4 Relationships Among Process Areas

In this chapter~~,~~ we describe ~~interactions~~ the key relationships among process areas to help you see the ~~organization's~~service provider's view of process improvement and which process areas build on the implementation of other process areas. ~~Relationships among process areas are presented in two dimensions.~~

The ~~first dimension comprises the interactions of individual process areas that show how~~ relationships among multiple process areas, including the information and artifacts that flow from one process area to another~~. Shown—~~illustrated by the ~~multiple~~ figures and descriptions in this chapter~~, these interactions —~~help you to see a larger view of process implementation and improvement.

~~The second dimension comprises the interactions of groups of process areas. Shown by the classification of some process areas as Basic and others as Advanced, these classifications illustrate that the Basic process areas should be implemented before the Advanced process areas to ensure that the prerequisites are met to successfully implement the Advanced process areas.~~

Successful process improvement initiatives must be driven by the business objectives of the organization. For example, a common business objective is to reduce the time it takes to ~~get a product to market.~~respond to customers. The process improvement objective derived from that might be to improve ~~the project~~ incident management processes~~ to ensure on-time delivery; those~~. Those improvements rely on best practices in the ~~Project Planning~~Service Delivery and ~~Project Monitoring~~ Incident Resolution and ~~Control~~Prevention process areas.

~~Four Categories of CMMI Process Areas~~

~~Process areas can be grouped into four categories:~~

- ~~Process Management~~
- ~~Project Management~~
- ~~Engineering~~
- ~~Support~~

Although we ~~are grouping~~group process areas in this ~~way to discuss~~ chapter to simplify the discussion of their ~~interactions~~relationships, process areas often interact and have an effect on one another regardless of their ~~defined~~ group, category, or level. For example, the Decision Analysis and Resolution process area ~~provides~~(a Support

process area at maturity level 3) contains specific practices to that address the formal evaluation that is process used in the Technical Solution process area for selecting a technical solution from alternative solutions. Technical Solution is an EngineeringService Continuity process area (a Service Establishment and Decision Analysis and Resolution is a Support process areaDelivery process area at maturity level 3) to select functions that are essential to the organization and must be covered in the service continuity plan.

Being aware of the interactionskey relationships that exist among CMMI process areas and which process areas are Basic and Advanced will help you apply CMMI in a useful and productive way. The following sections describe the interactions of process areas within the categories and only briefly describe the interactionsRelationships among process areas in other categories. Interactions among process areas that belong to different categories are described in more detail in the references within each process area and specifically in the Related Process Areas section of theeach process areas in Part Two. Refer to Chapter 2 for more information about references.

Process Management

Process Management process areas contain the cross-project activities related to defining, planning, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes.

The Process Management process areas of CMMI are as follows:

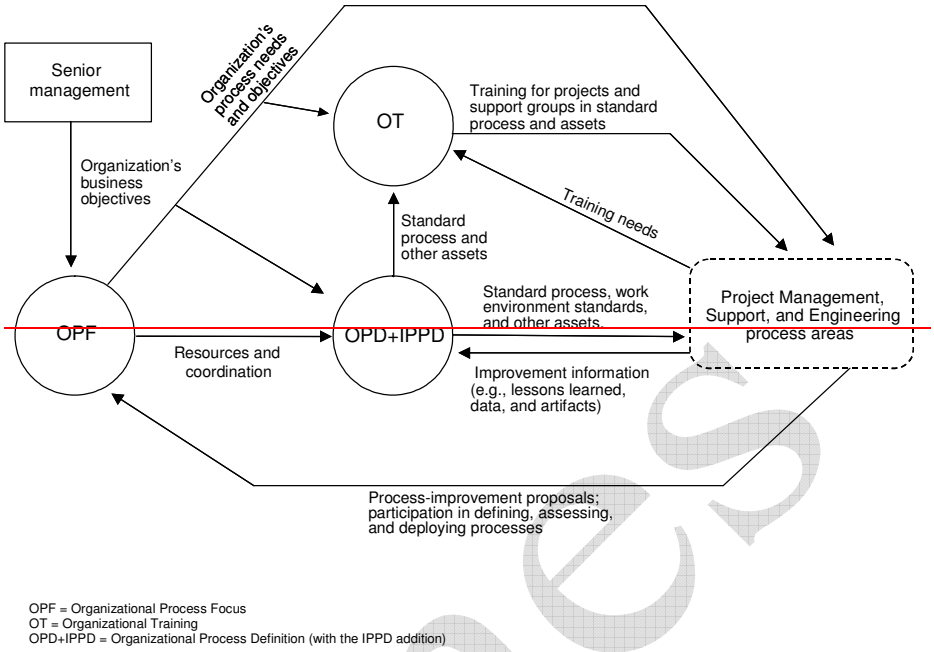
- Organizational Process Focus
- Organizational Process Definition +IPPD[1]
- Organizational Training
- Organizational Process Performance
- Organizational Innovation and Deployment

Basic Process Management Process Areas

The Basic Process Management process areas provide the organization with a capability to document and share best practices, organizational process assets, and learning across the organization.

Figure 4.1 provides a bird's-eye view of the interactions among the Basic Process Management process areas and with other process area categories. As illustrated in Figure 4.1, the Organizational Process Focus process area helps the organization to plan, implement, and deploy organizational process improvements based on an understanding of the current strengths and weaknesses of the organization's processes and process assets.

[1] Organizational Process Definition (OPD) has one goal that applies only when using CMMI with the IPPD group of additions.



~~Figure 4.1: Basic Process Management Process Areas~~

~~Candidate improvements to the organization's processes are obtained through various means. These include process improvement proposals, measurement of the processes, lessons learned in implementing the processes, and results of process appraisal and product evaluation activities.~~

~~The Organizational Process Definition process area establishes and maintains the organization's set of standard processes, work environment standards, and other assets based on the process needs and objectives of the organization. These other assets include descriptions of lifecycle models, process tailoring guidelines, and process-related documentation and data. Projects tailor the organization's set of standard processes to create their defined processes. The other assets support tailoring as well as implementation of the defined processes. Experiences and work products from performing these defined processes, including measurement data, process descriptions, process artifacts, and lessons learned, are incorporated as appropriate into the organization's set of standard processes and other assets. With the +IPPD addition, Organizational Process Definition +IPPD provides IPPD rules and guidelines to the projects.~~

~~The Organizational Training process area identifies the strategic training needs of the organization as well as the tactical training needs that are common across projects and support groups. In particular, training is developed or obtained to develop the skills required to perform the organization's set of standard processes. The main components of training include a managed training development program, documented plans, personnel with appropriate knowledge,~~

and mechanisms for measuring the effectiveness of the training program.

Advanced Process Management Process Areas

The Advanced Process Management process areas provide the organization with an improved capability to achieve its quantitative objectives for quality and process performance.

Figure 4.2 provides a bird's-eye view of the interactions among the Advanced Process Management process areas and with other process area categories. Each of the Advanced Process Management process areas depends on the ability to develop and deploy processes and supporting assets. The Basic Process Management process areas provide this ability.

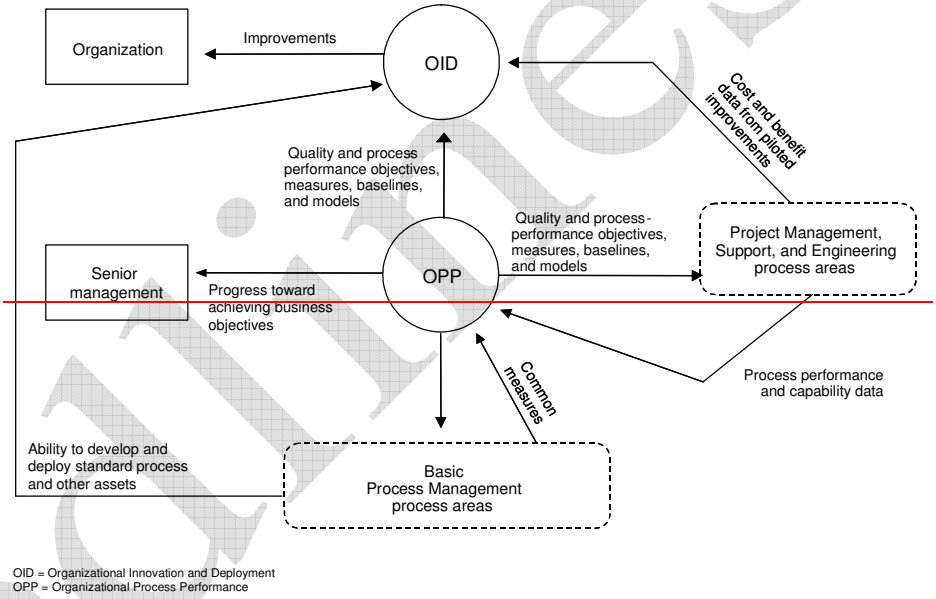


Figure 4.2: Advanced Process Management Process Areas

As illustrated in Figure 4.2, the Organizational Process Performance process area derives quantitative objectives for quality and process performance from the organization's business objectives. The organization provides projects and support groups with common measures, process-performance baselines, and process-performance models. These additional organizational assets support quantitative project management and statistical management of critical subprocesses for both projects and support groups. The organization analyzes the process-performance data collected from these defined processes to develop a quantitative understanding of product quality, service quality, and process performance of the organization's set of standard processes.

The Organizational Innovation and Deployment process area selects and deploys proposed incremental and innovative improvements that

improve the organization's ability to meet its quality and process-performance objectives. The identification of promising incremental and innovative improvements should involve the participation of an empowered workforce aligned with the business values and objectives of the organization. The selection of improvements to deploy is based on a quantitative understanding of the likely benefits and predictable costs of deploying candidate improvements, and the funding available for such deployment.

Project Management

Project Management process areas cover the project management activities related to planning, monitoring, and controlling the project.

The Project Management process areas of CMMI are as follows:

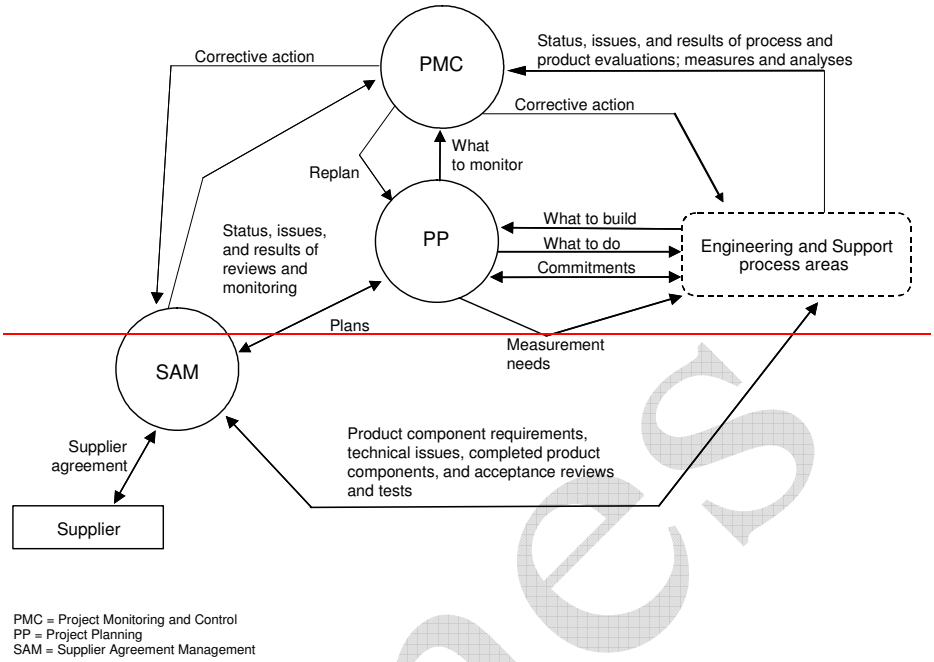
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Integrated Project Management +IPPD[2]
- Risk Management
- Quantitative Project Management

Basic Project Management Process Areas

The Basic Project Management process areas address the activities related to establishing and maintaining the project plan, establishing and maintaining commitments, monitoring progress against the plan, taking corrective action, and managing supplier agreements.

Figure 4.3 provides a bird's-eye view of the interactions among the Basic Project Management process areas and with other process area categories. As illustrated in Figure 4.3, the Project Planning process area includes developing the project plan, involving stakeholders appropriately, obtaining commitment to the plan, and maintaining the plan. When using IPPD, stakeholders represent not just the technical expertise for product and process development, but also the business implications of product and process development.

[2] Integrated Project Management (IPM) has one goal that applies only when using CMMI with the IPPD group of additions.



~~Figure 4.3: Basic Project Management Process Areas~~

~~Planning begins with requirements that define the product and project ("What to Build" in Figure 4.3). The project plan covers the various project management and development activities performed by the project. The project reviews other plans that affect the project from various relevant stakeholders and establish commitments with those stakeholders for their contributions to the project. For example, these plans cover configuration management, verification, and measurement and analysis.~~

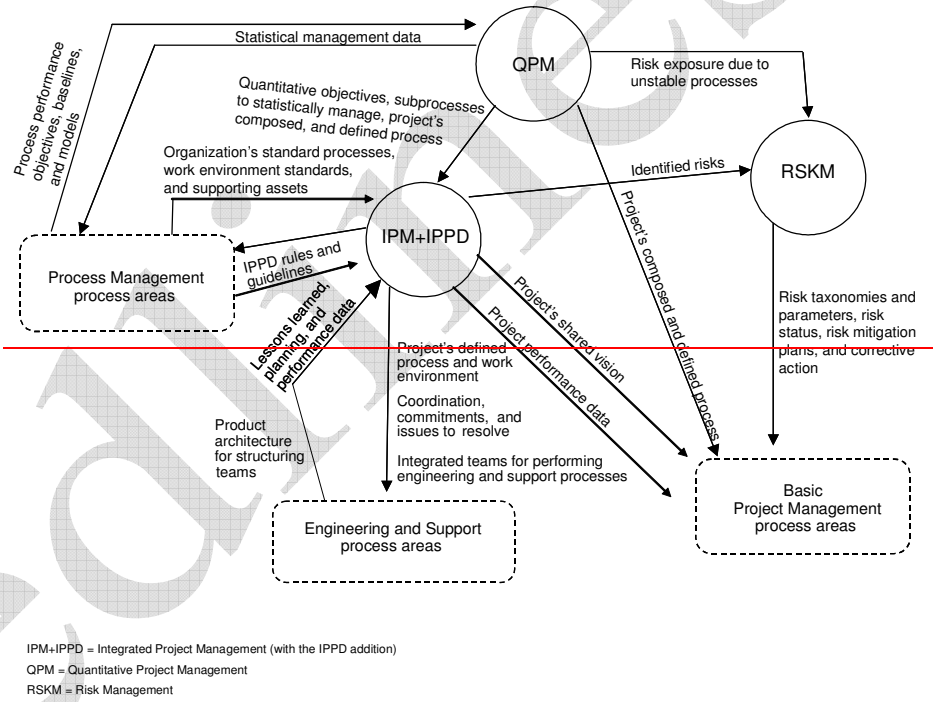
~~The Project Monitoring and Control process area includes monitoring activities and taking corrective action. The project plan specifies the appropriate level of project monitoring, the frequency of progress reviews, and the measures used to monitor progress. Progress is determined primarily by comparing project status to the plan. When the actual status deviates significantly from the expected values, corrective actions are taken as appropriate. These actions may include replanning.~~

~~The Supplier Agreement Management process area addresses the need of the project to acquire those portions of work that are produced by suppliers. Sources of products that may be used to satisfy project requirements are proactively identified. The supplier is selected, and a supplier agreement is established to manage the supplier. The supplier's progress and performance are tracked by monitoring selected work products and processes, and the supplier agreement is revised as appropriate. Acceptance reviews and tests are conducted on the supplier-produced product component.~~

~~Advanced Project Management Process Areas~~

~~The Advanced Project Management process areas address activities such as establishing a defined process that is tailored from the organization's set of standard processes, establishing the project work environment from the organization's work environment standards, coordinating and collaborating with relevant stakeholders, managing risk, forming and sustaining integrated teams for the conduct of projects, and quantitatively managing the project's defined process.~~

~~Figure 4.4 provides a bird's-eye view of the interactions among the Advanced Project Management process areas and with other process area categories. Each Advanced Project Management process area depends on the ability to plan, monitor, and control the project. The Basic Project Management process areas provide this ability.~~



~~Figure 4.4: Advanced Project Management Process Areas~~

~~The Integrated Project Management process area establishes and maintains the project's defined process that is tailored from the organization's set of standard processes. The project is managed using the project's defined process. The project uses and contributes to the organization's process assets. The project's work environment is established and maintained from the organization's work environment standards.~~

~~The management of the project ensures that the relevant stakeholders associated with the project coordinate their efforts in a timely manner. It does this by providing for the management of stakeholder involvement; the identification, negotiation, and tracking of critical dependencies; and~~

~~the resolution of coordination issues within the project and with relevant stakeholders.~~

~~With the +IPPD addition, Integrated Project Management +IPPD establishes and maintains the shared vision of the project and an integrated team structure for the project and then establishes integrated teams to perform the work of the project, ensuring the appropriate collaboration across teams.~~

~~Although risk identification and monitoring are covered in the Project Planning and Project Monitoring and Control process areas, the Risk Management process area takes a continuing, forward-looking approach to managing risks with activities that include identification of risk parameters, risk assessments, and risk mitigation.~~

~~The Quantitative Project Management process area applies quantitative and statistical techniques to manage process performance and product quality. Quality and process-performance objectives for the project are based on the objectives established by the organization. The project's defined process comprises, in part, process elements and subprocesses whose process performance can be predicted. At a minimum, the process variation experienced by subprocesses critical to achieving the project's quality and process-performance objectives is understood. Corrective action is taken when special causes of process variation are identified. (See the definition of "special cause of process variation" in the glossary.)~~

~~Engineering~~

~~Engineering process areas cover the development and maintenance activities that are shared across engineering disciplines. The Engineering process areas were written using general engineering terminology so that any technical discipline involved in the product development process (e.g., software engineering or mechanical engineering) can use them for process improvement.~~

~~The Engineering process areas also integrate the processes associated with different engineering disciplines into a single product development process, supporting a product-oriented process improvement strategy. Such a strategy targets essential business objectives rather than specific technical disciplines. This approach to processes effectively avoids the tendency toward an organizational "stovepipe" mentality.~~

~~The Engineering process areas apply to the development of any product or service in the development domain (e.g., software products, hardware products, services, or processes).~~

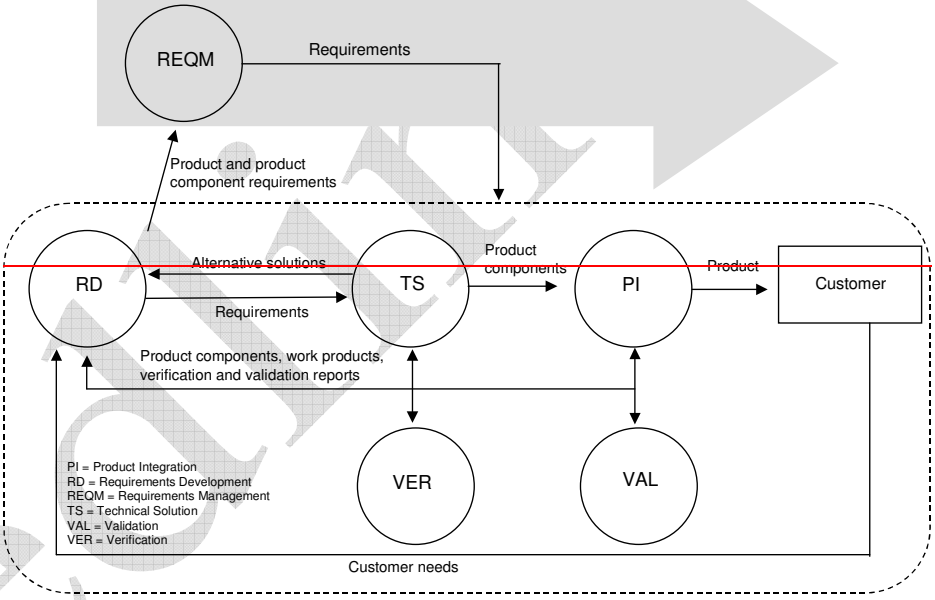
~~The technical foundation for IPPD is grounded in a robust systems engineering approach that encompasses development in the context of the phases of the product's life. The Engineering process areas provide this technical foundation. The implementation of IPPD is further addressed through amplifications to specific practices in the~~

~~Engineering process areas that emphasize concurrent development and focus on all phases of the product's life.~~

~~The Engineering process areas of CMMI are as follows:~~

- ~~Requirements Development~~
- ~~Requirements Management~~
- ~~Technical Solution~~
- ~~Product Integration~~
- ~~Verification~~
- ~~Validation~~

~~Figure 4.5 provides a bird's-eye view of the interactions among the six Engineering process areas.~~



~~Figure 4.5: Engineering Process Areas~~

~~The Requirements Development process area identifies customer needs and translates these needs into product requirements. The set of product requirements is analyzed to produce a high-level conceptual solution. This set of requirements is then allocated to establish an initial set of product component requirements. Other requirements that help define the product are derived and allocated to product components. This set of product and product component requirements clearly describes the product's performance, design features, verification requirements, and so forth, in terms the developer understands and uses.~~

~~The Requirements Development process area supplies requirements to the Technical Solution process area, where the requirements are converted into the product architecture, the product component design,~~

~~and the product component itself (e.g., coding and fabrication). Requirements are also supplied to the Product Integration process area, where product components are combined and interfaces are verified to ensure that they meet the interface requirements supplied by Requirements Development.~~

~~The Requirements Management process area maintains the requirements. It describes activities for obtaining and controlling requirement changes and ensuring that other relevant plans and data are kept current. It provides traceability of requirements from customer to product to product component.~~

~~Requirements Management ensures that changes to requirements are reflected in project plans, activities, and work products. This cycle of changes may affect all the other Engineering process areas; thus, requirements management is a dynamic and often recursive sequence of events. The Requirements Management process area is fundamental to a controlled and disciplined engineering design process.~~

~~The Technical Solution process area develops technical data packages for product components that will be used by the Product Integration or Supplier Agreement Management process area. Alternative solutions are examined with the intent of selecting the optimum design based on established criteria. These criteria may be significantly different across products, depending on product type, operational environment, performance requirements, support requirements, and cost or delivery schedules. The task of selecting the final solution makes use of the specific practices in the Decision Analysis and Resolution process area.~~

~~The Technical Solution process area relies on the specific practices in the Verification process area to perform design verification and peer reviews during design and prior to final build.~~

~~The Verification process area ensures that selected work products meet the specified requirements. The Verification process area selects work products and verification methods that will be used to verify work products against specified requirements. Verification is generally an incremental process, starting with product component verification and usually concluding with verification of fully assembled products.~~

~~Verification also addresses peer reviews. Peer reviews are a proven method for removing defects early and provide valuable insight into the work products and product components being developed and maintained.~~

~~The Validation process area incrementally validates products against the customer's needs. Validation may be performed in the operational environment or in a simulated operational environment. Coordination with the customer on the validation requirements is an important element of this process area.~~

~~The scope of the Validation process area includes validation of products, product components, selected intermediate work products, and processes. These validated elements may often require~~

~~reverification and revalidation. Issues discovered during validation are usually resolved in the Requirements Development or Technical Solution process area.~~

~~The Product Integration process area contains the specific practices associated with generating the best possible integration sequence, integrating product components,~~The process areas of the CMMI-SVC model have numerous interrelationships that are based on a transfer or sharing of information, work products, and other resources by their associated practices. This section focuses on identifying only the relationships encompassing the services-specific process areas. These relationships are best understood by functionally associating them into two distinct groups that span both maturity levels and process area categories:

Establishing and delivering ~~the product to the customer.~~

~~Product Integration uses the specific practices of both Verification and Validation in implementing the product integration process. Verification practices verify the interfaces and interface requirements of product components prior to product integration. This is an essential event in the integration process. During product integration in the operational environment, the specific practices of the Validation process area are used.~~

~~Recursion and Iteration of Engineering Processes~~

~~Most process standards agree that there are two ways that processes can be applied. These two ways are called recursion and iteration.~~

~~Recursion occurs when a process is applied to successive levels of system elements within a system structure. The outcomes of one application are used as inputs to the next level in the system structure. For example, the verification process is designed to apply to the entire assembled product, the major product components, and even components of components. How far into the product you apply the verification process depends entirely on the size and complexity of the end product.~~

~~Iteration occurs when processes are repeated at the same system level. New information is created by the implementation of one process that feeds back into a related process. This new information typically raises questions that must be resolved before completing the processes. For example, iteration will most likely occur between requirements development and technical solution. Reapplication of the processes can resolve the questions that are raised. Iteration can ensure quality prior to applying the next process.~~

~~Engineering processes (e.g., requirements development or verification) are implemented repeatedly on a product to ensure that these engineering processes have been adequately addressed before delivery to the customer. Further, engineering processes are applied to components of the product. For example, some questions that are~~

~~raised by processes associated with the Verification and Validation process areas may be resolved by processes associated with the Requirements Development or Product Integration process area. Recursion and iteration of these processes enable the project to ensure quality in all components of the product before it is delivered to the customer.~~

~~Support~~

~~Support process areas cover the activities that support product development and maintenance. The Support process areas address processes that are used in the context of performing other processes. In general, the Support process areas address processes that are targeted toward the project and may address processes that apply more generally to the organization. For example, Process and Product Quality Assurance can be used with all the process areas to provide an objective evaluation of the processes and work products described in all the process areas.~~

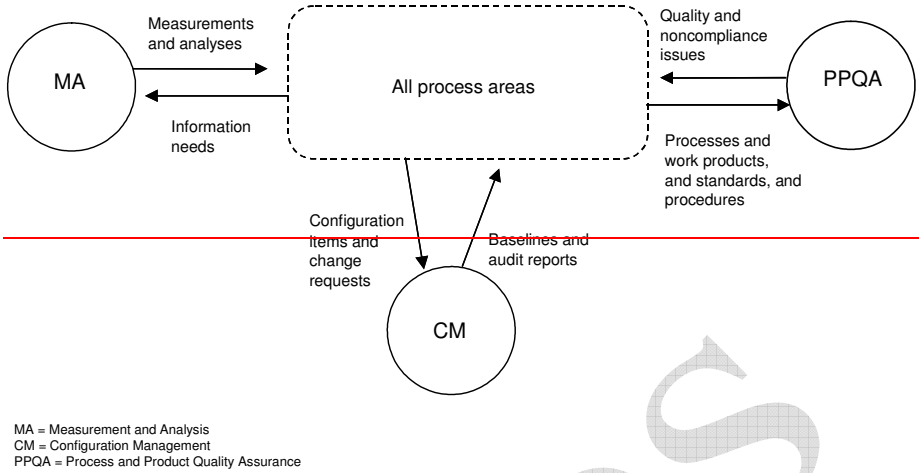
~~The Support process areas of CMMI are as follows:~~

- ~~Configuration Management~~
- ~~Process and Product Quality Assurance~~
- ~~Measurement and Analysis~~
- ~~Decision Analysis and Resolution~~
- ~~Causal Analysis and Resolution~~

~~Basic Support Process Areas~~

~~The Basic Support process areas address fundamental support functions that are used by all process areas. Although all Support process areas rely on the other process areas for input, the Basic Support process areas provide support functions that also help implement several generic practices.~~

~~Figure 4.6 provides a bird's-eye view of the interactions among the Basic Support process areas and with all other process areas.~~



~~Figure 4.6: Basic Support Process Areas~~

~~The Measurement and Analysis process area supports all process areas by providing specific practices that guide projects and organizations in aligning measurement needs and objectives with a measurement approach that will provide objective results. These results can be used in making informed decisions and taking appropriate corrective actions.~~

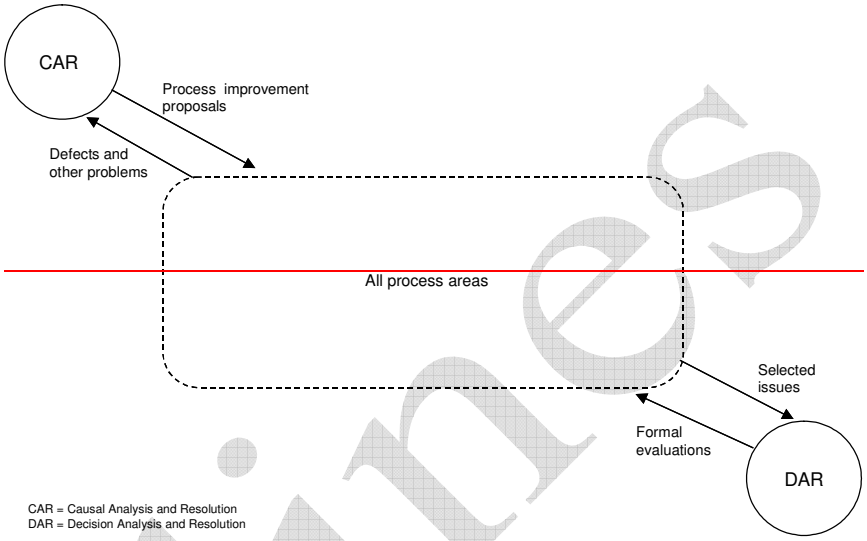
- ~~The Process and Product Quality Assurance process area supports all process areas by providing specific practices for objectively evaluating performed processes, work products, and~~ services ~~against the applicable process descriptions, standards, and procedures, and ensuring that any issues arising from these reviews are addressed. Process and Product Quality Assurance supports the delivery of high-quality products and~~
- Managing services ~~by providing the project staff and all levels of managers with appropriate visibility into, and feedback on, the processes and associated work products throughout the life of the project.~~

~~The Configuration Management process area supports all process areas by establishing and maintaining the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits. The work products placed under configuration management include the products that are delivered to the customer, designated internal work products, acquired products, tools, and other items that are used in creating and describing these work products. Examples of work products that may be placed under configuration management include plans, process descriptions, requirements, design data, drawings, product specifications, code, compilers, product data files, and product technical publications.~~

~~Advanced Support Process Areas~~

~~The Advanced Support process areas provide the projects and organization with an improved support capability. Each of these process areas relies on specific inputs or practices from other process areas.~~

~~Figure 4.7 provides a bird's-eye view of the interactions among the Advanced Support process areas and with all other process areas.~~



~~Figure 4.7: Advanced Support Process Areas~~

~~Using the Causal Analysis and Resolution process area, project members identify causes of selected defects and other problems and take action to prevent them from occurring in the future. While the project's defined processes are the principal targets for identifying the cause of the defect, the process improvement proposals they create target the organization's set of standard processes, which will prevent recurrence of the defect across the organization.~~

~~The Decision Analysis and Resolution process area supports all the process areas by determining which issues should be subjected to a formal evaluation process and then applying a formal evaluation process to them.~~Process area relationships are illustrated in flow diagrams that focus on key dependencies for the sake of clarity; not all possible interactions between process areas are shown, and not all process areas are shown. The process areas that have been omitted from these diagrams (primarily the Process Management and Support process areas) have potential relationships with all of the process areas that *are* shown, and their inclusion would make it difficult to focus on the key CMMI-SVC relationships.

Relationships that Drive Service Establishment and Delivery

Figure 4.1 shows process areas associated with the establishment of service delivery capabilities as driven by requirements from service agreements with customers, as well as with service delivery.

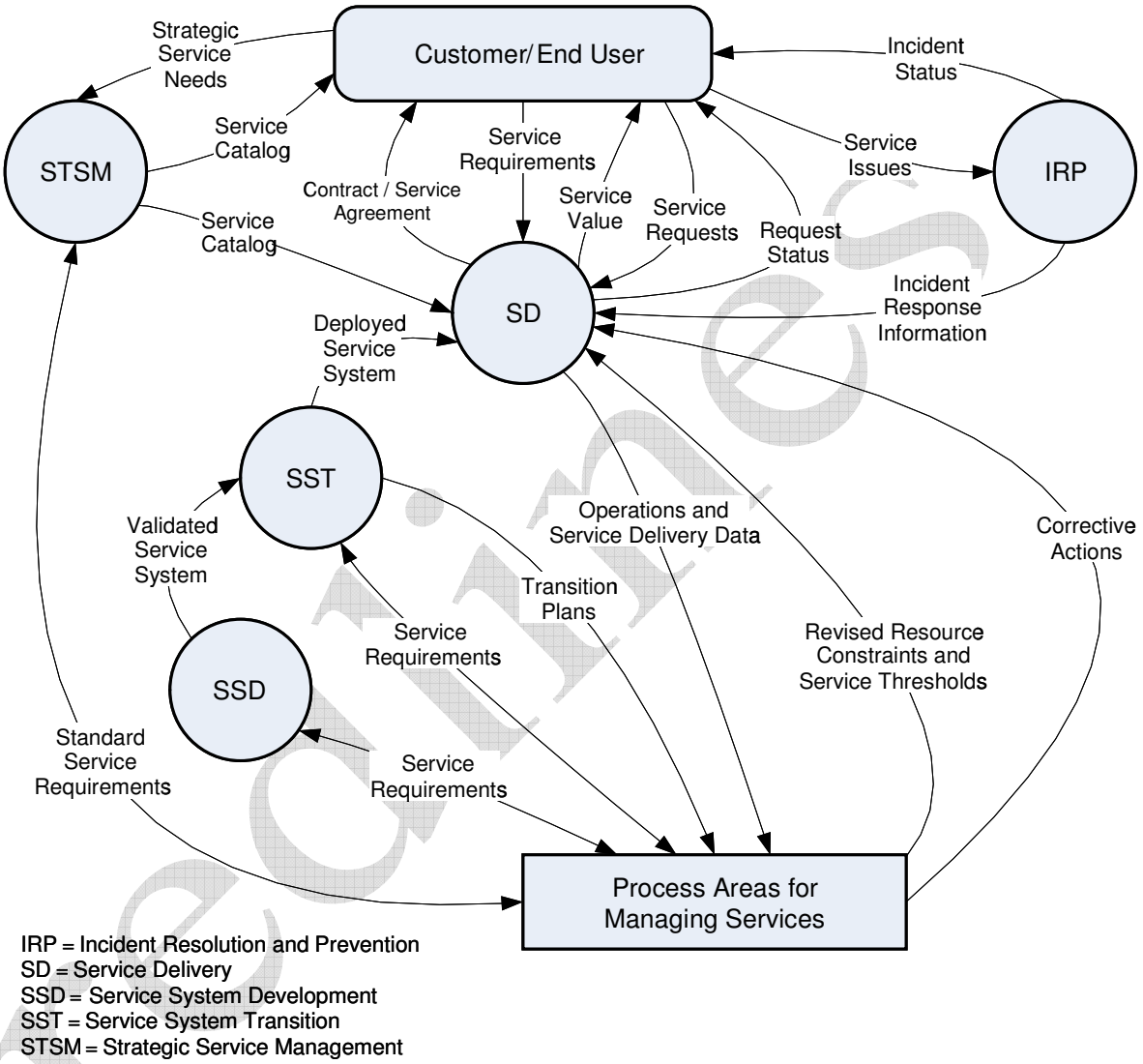


Figure 4.1: Key Process Area Relationships for Establishing and Delivering Services

All of the process areas shown in this diagram are in the Service Establishment and Delivery process area category. Note that the Service Delivery process area occupies a central role in these relationships.

Relationships that Drive Service Management

Figure 4.2 shows process areas associated with the management of services at the project level. Most of the process areas shown in this diagram are in the Project Management process area category, with the exception of Service Delivery. The reason that this diagram refers to "service management" rather than "project management" is that the Service Delivery process area contributes both to Project Management as well as to Service Establishment and Delivery, but can only be part of a single process area category in a CMMI model. Since Service Delivery is formally categorized in the Service Establishment and Delivery process area category, its inclusion in this figure means that *project management* is not a sufficiently broad description for what is shown.

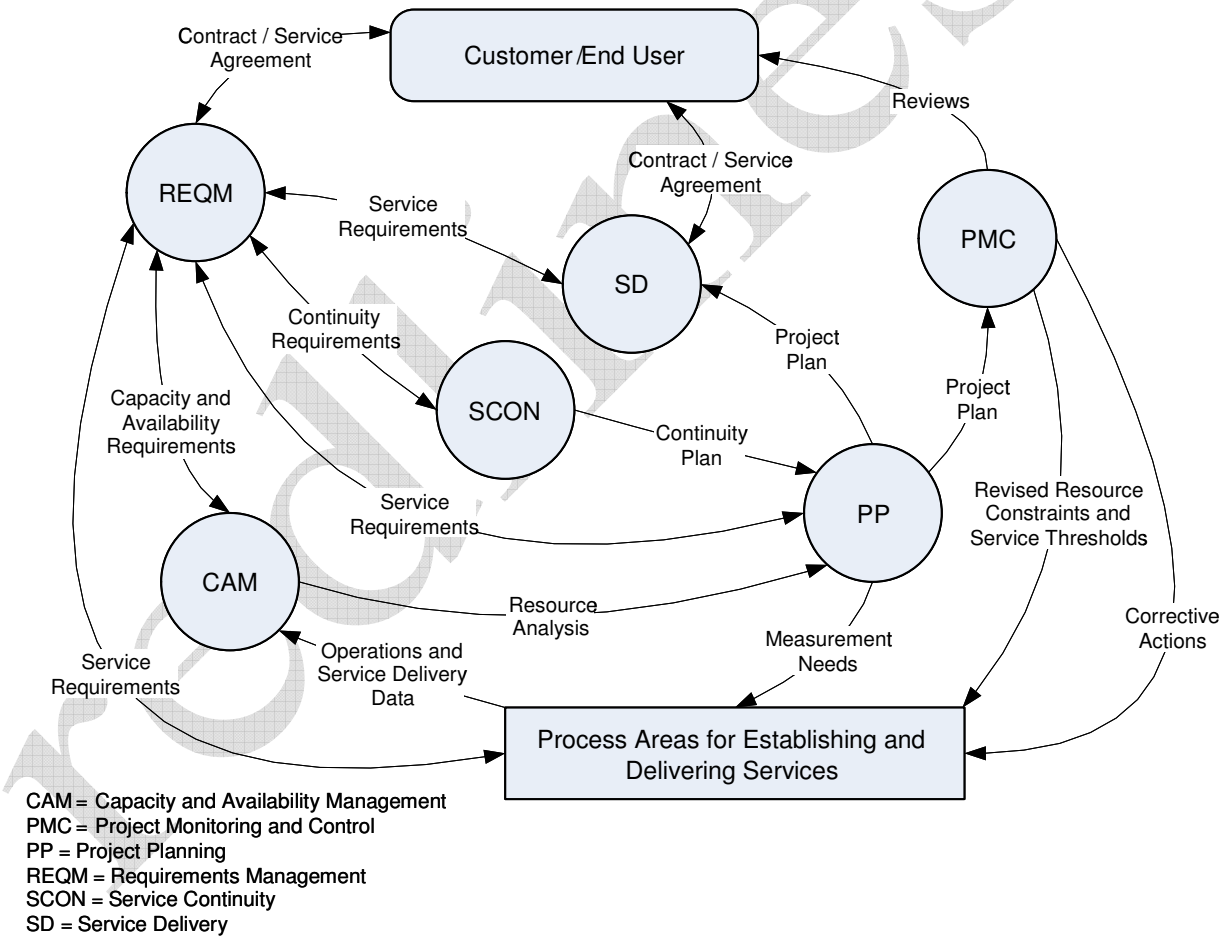


Figure 4.2: Key Process Area Relationships for Service Management