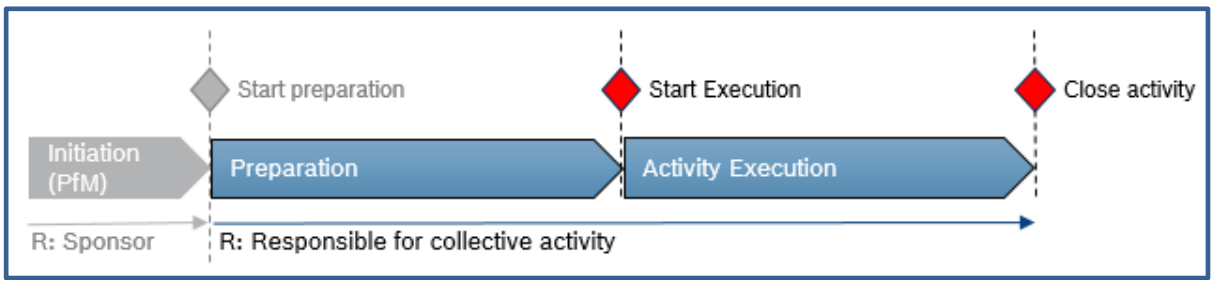

Figure 14: Collective activity life cycle

Each collective activity consists at least of phases for preparation and activity execution.

Each collective activities phases end by passing a milestone:

- Start Execution: end of preparation phase
- Close activity

There is no customer acceptance or Go live on collective activity level. This happens per each SIA.

6.6.6.2 Roles in Collective Activities

The mandatory roles for a collective activity are sponsor and collective activity responsible.

6.6.6.3 Documentation in Collective Activities

All activities of a collective activity can use the respective repository to store their individual activities documentation. A structure that allows to clearly separate files between the SIA is required for such scenarios.

Artefacts required for each activity (e.g. development documents, scope statement) can be aggregated on the level of the collective activity. Traceability between centrally documented artefacts and the respective activity must be ensured (e.g. common scope statement)

6.6.6.4 General Conventions

- A collective activity will be released with the start execution milestone via WorkON (RBITPJAPP) following the defined thresholds in chapt. “6.3.1 Activity Request and Approval”.
- The collective activity aggregates the planned resources, costs and with that, the planned budget for all activities belonging to the collective activity for the current and (if already planned) the following year. Necessary annual budget increases must be maintained via change request in WorkON (RBITPJAPP). In this case, the collective activity will keep its activity ID in the PM tool.
- There are 2 ways to implement small activities under a collective activity in the PM tool:
    - For activities with a budget between EUR 50k and EUR 200k a separate phase must be created
    - For activities with a budget below EUR 50k a collective phase can be created
    - A further formal approval (e.g. WorkON) for the creation of the respective phases is not mandatory, since it is given on collective activity level at start execution milestone.
    - Agreement of final scope per activity between customer, activity manager and the responsible for the collective activity must be documented.
    - Efforts and costs for the respective activities must be booked on the respective phases.
    - The phases will be used for the charging of the respective activity.
    - In case the distribution key for the charging of the phase differs from the distribution key of the collective activity, the activity responsible and the commercial manager must ensure correctness of the charging.
    - Rules for quality gates apply for each SIA as described in the Quality Management Process (IT Product/Service/Solution) (M4.1). Approval for e.g. QGs for the separate SIA can be documented via e-mail.
- In case an activity exceeds the project threshold, the activity must be removed from the collective activity and a separate activity must be created. In this case, the Portfolio Management Process must be applied.

Contact the support for the PM Tool in case of issues removing the SIA from the collective activity.

7 Quality Management Process (IT Product/Service/Solution) (M4.1)

For every IT P/S/S, an adequate quality assurance has to be defined and documented. Quality assurance is a set of activities that ensures that the IT P/S/S and all related work products reach a suitable quality for their intended purposes. These activities are in joint responsibility of engineering function and quality function.

In IT activities, this division of responsibility is implemented as follows:

- The engineering team performs the work to be done and creates the intended results
- The Quality Manager in IT Activities (PjQM) advises the engineering team on appropriate quality assurance activities in the development. Additionally, the PjQM double-checks that the engineering team performs that work and creates the intended results according to the defined quality strategy and definitions in IT PEP. For IT P/S/S with external market relevance the role of PjQM has to be staffed by the Engineering Product Quality (EPQ).

For IT projects and small IT activities, quality assurance shall be ensured by conducting the tasks defined in the attachment “IT PEP - Subprocesses and Roles”. The Quality Management Process (IT Product/Service/Solution) (M4.1) is divided in the following subprocesses:

- Quality assurance planning
- Quality assurance execution
- Quality assurance reporting

The integration of these subprocesses in different standard flows is described in chapt. “4.2 Standard Process Flows“.

For continuous development flows, the minimum requirements of quality assurance are described in the business value factors in the attachment “IT PEP - Subprocesses and Roles”.

The subprocesses and business value factors refer to the topic areas described in the following chapters.

7.1 Quality Definition

Definition of the expected quality is necessary to setup an efficient and economic quality management approach.

Based on the CI quality strategy and customer expectations, the IT Product/Service Owner or IT Solution Manager (IT PSO/SolM) determines the expected IT P/S/S quality. The Quality Manager in IT Activities (PjQM) derives concrete quality targets to support this strategy on IT activity level.

Typically, quality targets are defined for

- Performance
- Availability
- Product design
- Test coverage (especially for safety and security requirements)
- Minimum bug fixing before Go live

By defining corresponding key performance indicators (KPI), the PjQM has the possibility to observe, if the IT activity meets the quality targets. At least, the KPI defined in chapt. "5.2 Key Performance Indicators (KPI)" have to be implemented.

In addition, following KPI are recommended:

- Ratio of IT P/S/S availability to agreed service level agreement: This metric measures the availability of an IT system/service against the availability which was committed to the customer
- Ratio of IT P/S/S performance to agreed performance level: This metric measures the performance of an IT system/service against the performance which was committed to the customer
- Number of open problems ("problem" may be detailed on local level): This metrics defines the success rate of bug fixing
- Ratio of "recovery time objective" (RTO) and "recovery point objective" (RPO) to agreed RTO and RPO respectively: This metric measures the business continuity of the system

7.2 Quality Assurance Plan

The quality assurance plan provides an overview of all planned quality assurance activities and supports the quality targets.

For all IT P/S/S without external market relevance, the quality assurance plan can be part of the already existing IT activity documentation (e.g. project management plan).

7.3 Review

Reviews are used to check the work results and their conformance to the respective targets, specifications and existing documents in order to reveal any existing deficiencies and initiate corrective measures. Reviews have to be conducted as defined in the quality assurance plan. The plan shall include the review object and the frequency (e.g. triggers, maximum interval). At least, the following work products (if available) have to be included in the review plan.

- Stakeholder requirements
- IT P/S/S requirements incl. check if the requirements of relevant guidelines are covered
- Architecture incl. structure-modelling
- Test plan
- Re-used software
- Deliverables by third party
- Baselines
- Operation manual and support concept (within the stabilization phase)

For IT P/S/S with external market relevance, the EPQ has to conduct following reviews additionally:

- Review with regards to Product Development Code [lit 29]
- Reviews of reports from FMEA for IT incl. sample checks of effectiveness of the defined measures.
- Review of the safety checklist in case of safety relevance

The mandatory reviews, described in this chapter, shall fulfil at least following criteria:

- The review has to be conducted by a technical expert, but not the editor of the change.
- The topics to be checked have to be defined and documented upfront. The review has to be conducted based on this checklist.
- It has to be defined in which cases a follow up review has to be performed (e.g. maximum no of findings, legal issues).
- The result of the review has to be documented (e.g. list of anomalies identified, status, responsible and target date).

For IT P/S/S with external market relevance the EPQ shall perform spot checks periodically in agreement with the IT PSO/SolM to assess the adherence to relevant processes and regulations. For other IT P/S/S, this can be checked as part of the work product reviews.

In addition, following checks of work results are good practice:

- Pair programming
- Code reviews
- Static code analysis
- Review of configuration parameters
- Review of LH/PH document by method expert

For additional information about review techniques please refer to the “IEEE Standard for Software Reviews and Audits” [lit 25].

7.4 Quality Gates

Quality Gates (QG) ensure that at a specific milestone, the representatives of User Department and CI review and approve the status of the IT activity and the development of the IT P/S/S. For every creation of new or change of existing IT P/S/S, QG have to be conducted during the IT activity. QG must be performed according to the schedule at the end of the related phase. They shall be conducted as moderated (virtual) meetings of the interdisciplinary and cross-functional QG-Team, which is defined in the QG checklist template. For each QG, a baseline has to be available covering all relevant artefacts.

7.4.1 Quality Gate Planning

For IT activities above EUR 10k IT activity budget, QG0, QG4 and QG5 are mandatory:

- QG0 is conducted to assess if the IT activity has finished the IT activity preparation.
- QG4 is conducted to assess if the IT P/S/S can be released for Go live. If the released IT P/S/S is changed before Go live, the QG4 has to be repeated.
- QG5 is conducted to assess if the IT activity can be closed. The meeting can be substituted by circulation procedure.

For changes of existing IT P/S/S with an effort below EUR 50k, with an established development process and IT P/S/S documentation (e.g. Operation Manual, Export Control Checklist, Data Protection Checklist), the QG

proceeding including meeting and checklist can be substituted by written phase approval (e.g. e-mail) of the sponsors. The approval has to be given for each milestone (start execution, Go Live, closing). The substitution of QG proceeding has to be evaluated in a risk and opportunity assessment and documented with giving the reasons for decision.

For IT activities using any continuous development flow, the QG4 can be replaced by the IT P/S/S specific product release process (see chapt. “7.6 Product Acceptance and Release”).

The QG proceeding has to be documented and agreed with the sponsors and PjQM.

7.4.1.1 Standard Phased Flow

For IT projects with phase oriented flow, QG1 and QG2/3 have to be conducted, additionally:

- QG1 is conducted to assess if the concept phase is completed successfully.
- QG2/3 is conducted to assess if the realization phase is completed successfully.

If all tasks of the concept phase have been completed in previous activities (e.g. in a study), a consolidation of QG0 and QG1 as QG0/1 is possible. Furthermore, QG2/3 and QG4 can be combined, if only few implementation activities are necessary or in case of update/version change projects.

7.4.1.2 Standard Agile Flow

Additionally, for IT projects and small IT activities using the standard agile flow, QG4 is required before each Go live and has to cover the scope of all sprints delivered.

7.4.2 Quality Gate Execution

7.4.2.1 Quality Gate Preparation

For the QG preparation, the QG checklist has to be filled in completely based on the provided template. Therefore, the latest template version has to be selected. For running IT projects and small IT activities, it is allowed to update the used QG checklist with all changes on safety, security and legal topics.

As part of the preparation, the IT activity manager should give an assessment proposal. Following assessment scheme has to be used [based on lit 30]:

Assessment	Explanation
Red	The measurement criterion is not fulfilled. Despite measures, not all of the respective objectives are achieved within the scope of the IT activity. A decision of the responsible management is required.
Yellow	The measurement criterion is not fulfilled. Measures have been agreed. The respective objectives will be achieved once the measures have been completed.
Green	The measurement criterion is fulfilled. Additional measures are not required. The respective objectives will be met.

Table 7: QG assessment scheme

In the QG4, requirements marked with SSL relevance, that are not fulfilled completely, have to be assessed as red. Only in case of minor deficits that must be fixed before go live, the requirement assessment can be rated as yellow.

All documents used as evidence have to be stored, baselined and linked to the QG Checklist.

It is permissible to refer to the results of previous Quality Gates if

- these evaluations of the measurement criteria are accurate, valid and up-to-date,
- the references are also traceable by third parties (traceability),
- that is approved by the responsible PjQM.

The IT activity manager has to invite the QG team at least five working days before the planned meeting and provide all QG relevant documents. The mandatory participants are defined in the QG checklist template. The critical role combinations have to be considered.

The IT activity manager has to clarify and document the proceeding with all QG team members, who can decide about their participation. The Invitation of workers council is only required, if the result of the “workers council relevance check” is positive.

The IT activity manager can extend the QG team as necessary.

7.4.2.2 Quality Gate Meeting

The moderator has to check, if all mandatory participants are available, before starting the meeting. Critical role combinations have to be considered, especially for proxies. In case of missing participants, the moderator has to cancel the meeting.

The moderator checks, if all measures due from previous quality gates are closed and effectively introduced. The result has to be documented in the QG checklist.

The assessment proposal of the QG checklist has to be verified in an open discussion of the QG team. All participants in the QG, with exception of an activity-independent moderator, have full voting rights. The

assessment of each QG requirement has to be done with respect to the defined scope of the QG and aggregated according to the "worst case" principle. That means, the most negative assessment is decisive.

The moderator documents the assessment including the reason for decision comprehensibly and checks if all mandatory evidences are available. If a question is assessed with "yellow" or "red", the moderator documents the defined measures, additionally.

Each QG needs to be passed (overall assessment with "green" or "yellow") to move into the next phase. An IT activity can only be closed after the final QG has been passed with "green".

7.4.2.3 Quality Gate Approval

All participants or proxies who attended the QG meeting approve the overall assessment of the QG, the individual assessments of the checklist items and the defined measures. The approval can be requested by WorkON (RBITPJAPP or via SharePoint). Only if SharePoint (EUU) is used, the IT activity manager has to ensure that the QG documents (QG checklist in excel format and approval) are sent to "Quality Gates CI (CI/QMM)" for reporting purpose.

> The approval of the QG result by the workers council representative is not equal to the mandatory workers council approval for the IT activity. The customer or IT PSO has to request this approval separately.
>
> If a mandatory participant is substituted, it is recommended to include the mandatory participant in the workflow additionally (as cc).

7.4.2.4 Failed Quality Gate

If a QG is not passed, the IT activity is not allowed to start with the next phase. A follow-up QG has to be conducted. The follow-up QG is only passed, if the issues, which have been assessed with "red", are assessed with "green". In case of a major schedule change (based on last approved baseline), a change request has to be started according chapt. "6.4.1.4 Change Management".

In case of QG4, there is one further option to proceed the IT activity (see Figure 15).

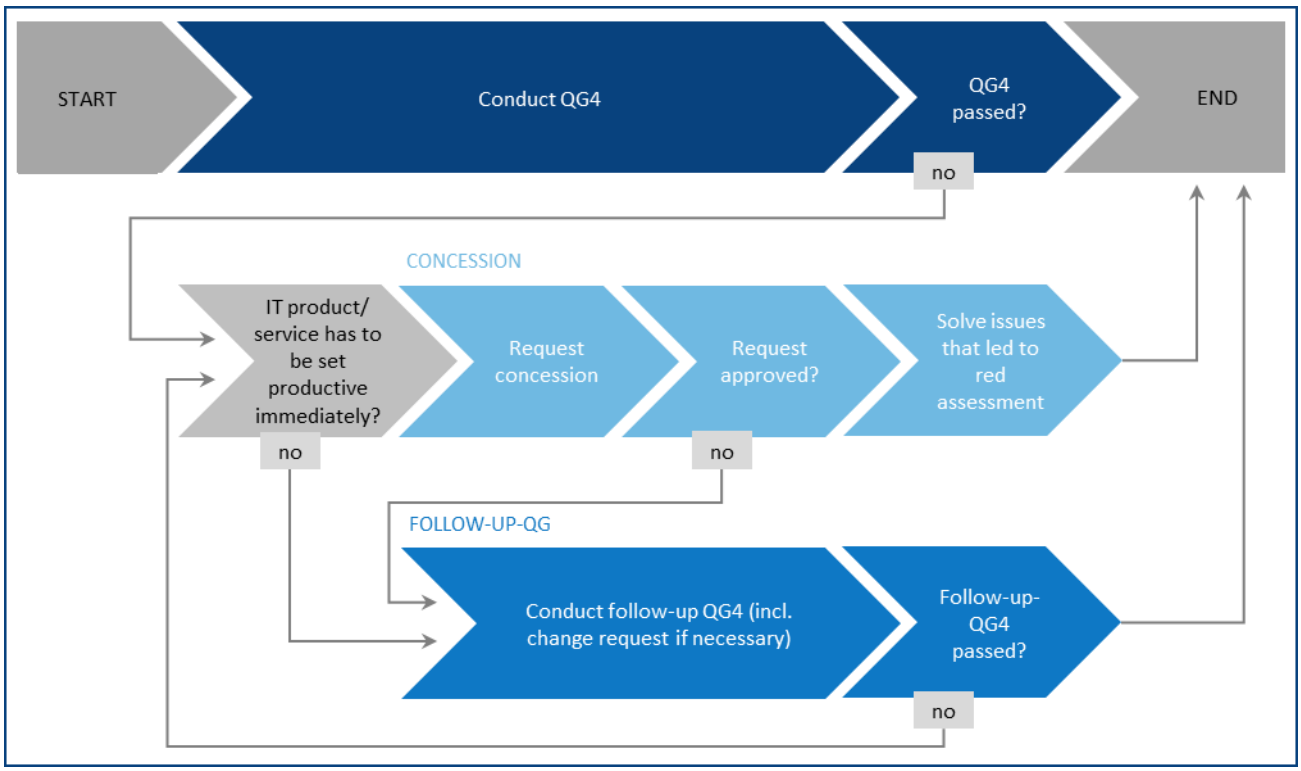

Figure 15: Proceeding after failed QG4

If the IT P/S/S shall go live despite "red" assessment in QG4 (e.g. due to a customer request), the IT activity manager can request a concession to get the required approval. A concession is always restricted concerning time or number of users and only possible if the following conditions are fulfilled:

- All legal requirements are met.
- The opportunity risk assessment concludes that there are no disproportionate security risks.
- If external market relevant: Compliance with Product Development Code [lit 29] has been assessed.
- The customer has been provably informed of existing customer-relevant restrictions and any restricted use has been agreed with him.
- The delivery quantity and/or delivery period are defined.

The IT activity manager has to file the request for concession within two weeks.

The following approval path must be adhered to:

1. Quality Manager in IT Activities
2. IT Product/Service Owner or IT Solution Manager
3. In case of IT Solution: Sponsor (customer)
4. Responsible Business Team Lead or responsible Vice President
5. CI/QMM, cc: CI/QMM Abteilungsbriefkasten
6. If external market relevant: Member of executive management of the market GE (or authorized representative)

7. Responsible CI/GL-Member.

If the concession is approved, the QG does not have to be repeated. But the approval is valid for the restricted release only. For any other releases, applicable QG4 has to be conducted.

The activity manager is responsible for removal of the causes that led to assessments “yellow” or “red”. In agile IT activities, the product owner has to be involved.

7.5 Technical Risk Management (TRM)

Technical risks of an IT P/S/S have to be managed adequately. This includes

- Selection of the Technical Risk Analysis (TRA) method.
- Execution of the TRA process: Identification, evaluation, and mitigation of risks.
- Communication of technical risks to relevant stakeholders.

The owner of the technical risks is the IT PSO or IT Solution Manager. He is accountable for TRM and TRA.

For IT P/S/S with external market relevance the method “Failure Mode and Effect Analysis for IT P/S/S (FMEA for IT)” is mandatory for TRA. For all other IT P/S/S, the technical risks have to be considered as part of the IT activity risk management (see chapt. “6.4.5 Opportunity and Risk Management”). However, for these IT P/S/S an FMEA for IT can be requested by management or customer to the CI FMEA Coordinator.

The TRA has to be started or updated latest after conception and to be finalized before each product release.

7.5.1 FMEA for IT Products/Services/Solutions

The method of FMEA for IT is the CI specific implementation of the Bosch centrally defined Technical Risk Analysis (TRA) according CDQ 0305 [lit 23]. The IT FMEA moderator conducts together with an interdisciplinary team the FMEA for IT. The objective of the FMEA for IT is to identify, evaluate and mitigate the risks of IT P/S/S proactively by taking corrective measures as necessary. The effect chains make the cause-effect relationship transparent. The failures are derived from the functions of the system, components or modules. The evaluation of the severity (S), occurrence (O) and detection (D), as well as the assignment has to be agreed and documented.

The CI FMEA coordinator is the first contact in CI for the IT specific method (contact see [lit 24]). The IT PSO/SolM is the sponsor for every FMEA for IT conducted for his IT P/S/S and has to ensure the resource management.

Every identified risk in the FMEA for IT must be considered. A risk can either be accepted or reduced by measures. Risk acceptance or risk mitigation measures must be documented. This must be done and approved by line management.

New high risks or measures with high invest must be escalated as soon as possible to the management.

For IT activities using an agile flow, it is recommended to conduct the FMEA for IT for each epic or large feature bundle.

FMEA for IT releases have to represent the status of the IT P/S/S at each Go live and must be approved at least before the first Go live. Further FMEA for IT releases have to be approved regularly.

The following approval path must be adhered to:

1. FMEA for IT Moderator (confirms the methodical and formal correctness)
2. FMEA for IT Team Representative (confirms the correctness of the FMEA for IT release content)
3. If external market relevant: EPQ
4. IT Product/Service Owner or IT Solution Manager
5. Other IT Product/Service Owner or IT Solution Manager, affected by risks or actions
6. In case of IT Solution: Sponsor (customer)
7. CI/QMM (could be delegated to CI/QMM1 or CI/QMM2)

The CI 8D coordinator has to be included in the workflow for information.

The moderator stores the FMEA for IT documents centrally in the CI_FMEA storage. The documentation of FMEA for IT has to be provided in English.

The results of the risk assessment are relative valuations, therefore different FMEA for IT ratings are not comparable.

7.6 Product Acceptance and Release

The IT P/S/S acceptance is conducted to release the IT P/S/S to production. Basis for the release are the defined acceptance criteria. An agreement on the handling of open issues has to be available.

The IT P/S/S is released for production, if the QG4 is conducted and approved successfully.

For small IT activities without QG procedure, the IT P/S/S can be released by written approval of the customer or IT PSO (e.g. e-mail).

For IT activities using a continuous development flow, an adequate release step has to be defined. Relevant release criteria have to be defined upfront in cooperation with the customer or IT PSO and the PjQM. If the defined criteria cannot be achieved, the release has to be assessed in a meeting with the customer and the PjQM. In case of critical issues (similar to “red” assessment as defined in Table 7) the release has to be stopped or a risk concession has to be requested. The preconditions and the approval workflow for the risk concession have to be considered according the definition in chapt. “7.4.2.4 Failed Quality Gate”.

Additional release criteria can be defined in cooperation with the customer. For IT P/S/S with external market relevance the acceptance procedure, including documentation and archiving, has to be agreed by the sponsors.

Additional release criteria could be:

- requirements determined by the customer, e.g. for the delivery of IT P/S/S,
- availability of technical specifications (e.g. drawings, test specifications, parts lists),
- description of intended use,
- fulfilment of statutory / official specifications and those customary in the industry (e.g. type approval procedure, EU-Guidelines, CE-identification, norms),
- agreements with the contractual partner.

For all IT activities, using the agile flow, the product release process shall at least include the customer demo and acceptance as part of the sprint review meeting.

It is recommended to agree on a release checklist, that covers all the activities, which have to be completed before release (similar to the DoD for user stories).

7.7 Reporting

To support effective management and to provide transparency on the quality progress a quality reporting has to be provided.

7.7.1 IT Product/Service/Solution Quality Reporting

The content, the frequency and the target group of the quality reporting has to be defined by the PjQM in cooperation with the IT Activity Manager and IT PSO/SolM.

For IT P/S/S with external market relevance a monthly quality reporting is recommended.

7.7.2 Quality Management Escalation

In case of any critical issues, the Quality Manager in IT Activities shall escalate to highlight the risks due to non-fulfilment of quality requirements. The standard escalation path described in Figure 16 has to be used. If necessary, this escalation path can be extended according to the project needs.

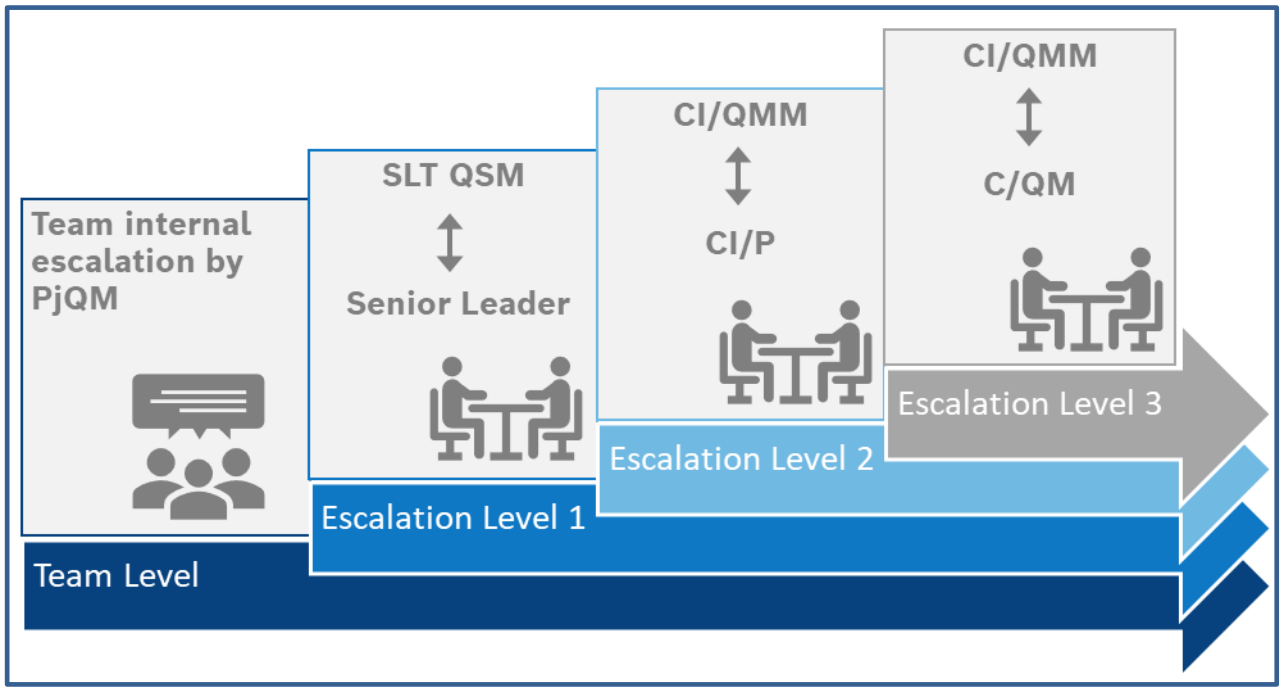

Figure 16: Quality management escalation path

CI/PD	CI/RXP, CI/PMO	CI/QMM
signed Bockholt	signed Kiefer	signed Zendler

8 Appendix

8.1 Attachment

IT PEP - Subprocesses and Roles – this attachment refers to templates and development guidelines as further applicable documents.

8.2 Further related documents

CI Management System Manual

8.3 Literature

[lit 1] Automotive SPICE®, V 3.0, VDA QMC Working Group 13 / Automotive SIG, 2015 (NormMaster)

[lit 2] Bosch Product Engineering System: Glossary BES-PE, V1.1, 2012

[lit 3] CI Business Processes > Glossary

[lit 4] Quality Requirements for Development of Software and Software determined Systems, CDQ0302, V 8.1, 2019-06-06

[lit 6] Project Management at Bosch, CD02500, Issue 2.3, 2019-05-24

[lit 7] Bosch UX Toolbox

[lit 8] Next Generation Workplace Docupedia

[lit 9] Project Risk Management in BGN

[lit 10] Project Management, Planisware User Guide

[lit 11] http://less.works

[lit 12] https://www.scrumatscale.com/scrum-at-scale-guide/

[lit 13] https://www.scrum.org/resources/nexus-guide

[lit 14] Program Handbook

[lit 15] Plan Cost, Planisware User Guide

[lit 16] N103SEC002 Security Engineering Process (SEP)

[lit 17] Management System Manual (Attachment 1): Binding CDQs for CI

[lit 18] O7 - IT Service Continuity Management

[lit 19] CI Free- and Open Source Software Policy (CI-VA 75)

[lit 20] CI Business Processes

[lit 21] S3 - IT Demand & Portfolio Management Process

[lit 22] O3 - Change Management

[lit 23] CDQ 0305 – Technical Risk Analysis

[lit 24] Wiki "Quality @ IT Delivery": Technical Risk Management

[lit 25] IEEE Standard for Software Reviews and Audits (IEEE 1028-2008)

[lit 26] Scrum Guide

[lit 27] Manifesto for Agile Software Development

[lit 28] ISO/IEC/IEEE 24765:2017 Systems and software engineering — Vocabulary

[lit 29] RB/GF-Directive 182 Product Development Code, Issue 2, 2019-12-13

[lit 30] CDQ 0304 Quality Gates, 2020-01-16

[lit 31] L3 - Request Fulfilment

8.4 Glossary

Term	Explanation
Development	Specification, construction, testing and delivery of a new IT P/S/S or of a discrete addition to an existing IT P/S/S. (based on [lit 28]) • Rollin / rollout is regarded as delivery of existing IT P/S/S to additional customers.) • Delivery is regarded as deployment and stabilization of the operation.
IT Product/Service	Standardized CI output, that is sold to customers on its own (make-to-stock). [lit 3]
IT Solution	Customer specific CI output (make-to-order). [lit 3]
KickOff	A KickOff is a prepared meeting of the project manager and all relevant project team members with the purpose to generate excitement for the project, provide a clear, shared perspective on the project goals.
Lessons Learned	The learning gained from the process of performing the project.
Product Backlog (agile approach)	An ordered list of everything that is known to be needed in the IT P/S/S. It therefore lists all features, functions, requirements, enhancements, and fixes that constitute the changes to be made to the product in future releases.
Resource	Skilled human resources (specific disciplines either individually or in crews or teams), equipment, services, supplies, commodities, materials, budgets or funds.

Table 8: Glossary

8.5 Revision History

Version	Date	Editor	Description of amendment
10.3	2021-05-01	CI/RXP -Wolf, -Rank, CI/PMO -Fuchs, -Wüst, CI/QMM2 -Bossert	Focus: Implementation of CI Steering • CI Business Process Map updated • Terms IT Product/Service and IT Solution revised • Scope adapted concerning standard service requests (chapt. 2) • Life Cycle Management chapter removed (chapt. 5) • Roles, approval paths and escalation paths adapted • Tailoring characteristics with scope CI/DA removed (chapt. 4.4) • KPIs aligned with requirements of CDQ0302 (chapt. 5.2) Within the text, changes are marked yellow.
10.2	2020-12-11	CI/DXP -Wolf, -Rank, CI/PMO -Fuchs, -Haaf,	IT PEP • framework for Continuous Development added • chapter "Changes and defect repair (bug fixing)" added • description for Collective Activity improved • definition "external market relevance" improved • CI Business Process Map (chapt. 4) updated Program & Project Management (U5)

		CI/QMM2-Bossert	• description of organizational projects enhanced • requirements for Small IT Activities reduced • UX requirements for studies added Quality Management (IT Product/Service, M4.1) • "FMEA for IT" integrated • description for Review improved • QG assessment scheme improved (table 7)
10.1	2020-05-01	CI/DXP-Wolf, -Rank, CI/PMO-Fuchs, CI/QMM2-Bossert	• SEP requirements detailed and transferred into attachment • SAP tailoring characteristic cleaned-up • QG approval substantiated • Editorial improvements