

Chapter 3

Business Activity model

What are business activities?

A business activity as defined in PSLX is a unit of business that is necessary from a manufacturing perspective. Many other system architectures have similar definitions, but those classify activities in a top-down manner, because they have modules of information systems according to a descending hierarchy of activities. Instead, PSLX Consortium focuses on bottom-up approaches, in which various kinds of exceptional information are involved.

PSLX business activities have to deal with all decision-making information related to planning and scheduling. In other words, such business activities are all about business processes based on plant floor management. In particular, management of detailed information, which has life cycles including creation, revision and disposition on plant floors,

should be carried out in PSLX business activities.

Granularity of business activities corresponds to the unit sizes of business process elements. This is different from the activities in UML activity models. Business activities cannot have hierarchy, and are defined without any overlap between them. Mapping from an activity of real-world problems to a model of business activities may feature multiple paths.

Each business activity has at least one “use case”, which is a sequence of actions for achieving certain objectives within the business activity. Use cases define interactions between circumstances and the business unit that is in charge of the business activity. The interactions incorporate physical processing and information processing.

When there is a need for certain use cases to interact with other use cases in different business activities, those interactions across business activities are defined as “collaboration”. There can be a huge variety of collaborations in real-world business. Therefore, PSLX defines only the typical and useful collaborations in the specifications.

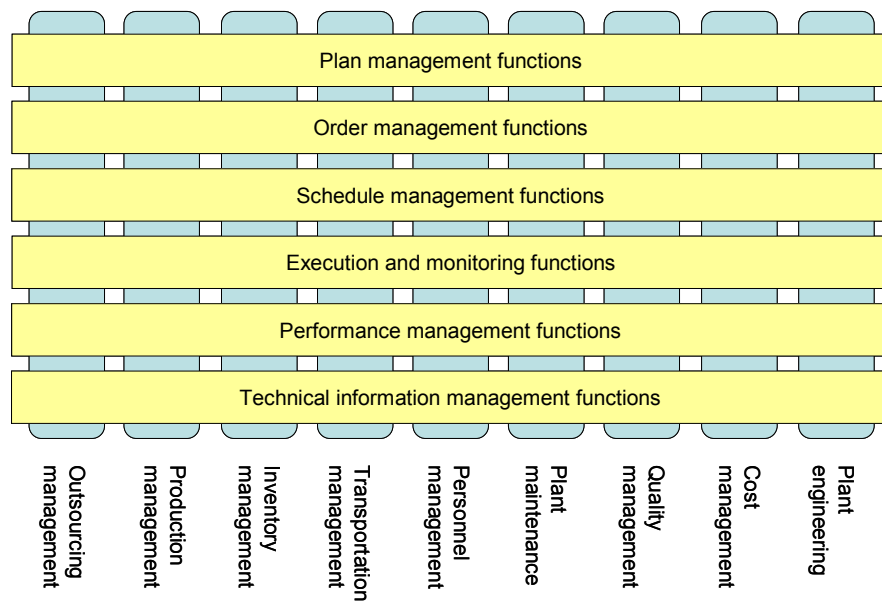
Business activity model

In order to define business activities as a PSLX specification, two comprehensive views are introduced. First, an administrative view shows particular objectives depending on the different business aspects. Groups divided according to the administrative view have their own information depending on the business context, making it easy to create a business organization with respect to this view. Outsourcing management, production management, inventory management, transportation management, personnel management, plant maintenance, quality management, cost management, and plant engineering are addressed in the administrative view.

The second view is a functional view, which is complementarily defined to classify more detailed functions in manufacturers' business processes. This shows functional aspects of decision-making, such as how each activity relates to planning and scheduling. The functional view of PSLX includes plan management functions, order management functions, schedule management functions, execution management functions, performance management functions, and technical information management functions.

Relationships between the administrative view and the functional view can be established for every combination of each of those two. In other words, each node in the 9 X 6 matrix, shown in Fig. 3-1, is the intersection between the administrative view and the functional view, respectively. Business activities defined by PSLX are a conceptual classification of business activities, corresponding to these 54 areas of intersection.

Fig. 3-1
Granularity of
business
activities



Depending on industrial segments, PSLX tries to define particular use cases for each business activity. At the same time, data models necessary for each business activity and corresponding interfaces for collaboration among business activities are defined in PSLX. Collaborations are either vertical, which is within an administrative view,

or horizontal, which is within a functional view. Use cases, data models, interfaces and collaborations are not mandatory but are very useful in the design and review processes of system development to realize interoperability between software applications across enterprise business processes.

Administrative view of activities

This section briefly introduces the administrative view of business activities. The following nine administrative groups are defined:

(1) Outsourcing management

Outsourcing management deals with activities conducted outside the enterprise, such as parts suppliers and manufacturing service providers. Activities in which control of detailed operations resides with other companies are managed, even if they are geographically located within the factory. This management is concerned with not only the purchasing of supply parts and materials, but also procurement of production resources such as equipment, personnel and tools.

(2) Production management

In production management, the target activities are various operations that transform parts or materials into other valuable items by changing their shapes and qualities. For these operations, efficient use of manufacturing resources such as equipment and personnel is organized to meet production orders. This includes dispatching of production work orders, Takt time monitoring and throughput control, bottleneck process management, work-in-progress inventory or Kanban control, etc.

(3) Inventory management

The quantity and status of all items produced or consumed by production processes are managed by inventory management. Those processes include all related operations from the point of receiving materials made by suppliers to the point of delivering products to customers. Materials inventory, finished product inventory, and components or intermediate parts inventory in storage zones are effectively controlled by managing their issue orders.

(4) Transportation management

Consistent with production, transportation management makes decisions about the movement of resources and materials between different work centers or different areas of plants. Methods and routes of transportation, resources for transportation, and lot size of transportation are discussed. Inter-enterprise transfers of products or materials are also included if the delivery processes are under the control of the management. The objectives are to provide the right quantity of right items to the right place, at the right time.

(5) Personnel management

Personnel management deals with every person who is responsible for a production process, either directly or indirectly. It covers the working hours and performance of each worker, qualifications and skills for particular operations, shift and group assignments, standard time analysis, training and instruction, etc. Maximizing the output of every worker in the enterprise is the goal of this management process.

(6) Plant maintenance

Plant maintenance activities focus on maintaining the performance of plant floor resources as designed. In order to do this, plant maintenance deals with monitoring and tracking of resource status, historical data on

resources, preventive action for malfunctions, analysis of performance data, utility and supply parts for equipment, inspection schedules, etc. In the event of accidents or malfunctions, plant maintenance activities operate to remedy problems as soon as possible.

(7) Quality management

In order to improve the quality of products and processes, quality management operates to eliminate errors that could reduce quality below the designed level. The targets of quality inspections are not only products and materials, but also include production processes and their resources and methods. For example, Total Quality Control (TQC) activities detect the sources of problems, using statistical analysis, and implement remedies to improve quality.

(8) Cost management

Cost management considers appropriate resource investment for equipment and personnel, in terms of cost and throughput. The performance of each resource is monitored relative to the designed specification and accounting information. Cost management can also deal with strategic decision-making for dynamic pricing in accordance with market reaction to the product. This requires knowledge of the real production cost of the product.

(9) Plant engineering

Plant engineering constructs actual plant and production processes that produce the products required by customers. Based on substantial engineering knowledge and experience, plant engineering manages and executes the development of a trial line for preliminary production. It also deals with improving the performance of the final production line for customer products. Information necessary for production and maintenance, such as instruction manuals, equipment specification documents, and engineering drafts are prepared.

Functional view of activities

The functional view of business activities defines horizontal aspects across every element of the administrative view. Functions addressed in this view are:

(1) Plan management functions

Long- or medium-term activities are managed by plan management functions. Target parameters to be achieved by activities are defined for each time phase (days, weeks, or months). Plan management functions operate to develop a plan, revise a plan, compare the plan against the result, store the history of the plan, etc. They also facilitate collaboration and coordination between enterprise divisions, to achieve enterprise-wide optimization.

(2) Order management functions

For each administrative element, orders to request particular actions are managed by order management functions. Orders include incoming and outgoing external orders, as well as internal orders created to provide greater detail. Order management functions create and revise orders and their relations, dealing with the reliability and probability of orders, which can change according to circumstances.

(3) Schedule management functions

Actions related to administrative activities require both resources and removal of constraints on execution. In particular, potential conflict between different actions should be resolved in advance. Schedule management functions are defined as scheduling activities on plant floors, taking into account various constraints and objectives. They also manage the results of such scheduling to collaborate with other administrative activities.

(4) Execution and monitoring functions

Taking into account real-world states, actions and operations on plant floors are finally executed in accordance with a schedule. Execution and monitoring functions manage these processes, and also monitor their performance. When exceptions are detected, they implement predefined procedures to remedy any problems and, where necessary, request revision of the schedule. Subsequently, a report on the event is forwarded to relevant business divisions.

(5) Performance management functions

Actions and operations carried out on the plant floor are recorded and their histories are filed for possible future reference. Data gathered from plant floors comprise information appropriate to requirements, which is duly aggregated and analyzed from various standpoints. Data obtained are also valuable in tracing materials flows in the plant in order to identify the causes of particular problems. Evidence of quality assurance also requires these data.

(6) Technical information management functions

These functions manage technical information for each administrative element. Technical information includes parameters or indicators for evaluation, specifications of products and processes, documents and engineering drafts, operation manuals, etc. These data are managed in conjunction with their revision history. Technical information that needs to be shared between different business divisions is managed with respect to consistency, negotiation with stakeholders, and data security.

Business transactions between activities

As mentioned in previous sections, PSLX defines nine categories under the administrative view and six categories under the functional view, which are aggregated to fifty-four elements of business activities. There are at least 54 X 53 potential combinations of types of data transactions between these business activities. In order to reduce complexity, the number of combinations is reduced by applying a rule that permits data exchange only if the two parties are in the same category. Thus, data transactions within the same category in the administrative view, or within the same category in the functional view, can be defined. In addition, some transaction combinations are ignored, depending on the context of the actual business situation.

Transactions between business activities are defined as special cases of collaboration, since business activities can collaborate with others in the same category under the administrative view or the functional view. Collaboration within the same category under the administrative view is referred to as vertical collaboration, while collaboration under the same functional view is referred to as horizontal collaboration.

As a general rule, a description using UML collaboration models contains several transactions between two or more actors. However, PSLX allows definition of transactions as common specifications to compose various collaborations in practical business processes, such as:

(1) Invoking a receiver's activities

This is a case where one activity invokes a use case of another activity. This transaction can initiate a particular use case or resume from a breakpoint in a use case that is executing in different activities. The initiator needs to send detailed information on options and preferences to invoke the functions, while the reactor responds with the results of execution of the request.

(2) Pulling information for sender's activities

This is a case where one business activity requests certain information from other activities. An information query is a typical example. In this transaction, information is either stored in a certain place managed by the other activity, created for each request using stored data, or obtained through further collaboration with another activity.

(3) Pushing information for receiver's activities

In this case, one business activity sends information to the other. Recipient business activities need to have a mechanism for reacting to any requests from initiators of such a transaction, including a rejection mechanism. An initiator sends information to the reactor with additional information to identify the context of data for interpretation in a particular business situation.

The three transaction patterns described above are types of business protocols of collaboration between different business components. This should be distinguished from data communication protocols such as TCP/IP and SOAP, which are beyond the scope of this specification. It is also necessary to define security-related protocols; however, PSLX does not have a specification for security.

In PSLX specifications, business collaborations are defined at the business transaction level, rather than being complete definitions of business collaboration. However, it will soon be possible to access information on this subject as a result of publication of PSLX business collaboration best practices.