Chapter 6

Requirements Engineering

LEARNING OBJECTIVES

After reading this chapter, you will be able to understand:

- What is requirements engineering?
- Document requirements using the following
  - Structured English
  - Event process chains by SAP
  - Object-oriented modelling
  - Object Process Model
  - Data Activity Model for Configuration (DAMC)

6.1 INTRODUCTION

As mentioned in Chapter 2, an ERP implementation has multiple phases (refer to Figure 2.1). This chapter concerns the second phase of ERP implementation namely requirements engineering (RE). This phase is also referred to as creation of business blueprint. In the RE phase, needs of different stakeholders are identified and documented using some standard modelling technique for subsequent communication and realization purpose. This phase consist of requirements elicitation, requirements representation and requirements validation. Requirements are gathered from customers, system users and others who have a stake in the system during requirements elicitation phase. Requirements are represented through various models.

An ERP system automates and integrates business processes across the organization. Therefore, requirements are expressed in terms of business processes that are being considered for inclusion in ERP system. Defining and documenting the requirements involve the following:

- Establishing a high-level project scope by working with senior executives to determine the processes to be included in the ERP implementation.
- Establish ownership for the business processes included in the ERP implementation.
- Designate team leaders for documenting business processes.
- Produce business process documents.

As described in Chapter 1, an organization and its business processes evolve over a period of time. Business processes may not be documented or the documents may not be up-to-

date. It is a challenging task to gather requirements for ERP system. But once business blueprints are created, they can be used for multiple purposes.

- Use these documents to invite quotations or bids from the perspective ERP vendors.
- These documents serve as baseline documents for establishing the gap between the solution offered by the vendor and the requirements. One would like to select an ERP solution with minimum gap. The gap is a factor in the ERP implementation risk, time and cost.
- These documents are used as reference for ERP configuration.
- These documents also serve as reference in education and training.
- In future, if a change is required in a business process, these documents serve as reference documents, a new version of the document is created and a log is maintained.

A big question is whether *an organization should model its business processes from the scratch or not*. Modelling business processes of an organization is expensive and time consuming. If the organization has never documented its processes, its staff may not have modelling expertise. Simple mistakes such as focusing on functions rather than processes can render the whole effort worthless. For example, if modelling focuses on individual's activities rather than the processes of the organization, the model will unnecessarily proliferate and the larger picture may be lost. Sometimes, an amateur may misrepresent processes specially in the absence of any documentation.

An alternative is to do a preliminary shortlisting of potential ERP vendors and then choose business models of one of the vendors as reference. Business process modelling involves identifying the common components, adding the missing components and deleting extra/irrelevant components. The advantages of this approach are easy gap analysis and communication with the vendor because of the common reference.

Some researchers oppose the idea of using an ERP specific modelling technique; rightly so, since the issue addressed by the enterprise requirements are independent of the specific ERP package.

All companies manging from small and medium enterprises (SMEs) to large, seem to gather basic information about ERP vendors and then shortlist them based on some very high level factors such as their past clients, implementation time and cost, etc. Then the requirements are documented using either structured English or questions (discussed in Section 6.2). The shortlisted vendors are asked to make a presentation. Equipped with a reasonable knowledge of the systems, they make a selection by analysing the prototype, examination by consultants and/or taking the studies done by companies like Gartner etc. The vendor is then involved in modelling the business processes using its own modelling techniques.

Another approach is to pick an ERP solution that has minimum gap and then adapt its business processes discarding the existing business processes of the organization. This approach is referred to as IT-driven re-engineering. Business process re-engineering is discussed in Chapter 7.

Irrespective of the approach taken for modelling the business processes, it is a good idea

to start with critical business processes. Business processes that give competitive advantage to an organization are referred to as critical business processes. These processes are added to the requirements first, and in the next iteration more generic requirements are added. The generic processes will be supported by almost all ERP solutions.

The business blueprints will have to be managed and maintained to counter the following problems:

- **Simultaneous update:** Multiple persons may have to work separately on the same document or different parts of the document. If everybody works on the same copy, the last one to make changes may easily destroy the work of others.
- **Shared document**: If multiple copies of the document are created, a change in one copy may not reflect in all other copies.
- **Common document**: A document that has been finalized becomes a reference document and multiple people may refer to it. If for some reason, a change is made to the reference document, every user must be informed. That means someone has to know who all are affected by the change in the reference document.
- **Versions**: A change in the document may fix one issue but may introduce another one. Sometimes, one may have to go back to what was discussed and rejected earlier.

The primary requirement is management of documents including sharing, version and change management. A librarian will manage the documents. Once a document is finalized and becomes part of the library, it cannot be changed casually. The change has to be justified, costed and approved by the concerned authority. The change approval strategy has to be worked out a priori. The librarian has to maintain record of all references (people and documents) to the documents in the library. In case, a document from the library is changed, all concerned people are informed (a policy is required to know how changes are communicated) and all documents are cross checked for any conflicts or discrepancy. The documents such as requirement documents, re-engineering documents, test plan and technology documents are all maintained by the librarian. Thumb rule is that all the documents that go through multiple revisions, developed by multiple people and refereed to by multiple people and documents should be maintained and managed.

ERP vendors offer help for modelling business processes using their own reference models. For instance, SAP suggests that you model your business processes using their reference EPC models (discussed in Section 6.3). Some techniques used for capturing requirements are discussed next.

6.2 STRUCTURED ENGLISH AND STRUCTURED INTERVIEWS

SMEs do not adopt any formal method for modelling their processes. Often times, the inhouse team may not have skillset to undertake the business process modelling task. They rely on the implementation partner to a greater extent. Recall that an ERP implementation involves a vendor (who supplies the ERP software), an implementation partner (who configures the ERP software according to the business needs of the client) and a consultant (who advises the client and protects the client's interests). In the beginning, the client team prepares an informal description of their processes by talking to business

process owners. In SMEs, processes are mostly people centric. On a visit to two SMEs in Kanpur, and after having discussion with their project leader and implementation leaders, it was found that they did not use any specific modelling technique. Incidentally, processes were not documented anywhere and it was a challenge to get a description of the business processes. Employees were the business process owners who showed some resistance (refer to Chapter 4) in sharing their business processes with the implementation partner and the consultant.

One popular method for capturing requirements informally is through structured interviews. The client will need to detail company profile and processes. Some of this information may seem trivial but it is important for the vendors and consultants to understand the organization. A set of high-level questions for capturing the organization structure that are seen across client organizations, software vendors and consultants is shown in Figure 6.1.

1. Type of industry
2. The products and services provided (has a bearing on implementation complexity and cost)
3. Number of employees (license cost)
4. Vision statement (for aligning ERP with vision of the company)
5. Mission statement (ERP methodology must match with mission)
6. List and prioritize business area (all three parties need to understand business priorities)
7. Prioritize business area for improvement (required for re-engineering)
8. Organization structure (ERP maps organizational structure)
9. Relationship among businesses (ERP needs this information)
10. Geographical locations (ERP, hardware and networking needs this information)
11. Accounting profile (ERP setup this information)
12. Accounting calendars (ERP setup this information)
13. Currencies and conversion policy (ERP setup needs this information, client and vendor will also need this information for gap analysis)
14. Naming/Numbering standards (ERP setup needs this information, client and vendor will also need this Information for gap analysis)
15. Business functions that are performed centrally
16. Naming/Numbering standards (ERP setup needs this information, client and vendor will also need this information to check gap)
17. Business functions that are performed by each business unit (ERP setup needs this information, client and vendor will also need this Information to check gap)

FIGURE 6.1 Questions for Capturing the Organization Structure Using Structured English

To summarize, a written document about organization's vision, mission and structure provides a common baseline to the clients, the vendors and the consultants. During the process, the client gains a better understanding of its organization. The next step is to detail each process that will be included in the ERP implementation using structured interviews and recording the responses using structured English. A sample set of questions for material requirement planning process of a manufacturing organization is shown in Figure 6.2.

These questions partially capture MRP process of an organization. This list of questions is not exhaustive. An organization will come up with questions to represent their own concerns and process specific details. One can add another 30 questions easily. The questions and their answers are organization specific but vendor independent. Structured interviews may compliment any of the formal techniques for capturing requirements.

6.3 EVENT-DRIVEN PROCESS CHAINS

We already know that SAP is the largest ERP company. SAP has its own proprietary modelling technique called event-driven process chain (EPC).

SAP uses EPC as basic modelling technique. An EPC captures tasks or functions (what should be done), events (when should something be done), organization (who should perform the task) and communication (what information is required to perform the task). In EPC diagrams, events are passive elements. They describe the circumstances that trigger a function. Examples of events are sales order entered, stock not available, quality test failed, etc. In the EPC diagrams, an event is represented as a hexagon. Functions are active elements in EPC. They model the tasks or activities within the company. Examples of functions are create sales order and check stock. A function is represented as a rounded rectangle. A function in EPC diagram may end with more than one mutually exclusive events. There are objects such as information, material or resource objects that portray objects from the real world. A function may use these objects as input or may produce them as its output. Examples are material data, purchase order data, etc. An object is represented as a rectangle. The organizational unit that performs the activity is represented as an oval. Example organization units are sales department, purchase department, quality department, etc.

- How is a purchase order created?
- How planned purchase orders are executed? Possibilities are
  - Automatically go to a specific vendor.
  - Automatically become part of a master order.
- Is purchasing decentralized?
- Does material requirement planning tales sales orders into account?
- What is the nature of your requirements—seasonal, highly variable etc.?
- Does raw material change from season to season?
- Do you stock material to respond to seasonal requirements?
- How long is the typical forecast cycle?
- Is forecast algorithm automated or human intervention is allowed?
- Does capacity play a role in MRP?
- Does MRP take input from demand forecast, on hand stock, order policy, safety stock policy etc?
- Can planner change planned orders?
- Do you have multiple distribution centre?
- How do you store material? Is it a networked warehouse?
- Do you run any MRP simulations?
- Do you keep track of individual inventory at different locations?
- Do you have flexibility in estimating material requirements?
- Do you setup vendor schedule?
- How is vendor selection done?
- How does a purchase requisition get converted into a purchase order?

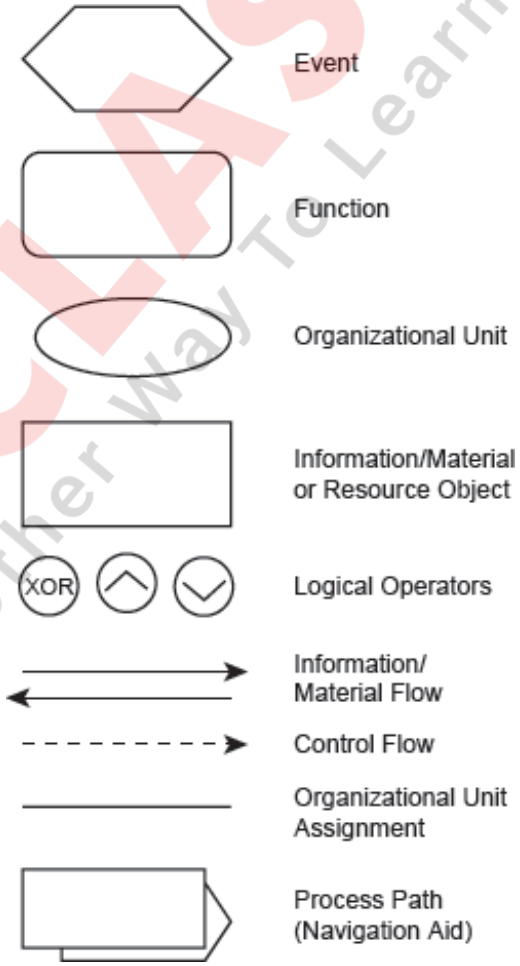
FIGURE 6.2 Questions for Finding About the Purchase Process of an Organization

A control flow connects events with functions creating chronological sequence and logical interdependencies between them. A control flow is represented as a dashed arrow.

Information flow shows connection of a function with input and output objects. Input objects are read, and the output objects are changed or created. Information flow is represented as a solid arrow. The legends are shown in Figure 6.3. The sales and order processes using EPC are shown in Figure 6.4. EPC shown in Figure 6.4 is not a standard reference model of SAP. It is a generic process. For reference model of SAP, the book on SAP business blueprint can be referred.

This process creates a sales order for a particular customer after verifying their credit limit. Then the availability of items is checked. If items are available, the material is packed and dispatched updating the inventory. Customer invoice is created and the financial records are updated. If ordered items are not available, they have to be procured from the vendor by first creating a purchase requisition and then converting it to a purchase order. The purchase order will be given to a selected vendor who will supply goods. The received goods/items go through a quality check and finally goods receipt is created. Inventory is also updated. When invoice is received from the vendor, payment is made and necessary postings to the financial accounts are also made. The pending sales orders can now be processed.

FIGURE 6.3 EPC Legends



Each function in EPC accesses global data and communicates with other functions through global data. EPC reference models can be viewed in the following four different ways.

1. **Component model:** Component model captures all the functions performed by an organization. If we retain only the functions that are performed and do away with all other details contained in an EPC, then a component view is seen. A component view looks like a tree that may have multiple levels as follows.
    - Level 0 describes an application as a whole.
    - Level 1 contains the functional areas covered by the application.
    - Level 2 contains the main tasks of a given functional area.
    - Level 3 contains the individual tasks performed within the scope of a main function from the reference models.

    Figure 6.5 shows a partial component model of a company that trades stationary.

2. **Organization model:** The organizational model captures the structure of the organization. An organization is divided into functional units and business units. A functional unit may have further divisions such as departments or cells, etc. An organizational map, which also looks like a tree, shows the relationships among the organizational units. The organizational map serves as a reference for organization restructuring. The organizational model also serves as a reference for deciding different levels of access required at different levels of hierarchy. Figure 6.6 shows a partial organizational model of a company that trades stationary. This company has units to manage sales, purchase and warehouse. There would be other units that have not shown. Each unit may have further subunits. Such a figure captures the organizational structure and the division of responsibilities.

3. **Data model:** The data required by functions is captured by the data model. The model that SAP uses is different from the standard techniques such as entity relationship diagrams (ER) or extended ER diagrams. The data/information and resources are represented as rectangles. Arrows are used to show specialization/generalization and a two-headed arrow with a stroke is used to show a relationship between data entities. In Figure 6.7, a customer could be an orderer, a receiver of the goods or a debitor. A customer is associated with an account that could be a general ledger account (payable/receivable).
4. **Interaction model**: Firstly, it is required to club together the functions that an organizational unit performs, then an interaction map to show interaction between organizational units is created. No details are included in the interaction map. For example, a customer interacts with sales units of the organization and sales unit interacts with accounting. An interaction map shown in Figure 6.8 captures these interactions.

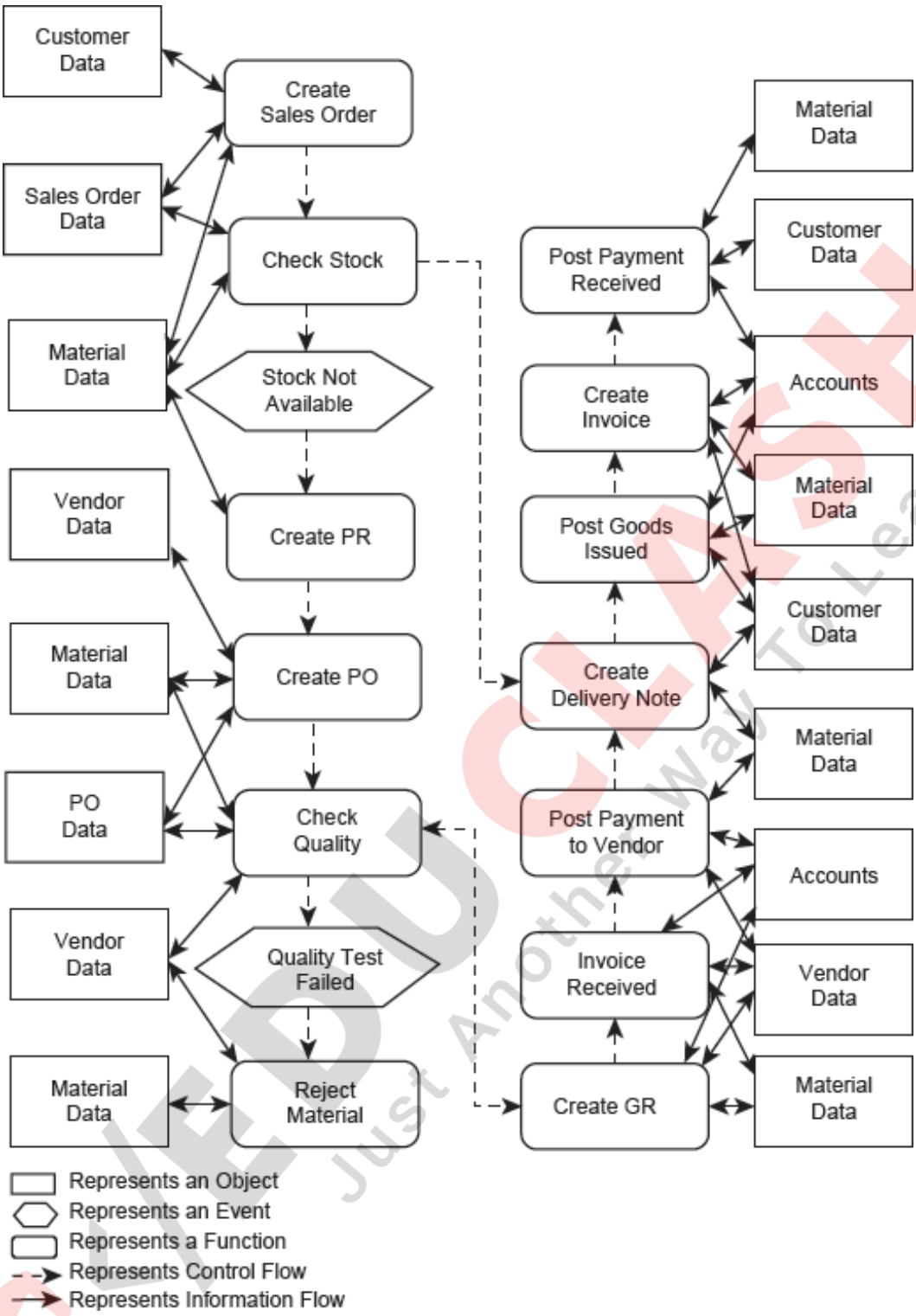


FIGURE 6.4 Event Process Chain for Sales and Order Process

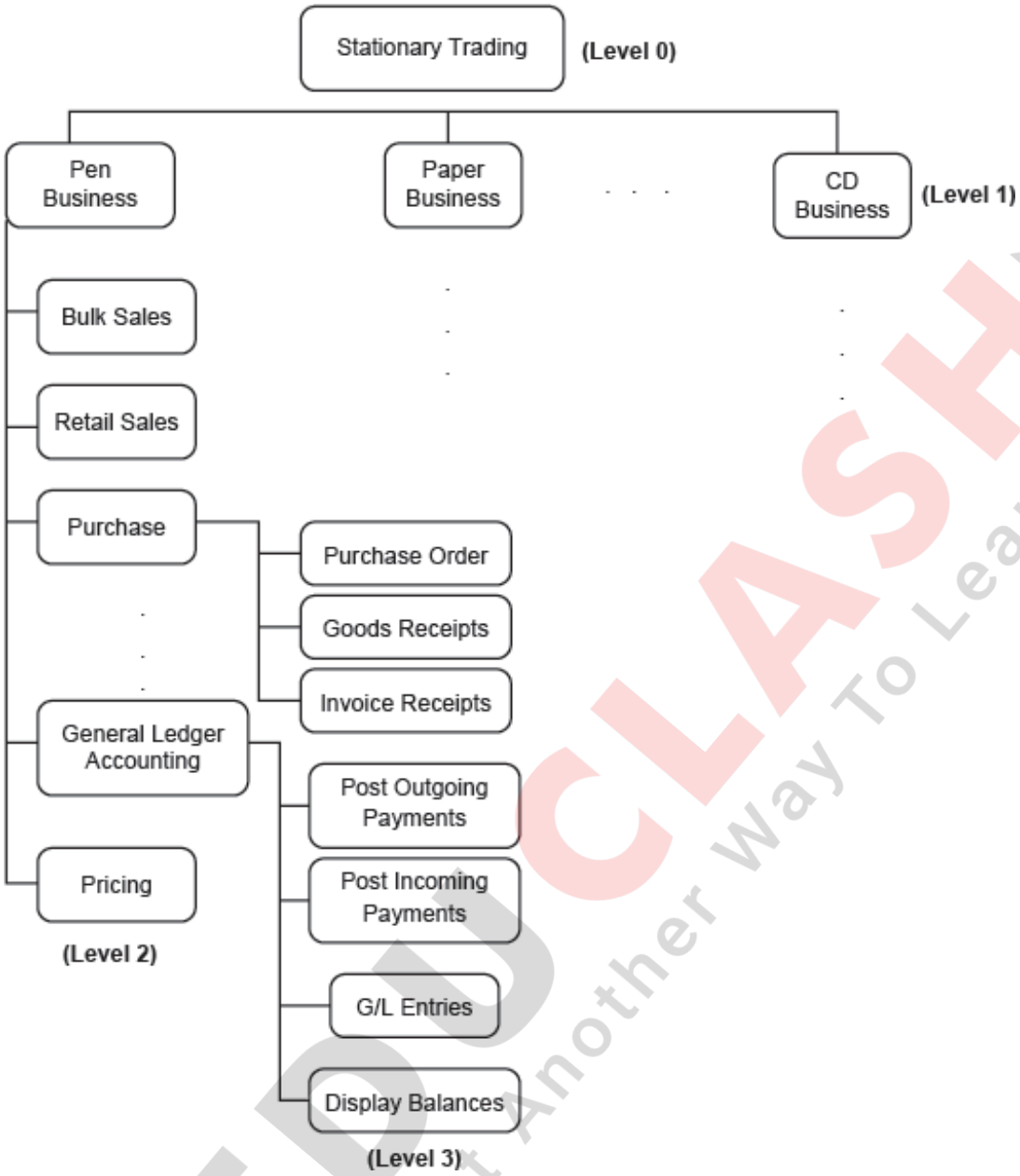


FIGURE 6.5 Component Model (Partial) of a Stationary Trading Business

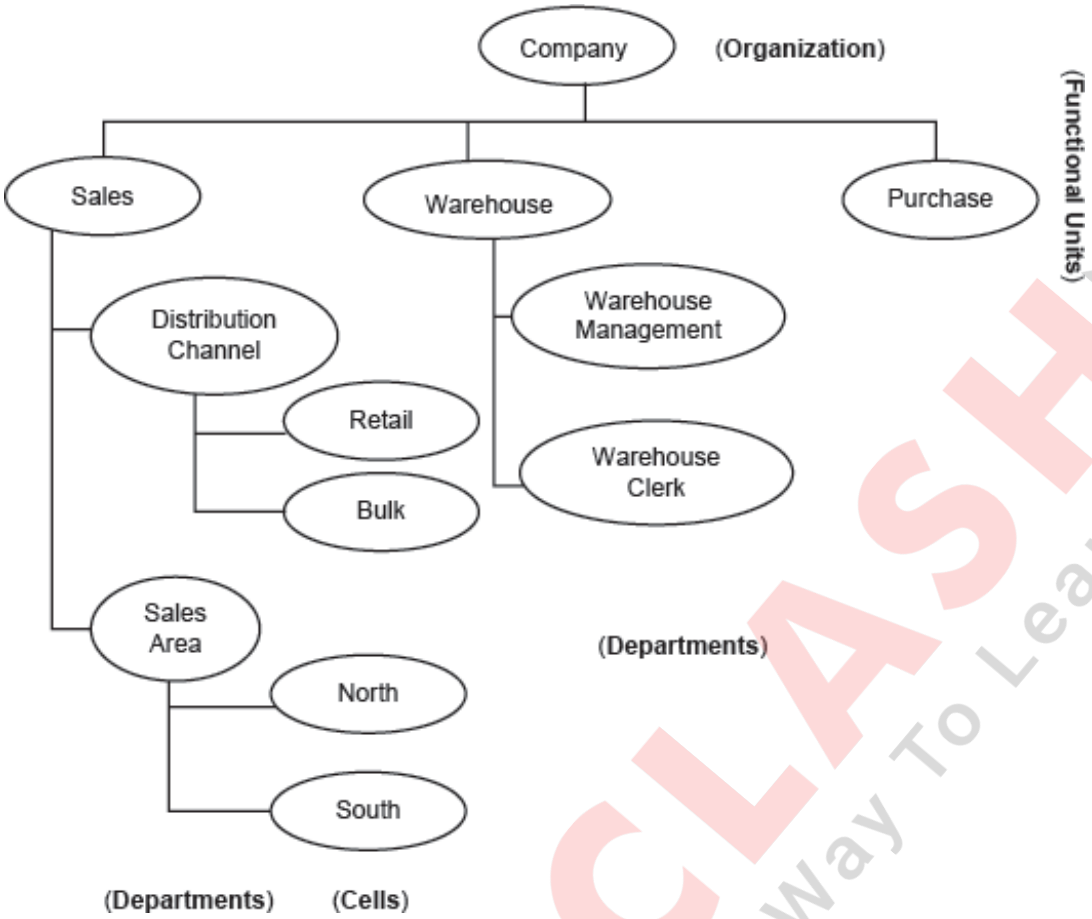


FIGURE 6.6 Organizational Model (Partial) of a Stationary Trading Business

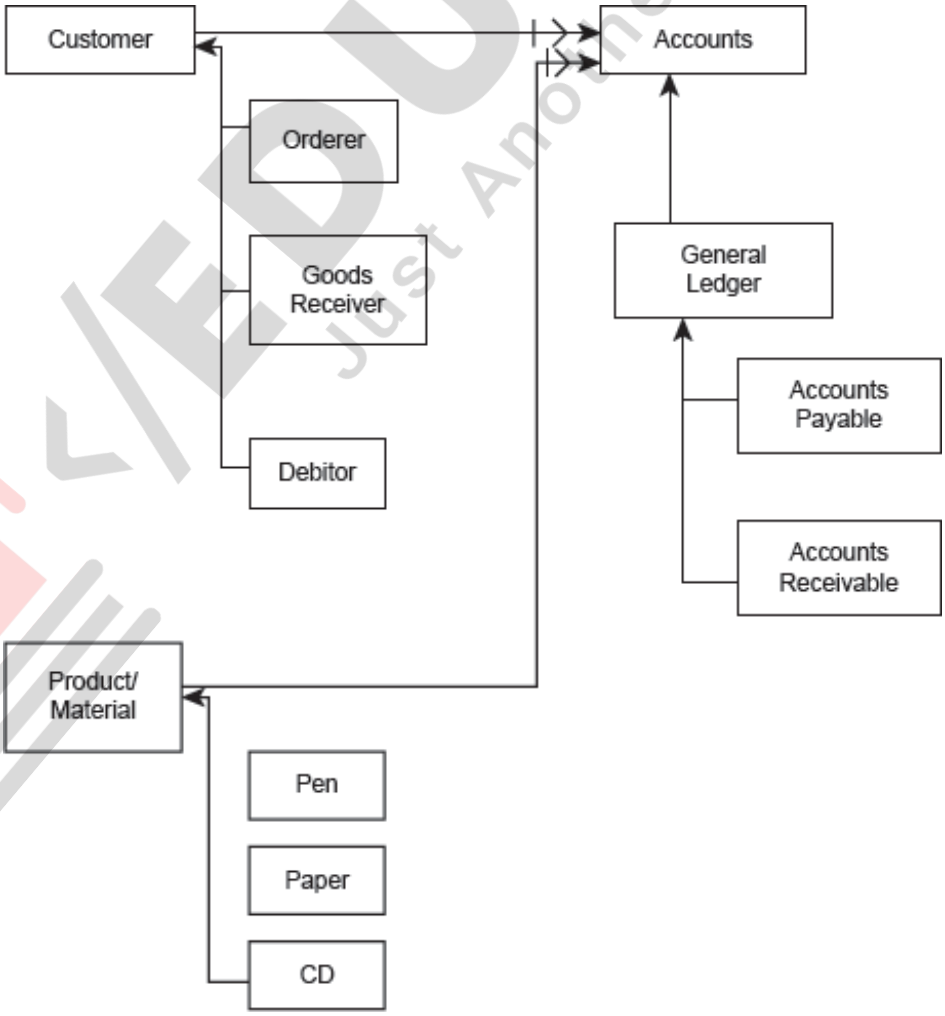


FIGURE 6.7 Data Model (Partial) of a Stationary Trading Business

Variation of EPC called configurable EPC also exists in which a function can be marked as optional. SAP has 3,000 reference business processes represented as EPC models. SAP claims that these reference models capture best business practices followed across the globe. An organization should be able to find almost all of their business processes among these reference models. These models include business processes from all business units of an organization such as financial accounting, inventory management, organizational management, plant maintenance, procurement, production planning, project management, quality management, sales and distribution, etc. There are multiple versions of the same process to cover variations in the processes. SAP also claims that their reference models cover all options for a process and these represent best practices. If a client is doing a process in any other way, they should consider changing their business process. The question whether an organization should change its process or not falls under the general discipline of business process re-engineering. Business process re-engineering is discussed in Chapter 7.

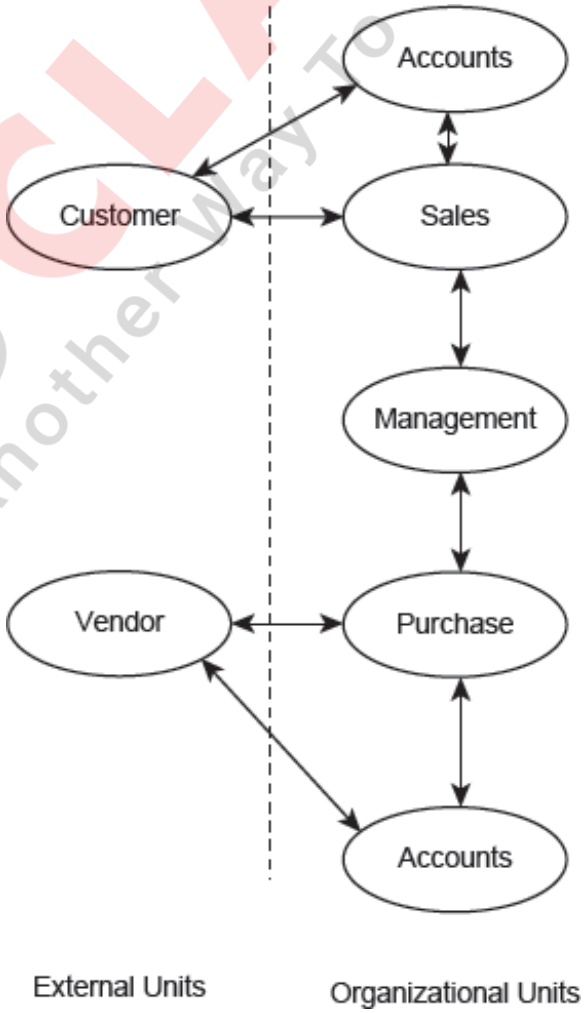


FIGURE 6.8 Interaction Model (Partial) of a Stationary Trading Business

6.4 OBJECT-ORIENTED MODEL

It is observed that 70 per cent or more of flow within an organization (manufacturing or service) is information. This result confirms the claim by Toffler, that we are living in an information society and organizations have become *information organizations*. For a business process, data is important and a business process should be analysed in terms of data and information that it modifies. Data is an important constituent of business processes and one needs to look at how data is defined, created, modified and used. In fact, enterprise resource planning software models an organization in terms of data and their relationships, and a set of functions that operate on the data.

Object-oriented (OO) model supports this view point and focuses on the data entities. The building block of OO model is named class that consists of data and methods (functions) that operate on the data. A class has relationship with other classes and interacts with other classes. A class may request another class to perform some action and/or provide data. The modelling may proceed in two different ways:

- **View integration approach:** Translate informal individual requirements into formal representation and merge.
- **Centralized schema design approach:** Merge informal individual requirements and

then create formal representation.

Since OO modelling technique is not directly supported by any of the major ERP players, no reference models would be available. Starting point for capturing requirements would be legacy systems if they exist. The existing documents explaining the existing business processes may also provide inputs to the requirement gathering phase. The team who is creating OO model may also interview the business process owners (BPOs) for details. It is important to make the BPOs feel comfortable during the interviews. BPOs would open up and tell the details, strong points, trouble spots and bottlenecks only if they do not feel intimidated, undermined or threatened. The team consolidates information gathered from all sources. It remains a challenge to filter out what is information and what is not; what is to be retained and what is to be discarded.

The legends used in an OO model are shown in figures 6.9 and 6.10. There are classes or objects (shown in Figure 6.9(a)) that have attributes (or data part) and methods. A class can be specialized form of a general class (Figure 6.9(b)). The objects are related other through associations (Figure 6.9(c1) and (c2)) that have multiplicity (Figure 6.9(d) that defines the number of instances that can relate. A relationship or association may itself have attributes (refer to Figure 6.9(c3)). A class may request another class to perform functions (refer to Figure 6.9 (e1) and (e2)).

There are some guidelines that one can follow during modelling. One should start with the set of nouns that have been mentioned during interviews and found in the legacy systems. Out of the nouns with similar meanings, retain the one which is most general and descriptive. For example, out of client, buyer, receiver and payer, retain client as other words explain the role played by the client. The nouns which are out of the scope and irrelevant, are also deleted. The nouns that do not convey specific meaning and are vaguely defined should also be deleted. Nouns that describe individual objects and whose independent existence is not required are attributes that belong to an entity and not entities. For example, weight, price and colour are all attributes of an entity item. The verbs or actions are the methods or relationships. A verb that describes a relation between two classes is an association. Any dependency between two or more classes is also an association. A reference from one class to another is an association as well. Associations correspond to stative verbs, and verb phrases such as next to, part of, contained in, drives, talks to, has, supplies, works for and manages. An association should describe a structural property of the application domain, not a transient event.

Associations between entities provide path for data sharing and collaborations. Ask questions that should be answered by the model to make sure that there are enough entities, attributes and associations to answer your questions. If multiple paths exist between classes, eliminate the redundant ones. For a detailed description of OO modelling, refer to Rumbaugh et al. Figures 6.10 and 6.11 shows OO model and collaboration model for the processes shown in Figure 6.4. There are six data items namely customer data, sales order data, purchase order data, vendor data, material data and accounts in Figure 6.4. The corresponding OO model has the same classes. With each class, we have methods/functions associated that cover all functions shown in the Figure 6.4. OO model provides a different view than EPC model. These two complement each other nicely. We can also create a collaboration model as shown in Figure 6.11 to capture the interaction

among classes.

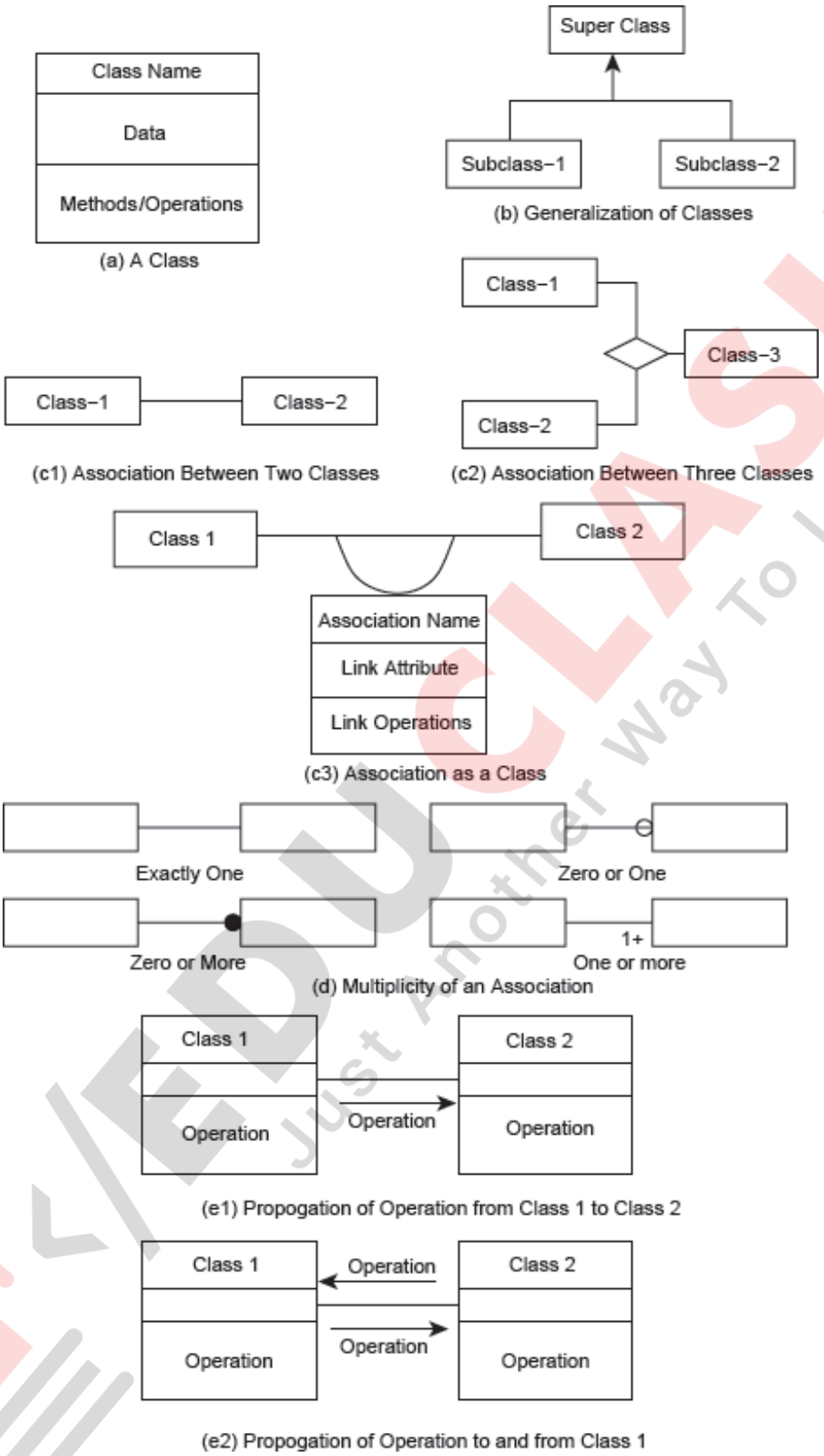
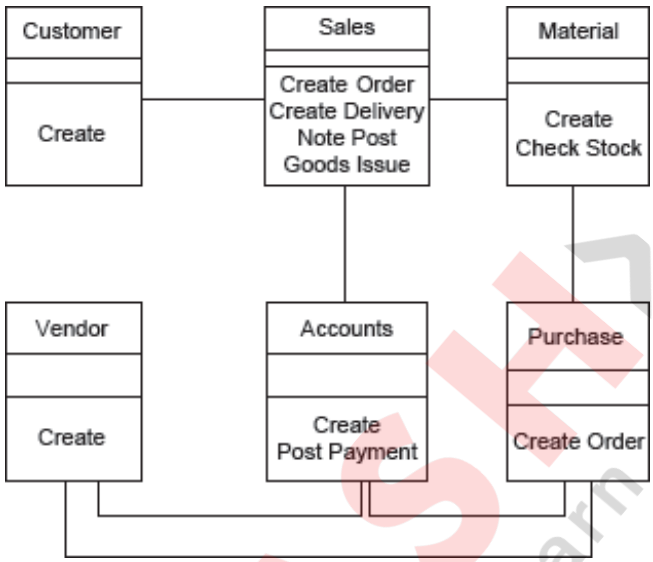


FIGURE 6.9 OO Legends

FIGURE 6.10 Example of Data Model



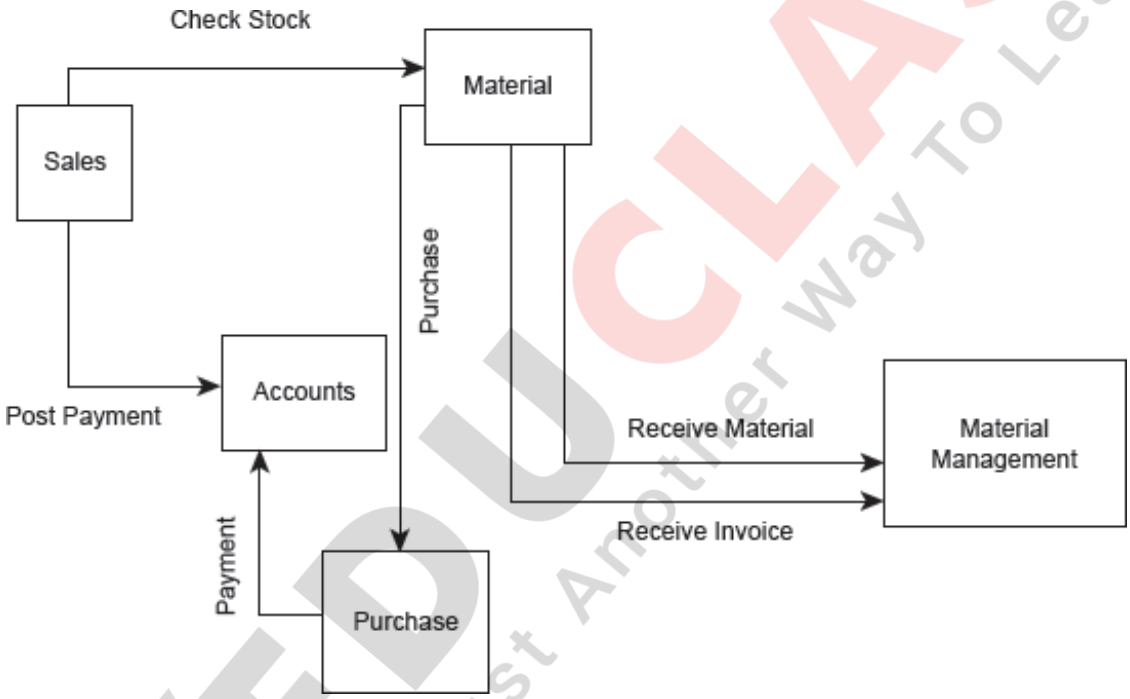


FIGURE 6.11 Example of Collaboration Model

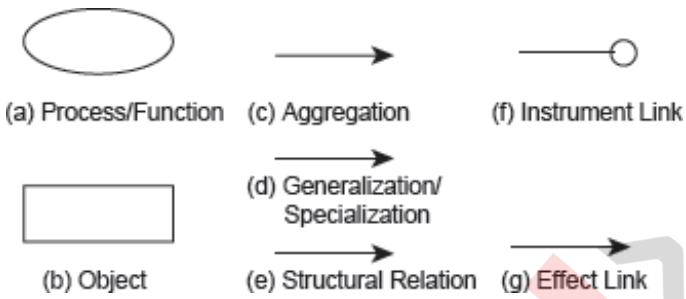
6.5 OBJECT PROCESS MODELLING

Object process modelling (OPM) captures data and processes/functions without worrying about the sequence in which processes are invoked. Basic building blocks of OPM are entities that represent processes and objects. Relationships between entities are represented by links that are either structural or procedural. The entities can be high level or abstract and an entity can be detailed in another OPM creating a top-down representation of the requirements.

OPM legends are shown in Figure 6.12. In OPM, a process is represented as an oval and an object as a rectangle (Figure 6.12(a) and (b)). An object may be linked with another object or process with a link of one of the following types:

- If many instances of an object form another object, they are linked by an aggregation link (shown in Figure 6.12(c)).

FIGURE 6.12 OPM Legends



- Two objects may have a generalization–specialization relationship. An item object is a generalization of a non-inventory items and inventory items (shown in Figure 6.12(d)).
- Two objects may have structural relationship. For instance, inventory by location and warehouse have a structural relationship (shown in Figure 6.12(e)).
- An entity may play an instrumental role for another entity. That is, if a process requires an entity to execute, then the process and entity will be linked with an instrument link (shown in Figure 6.12(f)).
- If a process modifies an object, the relationship is shown as an effect link (shown in Figure 6.12(e)).

An example OPM to handle sales order is shown in Figure 6.13. OPMs can be created at different levels of abstraction to get the desired level of details. There are some other components of OPM which are not included in the description. For a detailed treatment of OPM refer to Sturm, Dori and Shehory.

6.6 DATA ACTIVITY MODEL FOR CONFIGURATION

A configurable data model[10, 11] created to align the organizational structure to an ERP organizational structure forms the basis of Data Activity Model for Configuration (DAMC). The techniques which are described so far, focus on capturing the business requirements so that a suitable ERP solution can be selected. Assumption is that the information required during configuration phase is captured during RE phase. This assumption is not correct. During RE phase, the focus is on business requirements whereas the focus shifts to ERP software during configuration. The RE modelling techniques are process modelling techniques which emphasize on functions, processes, their interactions and required data. Configuration involves defining a business process in terms of data, their interrelationships and interactions to accomplish a task. The process modelling techniques used in RE phase may capture data elements but they fail to show their interactions and interrelationships. DAMC is suitable for capturing configuration specific requirements for ERP system.

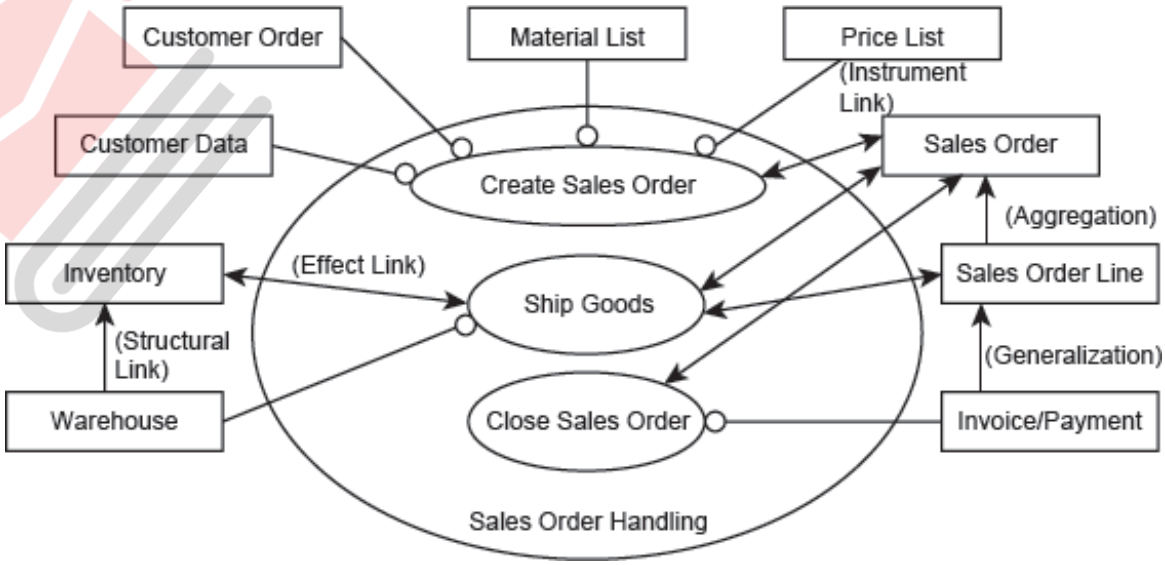


FIGURE 6.13 OPM to Handle Sales Order

The following information about data and processes is significant for configuration:[12, 13]

- Information regarding processes, functions, control flow and data is required for configuration. Process should be defined in terms of its functionality and control flow.
- While configuring an ERP system, many decisions about alternative functions, tables and parameters have to be made. Configuration reference models should be able to capture these decisions. The decisions can either be mandatory or optional in nature. Some configuration decisions are critical while others are non-critical. Critical decisions have significant impact on the business processes. The decisions should be differentiated between critical and non-critical decisions.
- There should be a logical sequence to take decisions for configuration. A decision may include processes and data objects. The logical sequence is through interrelationships within one process model, between one or more process models or between process and data models.
- ERP-specific configuration details may also be required. For instance, SAP configuration is done through its IMG. Such information may provide valuable information to the configuration team.
- Reference data models are important for configuration. ER diagram or its variants are used for data models. We need to distinguish between optional entities and required entities. An entity is connected to another entity through a relationship. A relationship may be optional. Distinction between mandatory and optional relationship is required.

In addition, following information is also important:

- Distinction between persistent (master) and transactional data is important. Transactional data is created when a transaction is executed after a successful configuration. It is master data that is used for configuration.
- **Representation of business rules:** Business processes have integrity and activity rules.[14] Activity rules prescribe actions or operation sequences which are to be performed and incorporated in any process and/or information constraint that is required for an activity.[15, 16] Activity rules can either be structural or operational in nature. The type of relationships and cardinality constraints define structural rules. Cardinality expresses maximum number of entities that can be associated with another through a relationship.[17] Operational rules define pre-condition/s and post-condition/s for an activity. A precondition is a constraint that specifies what must be true before an activity is performed. Post-condition is a constraint that is true after an activity is accomplished.[18] During configuration, there is a need to know the business rules associated with an activity as well as the type and cardinalities of relationships among participating entities. Thus, structural and pre-condition activity rules are required while modelling.

DAMC has notations to represent entity, its attributes and relationship type between entities along with representing pre-condition and structural business rules. An entity represents data. Data can be either master data or transactional data. A rectangle denotes an entity representing master data, whereas a double rectangle denotes an entity representing transactional data. An entity has attributes. An ellipse represents an attribute. A relationship

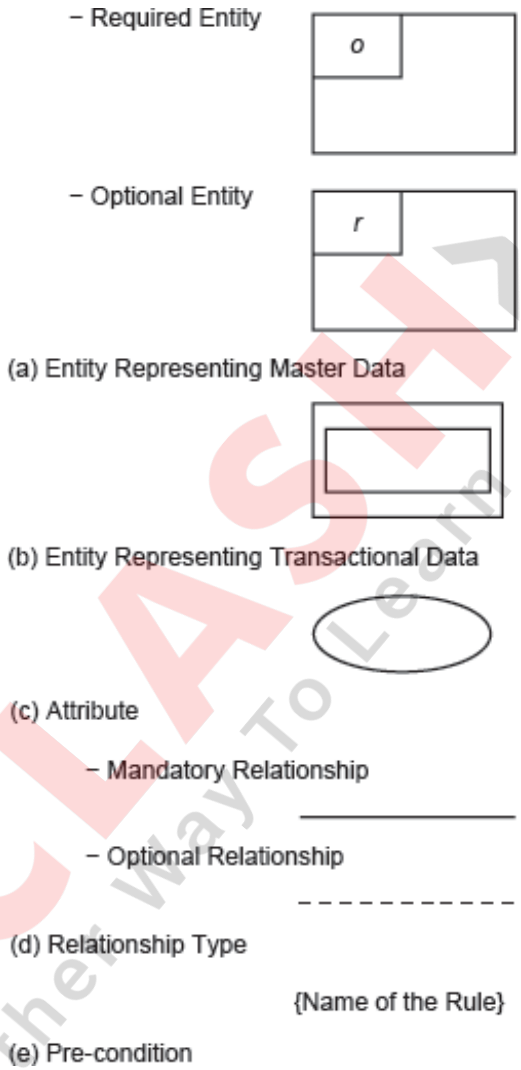
connects entities and can either be mandatory or optional in nature. It represents an activity and has a unique name. A solid line represents a mandatory relationship whereas a dotted line denotes an optional relationship. The entities participating in an optional relationship may themselves be optional. In other words, one may not depict entities participating in an optional relationship. A required (mandatory) entity is represented with an *r* and an optional entity is depicted with an *o* written in the corner of an entity representing master data. One-to-one, one-to-many and many-to-many cardinality constraints depict structural rules. Precondition rules check availability of external or transactional data and output of an activity/relationship. Conditions/constraints associated with a relationship represent precondition business rule within curly brackets just below the name of a relationship. Figure 6.14 summarizes the notations of DAMC.

Figure 6.15 shows a simple DAMC containing *A* and *B* entities that participate in the relationship *T*1 and has precondition: *C*1 to be true. These entities represent master data. Activity *T*1 creates transactional data that is stored in an entity *M*. *T*2 is an optional relationship between entities *B* and *C* that represent master data. *T*2 has precondition *C*2 associated with it. For the optional activity *T*2, entity *B* is required entity whereas entity *C* is optional. Activity *T*3 reads entity *A* if precondition *C*3 is true. *A*1 and *A*2 are the attributes of entity *A*.

DAMC for creating a sales order activity is shown in Figure 6.16. A sales order consists of the customer details, and the material details that are fetched from persistent entities customer and material. The sales orders are stored in a transactional entity sales order. A sales order is created if either a quotation or a purchase order is available.

Credit of a customer may be verified under any of the following conditions. For one time sales order, *credit* of a customer is verified (*using verify credit status*) whereas for *recurrent sales orders*, this is an optional activity. Similarly, if a customer is a one time customer then his credit limit may be verified but for regular customers it may be an optional activity. *Discount* may be associated with a *customer* and *material* depending upon the discount strategy and/or customer type and discount strategy and/or material type, respectively. For this optional relationship, entity *customer* is required whereas the entity *discount* is optional. Tax may be associated with material depending upon its type and/or taxation strategy. *Compute discount and compute tax* relationship between entities discount-pricing and tax-pricing is optional and depend upon *discount status* and *tax status*, respectively. The pricing procedure determines pricing of the material that uses entity pricing and material. Pricing uses entity discount and entity tax. More details of DAMC may be found in Negi and Bansal.[19]

FIGURE 6.14 DAMC Legends



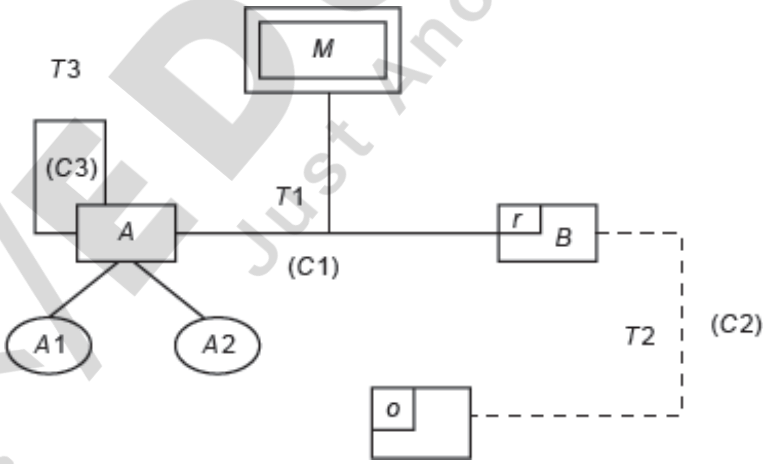


FIGURE 6.15 Small Example of DAMC

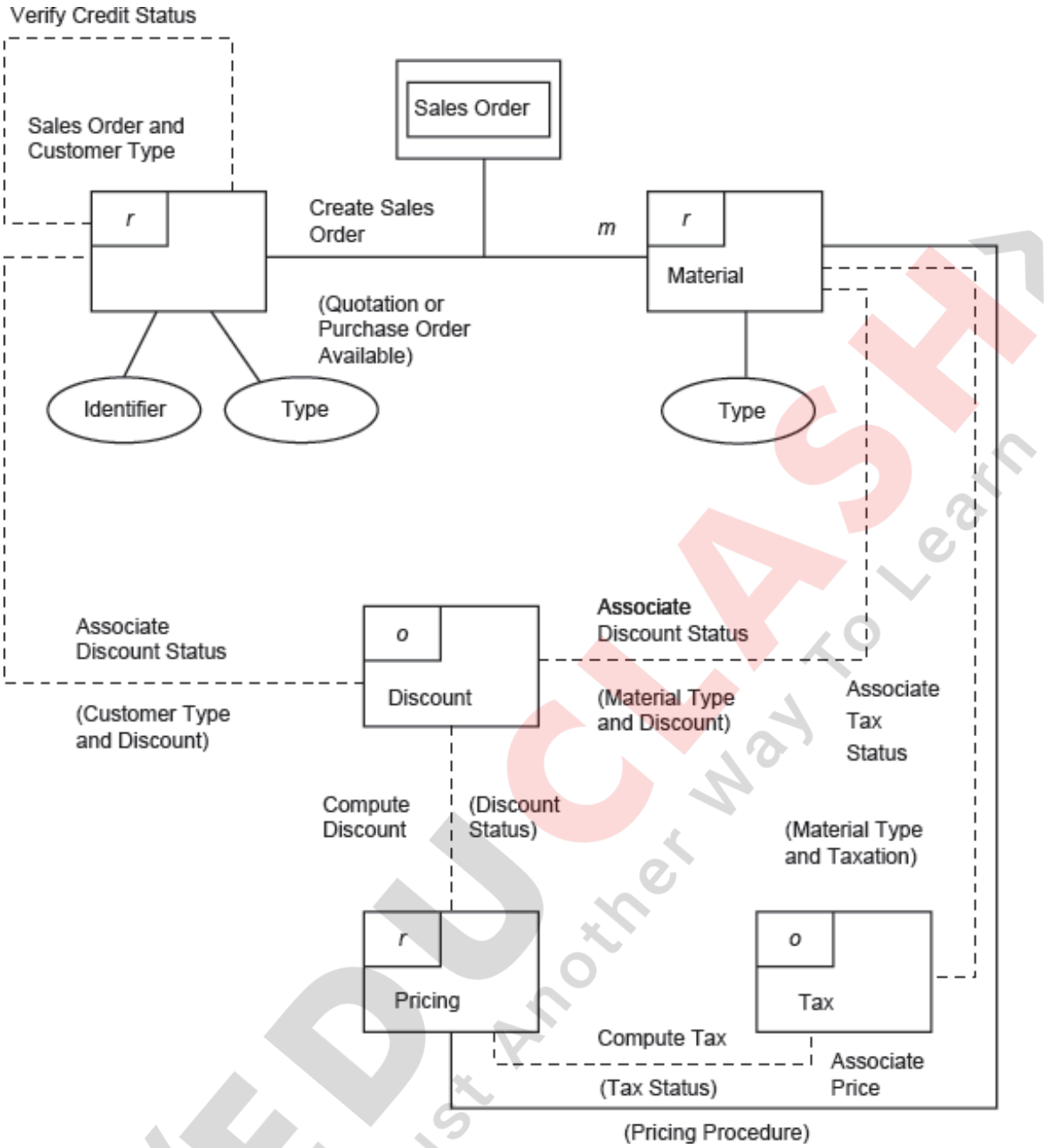


FIGURE 6.16 Sales Order Processes in DAMC

CONCLUSION

The objective of this chapter has been to understand the RE phase of ERP project. The various ways of documenting requirements are learnt. One of the ways of documenting requirements is to use structured English. Small organization would generally use structured English for documenting their requirements. There are many formal ways of documenting the requirements. Event Process Chains by SAP, Object Process Model,[20] object-oriented modelling[21] and Data Activity Model for Configuration (DAMC)[22] are the ones which are discussed. There are many more modelling techniques which have not been discussed. The aim is to capture the requirements in sufficient details so that an appropriate ERP system can be selected.

CASE STUDY

Let us continue with RetailS and document their requirements. Recall that we have been working with RetailS in previous chapters. This is a retail company in Delhi, India. Here, we will look at the requirements of RetailS.

Business Processes of RetailS: The CMD of RetailS explained the business processes to us in detail and we have documented the processes. The objective of our interaction with the CMD was to understand the requirements and their concerns. Let us first understand the material that RetailS deals in. None of the material in which RetailS deals is manufactured by the company. The parameters associated with a product are just too many.

Just to get an idea, let us consider a metallic easy open can, one of the items that RetailS deals in. We have seen these cans used by Coke/Pepsi (RetailS may not be supplying cans to Coke/Pepsi). The parameters associated with these cans are as follows:

- Capacity
- Capacity unit
- Diameter of the can
- Height of the can
- Diameter of the top lid
- Diameter of the bottom lid
- Color of the can
- Color of the lid
- Color of the lacquer
- Text to be written on the lid

One way of representing data of a company is by using entity-relationship diagrams. These diagrams are taught in the course on database management course (refer to Bansal[23] for a brief introduction). Figure 6.17 shows the entities maintained by RetailS. RetailS maintains data about all its customers, suppliers, shipping agencies and items that it deals in. The entities are as follows:

- Customer
- Vendor
- Supplier
- Product
- Order

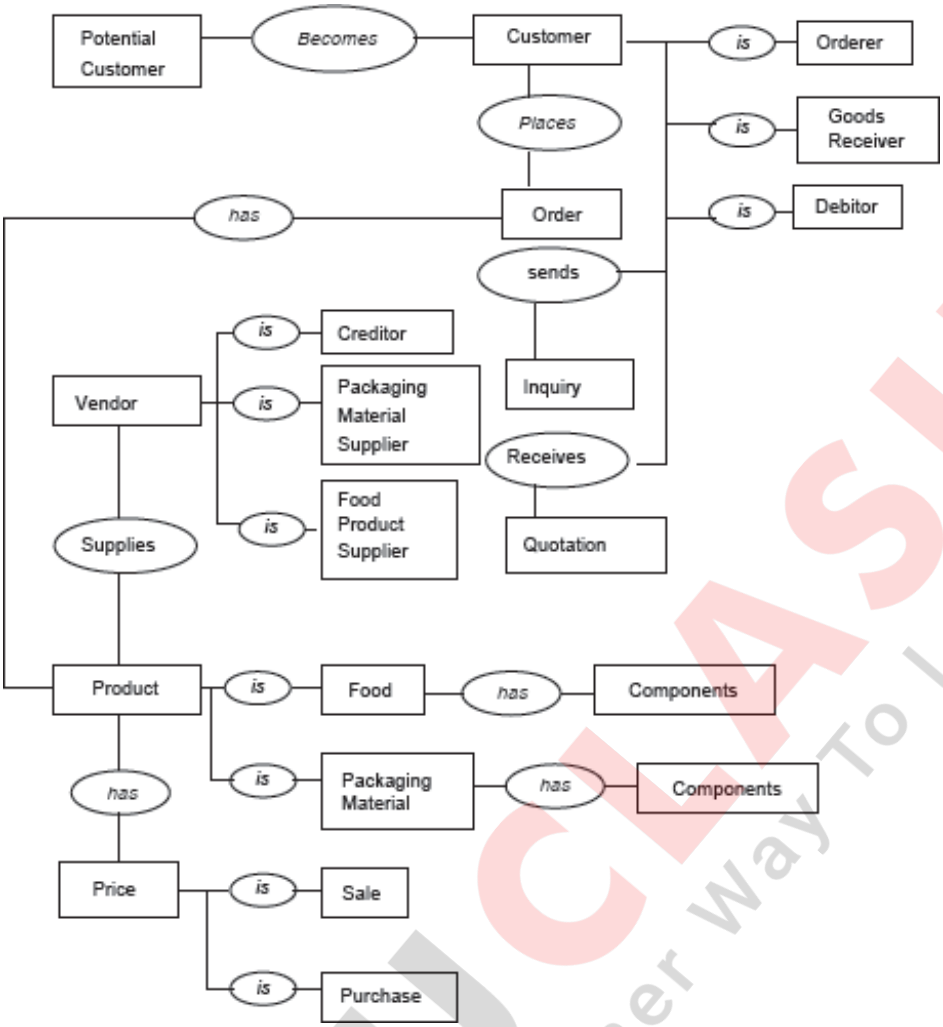


FIGURE 6.17 Entity-relationship Diagram for RetailS

Product entity has two specializations namely food and packaging material. Each of these has components which are different for each of them. A vendor plays different role such as creditor, packaging material supplier or food product supplier. For the reference of the staff and management, a price list is maintained consisting of sale price and purchase price. The prices are revised/validated every month. The top lids and bottom lids are separate components that may have their own specifications such as thickness, tab design, its location and style. Coming to the business processes, let us first look at the sales process. The salesman takes orders from a customer and then gets the material from a supplier directly shipped to the buyer. This seemingly simple process involves many steps and multiple outcomes for each step. Figure 6.18 shows simplified version of the process using EPC notation (from SAP). This process stepwise is mentioned below.

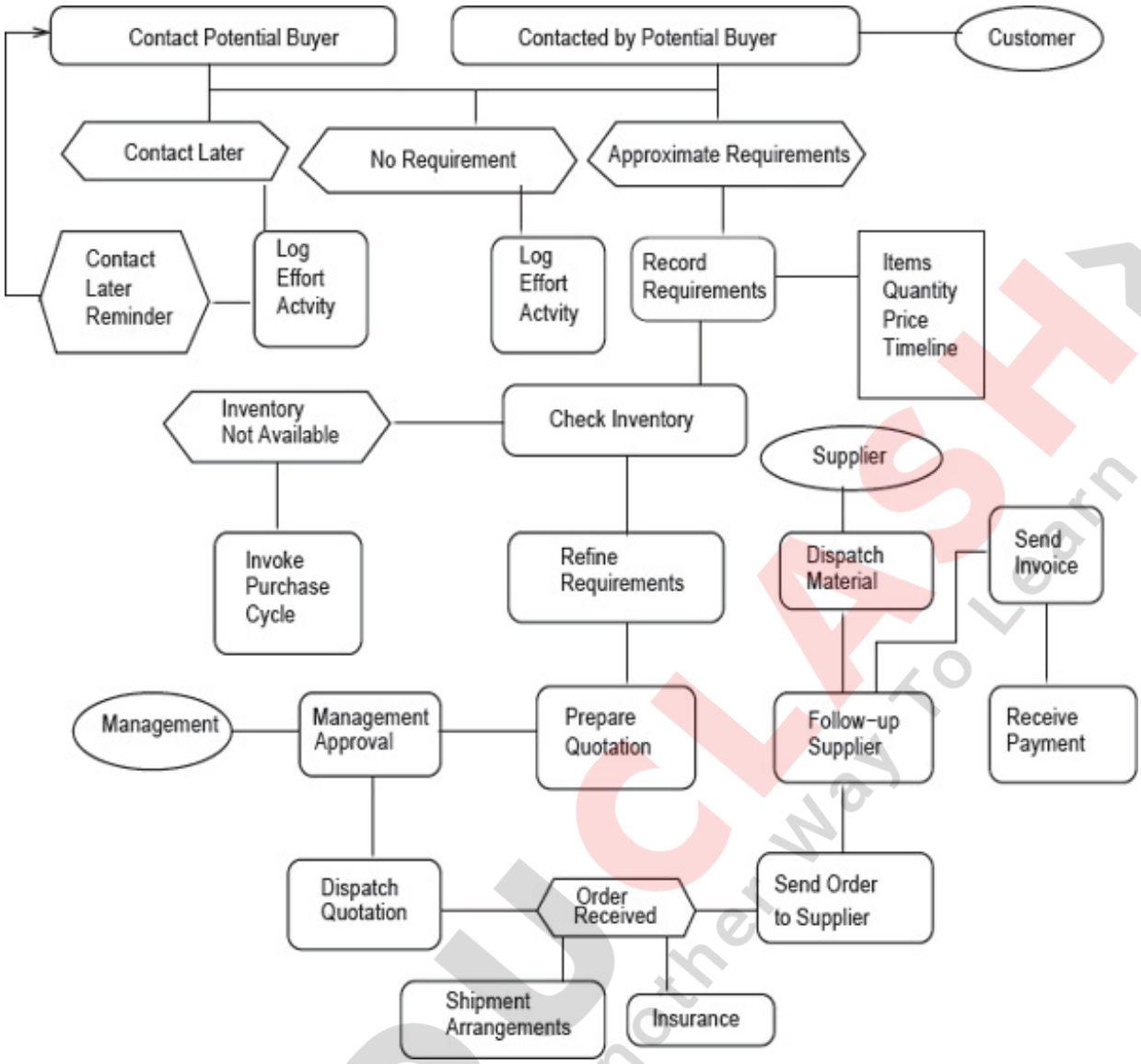


FIGURE 6.18 Sales Process for RetailS

1. The salesman of RetailS may approach a potential buyer and ask their requirements. There are four possibilities:
    1. The effort to contact may fail due to the change in contact details.
    2. The potential buyer may not have any requirements.
    3. The potential buyer may ask the salesman to contact later.
    4. If there is a requirement, they may give their approximate requirements in terms of products, price, quantity and timeline.

    In case (i), the salesman would record his efforts in his log book and make another attempt to get the changed contact information. In case (ii), the salesman would record his efforts in his log book. The recording serves two purpose, one is no other sales person should contact them and the other tells the management about the activities of the sales staff.

    In case (iii), the salesman would like to record the call and a reminder to himself to contact again. A mechanism is required to remind the sales person to contact the party again. It is worthwhile to point out that RetailS should contact the potential buyer as promised even if the sales person have left the organization or is on leave. Again, an ERP system would help sales staff to make the follow-up call.

In case (iv), he would like to record the details of the potential buyer along with the requirements and move on to Step 2.

2. All five components—items, quantity, price, delivery date of the order and payment terms need to be dealt with.
   - **Items included in the order:** The salesman would check the existing list of items that RetailS sells. Each item is very complicated and may have as many as ten different parameters. The salesman must check all of them.
     – If the potential customer is interested in a new product, the salesman gets in touch with the management to check if RetailS wants to supply the new product before committing anything to the potential buyer. Management may decide to supply the product. This would trigger a chain of activities that would include identifying vendors, negotiating prices, delivery period and including all this information in the database of the company.

     – If RetailS is not interested in the new product, the salesman would convey the message to the potential customer accordingly.

   - **Quantity and inventory:** The salesman checks with the purchase team for the availability of the items in the desired quantity by required delivery date. The checking has to be done very carefully against all parameters of the order. This process is very error prone. Purchase team will perform the purchase in a manner similar to sales.
   - **Delivery date:** In order to fix a delivery date, the following components are considered:
     – Manufacturing time.

     – Shipping time that depends on the location of the buyer. If the buyer is overseas, distance from the nearest port plays an important role. RetailS has to give a delivery date that it would be able to honour in spite of the potential delays in manufacturing and shipping.

   - **Price:** Price list is consulted to check the availability of the price for the item(s) of the potential order. If the price list is valid (it is less than a month old) and the price is available for the item(s) of the order, the salesman can use these details in their further communication. If the price list is stale or a price is not available, the sales person would have to contact the management for the price.
   - **Payment terms:** The salesman also negotiates payment terms with the potential buyer.
3. The salesman after obtaining all required information, records them, creates a quote and e-mails to the potential buyer. At present, RetailS has paper files for each customer containing all communications.
4. The salesman is expected to make follow-up calls to the potential customers and convert them into customers. When a salesman contacts a potential customer again, any of the four key components of the order may get modified including items, price, quantity or delivery date. The salesman may have to do another iteration of steps 3 and 4 before actually receiving an order.

5. The material is shipped directly to the customer through a shipping agency. The shipping agency is also contacted and space on the shipping vessel is reserved by the salesman. The terms and conditions are also negotiated by the salesman.
6. All material is insured before transporting.
7. As soon as a potential order is in view, the purchase team has to become active. The interaction of the purchase team with potential vendors is similar to the interaction of sales team with potential customers.

When we started talking to the CMD of RetailS, he voiced many of his concerns and his reasons for wanting to deploy an ERP system. We have mentioned some of his concerns while describing the process above and an overall picture of his concerns is given next.

Why RetailS Wanted ERP system?

- **Prices and their validity:** Associated with each item that RetailS deals in, there is a sale price. The management fixes prices for the known items and creates a price list. These prices are generally valid for a month. In certain cases, the prices may fluctuate in a positive or negative direction about which only the management knows. It is the responsibility of the management to update the price list. Since the management team consists of only three people and they are multi-tasking, it is not unusual for them to forget to update the price list. Sometimes, the monthly update of the price list is also not done. The sales staff may use the old list and cause loss to RetailS or overprice the customer that may result in loss of the customer or his goodwill or both.
  The sales price is dependent on the purchase price. The management negotiates the purchase price with vendor before creating the sales price list.

  The management wanted an IT system that will send a reminder to the management after a month to update the price list. The IT system should also prevent the sales staff to use a stale price.

- **Reduce errors:** Every order involves details that need to be carefully defined. There are multiple parameters associated with a product that RetailS deals in. A mistake or omission of one of the parameters may result in delay, cancellation or rejection of the entire order. IT system can force the staff to check every parameter.
  For instance, the payment terms have to be defined and agreed upon by RetailS and the customer. Any omission or a mistake may cause delay or confusion in the payments. IT system can help RetailS create a master list of possible payment terms to avoid any errors.

- RetailS needs to frequently follow up with their customers, vendors and shipping agents. A customer is contacted multiple times during the process of a sale that also requires staff to contact the vendors multiple times as well. IT system can generate a reminder to the concerned staff for a follow-up activity.
  An issue that management faces here is that the remaining sales team may not know about the call and others may also call the same potential buyer resulting in possible annoyance. An immediate solution is to divide the companies or zones among the sales staff. The solution suffers from usual load-balancing issues. The more

reasonable solution is to have a real-time integrated platform where the call details and its outcome may be recorded for the sales team to see. This was one of the reasons, management wanted an ERP.

- **Trade secret:** RetailS succeeds in their business by identifying customers, providing them the items of required quality at agreed upon prices in a timely manner. All this is possible if the vendors supply them quality items at a reasonable cost and on agreed upon time. RetailS has to protect price information from their existing competition and from the potential competition that may even shoot up from within RetailS. The information should be available in a very selective manner to the employees. IT system can help RetailS to make only the required information available to an employee.
- **Reports:** IT systems can provide required reports to the management about the organization in real time in a desired format.

EXERCISES

Check Your Understanding

1. What do understand from the term *requirements engineering*? What are the stages preceding this phase in the life cycle of an ERP project?
2. What are the various ways with which a company may approach requirements engineering?
3. Why do we need to document the requirements and then manage these documents?
4. How can you capture requirements for an ERP system using structured English? Document sales process and requirements related to this process using structured English. Assume that the organization is a manufacturing organization and sells to their dealers in bulk only. List all the assumptions you make about the organization and its sales process.
5. Explain different components of EPC. Give an example for each component.
6. What are two different approaches to creating an object model? When will you use each of the approach?
7. Explain object process modelling technique. What are the main components of OPM. Create an object process model for scheduling production. You may have to make assumptions about how the production gets triggered. The choices may include inventory levels, sales orders, forecast or a combination of these.
8. Create a DAMC for delivering a sales order to the customer. The order is a bulk order and would be delivered by company's delivery vehicle to the customer. List any assumption that you may make about the process.

Apply Your Understanding

1. Study the available documents in your chosen organization if the documents are available and talk to people to check if the documented processes are followed in practice.
2. Document some of the processes of your organization in a formal way using the techniques that are discussed in this chapter using the existing documents as a reference. If the documents are not available, are incomplete, outdated or

inconsistent, you may have to talk to the employees to understand business processes. What modelling technique did you use and why?

3. If your organization has already automated some of their business processes, find out all about requirements gathering and documentation.