Chapter 6
Information Flows

The most important challenge for information flow security stems from the difficulty of managing complex security policies [249]. E-business organisation security should be considered in the perspective of electronic processes, which involve information flows. In this chapter the meaning assigned to the term information flow is discussed. The definition adopted here is also compared with definitions used elsewhere in the literature. The chapter is structured as follows. A definition of the term information flow is provided, the types of information flows that might exist in an e-business company are discussed, and the various types of information flow present in an e-business organisation are illustrated. Finally the chapter summary provided.

6.1 Information Flow - Definition

An information flow control system can be specified as a combination of an information flow policy, a flow relation that defines permissible flows among the classes of objects defined by the policy, and a method of binding each storage object to a class [54].

Information flow analysis involves statically determining how program outputs are related to their inputs, namely how outputs and inputs are dependent, directly or indirectly. In this thesis we consider information flows in the context of the execution of the components of an e-process. That is, an e-process is composed of various pieces of information exchanged between process agents.

As discussed earlier, an e-business organisation runs its business differently to a traditional organisation. The existence of an e-business organisation is dependent on the proper functioning of its electronic channels, and the proper functioning of Internet-related technology. Information quality and availability is becoming a critical issue for all e-business organisations. Regardless of the e-business model, any e-business organisation functions by transmitting information over the links connecting the participants both inside and outside the organisation. These links constitute a PVN (see section 4.1). As discussed in section 4.2.2, all e-business companies, by definition, share the following features:

- Business functions are enabled by electronic means;
- Relationships between business functions are enabled by electronic means;
- Relationships with the environment are enabled by electronic means.

E-business is based on electronic transfer of business data. All activities related to business are performed electronically. A process requires documents to be transmitted between the various stations of the process; therefore, one way of representing a process is in terms of the information...
handled (i.e. produced, transmitted and stored) by the process. Such information-based processes can be identified using the business functions of which the processes are a part. Significant volumes of information are exchanged between the various participants in the B2B (Business-to-Business) marketplace, including between buyers and sellers, suppliers and manufacturers, and among competitors. Such information includes details of products, prices, transactions, and competitors [143], and information relating to Information Technology infrastructure operation.

E-business processes involve the transmission of information flows between the various pre defined process stations and participants which we refer to as process agents. An e-business process, as discussed earlier in chapter 5, is completely characterised by the set of information/data flows that enable its existence. Hence, the following definition of information flow is adopted here - Information flow refers to any digitally expressed business-related and/or technology-related information, transmitted between process agents in order to execute a specific pre defined part of an e-process, or to support a specific pre defined action between the process agents. As discussed in chapter 5, two main types of information flow are exchanged between the participants in an e-process. These are:

- **Business-Related Information Flows** - Information Flows that are generated as a direct consequence of the business logic for e.g. the transfer of customer details from a customer computer to the company's database as part of the customer registration process.

- **System-Related Information Flows** - Information Flows that are generated as a result of technology-related operations.

6.2 E-business information flows

The discussion here is based on the Porter Value Chain Model for a traditional business organisation, which is appropriate for this type of analysis. (Because of the large number of business functions, and even larger number of processes associated with them, the tables below illustrate only a few of the functions performed by a generic business.). Following the Value Chain Model, we separately present examples of both Primary Activities and Support Activities. Table 6.1 lists processes associated with some of the primary activities of a generic business organisation. Table 6.2 lists examples of processes for the support activities of an organisation. Infrastructural activities are represented by Administration and Finance functions, and the 'Product and Technology' functions are represented by Technology processes.

Tables 6.1 and 6.2 provide examples of functions and processes performed by almost any traditional business organisation. (A more detailed illustration of business functions and processes can be found in Appendix A, tables A.1 and A.2). We use these traditional generic business functions to derive corresponding e-business functions.
Reviewing these functions in the context of an e-business leads to the conclusion that, when a business changes from a traditional business mode to operating as an e-business, there is a redefinition of traditional roles for business functions, and new processes are developed using information technology [41]. For example, inbound and outbound logistics, which are typically two separate functions in a traditional business, are likely to be integrated, possibly with other functions (such as distribution and procurement), in a networked e-business organisation. The logistics function is a critical function in an e-business organisation - no business can afford large-scale non-fulfillment of orders, late deliveries or massive returns of orders. Similarly, administrative functions in an e-business organisation are not likely to be separate activities, but are automatically performed by means of ERP mechanisms and distributed across other functions. Correct execution of e-business functions appears to be of critical importance for organisations for the following reasons:

- Since e-business functions are distributed across other functions, any failure in one of them has an immediate impact on other functions, and, consequently, on the entire e-business because of the technological and business connectivity; by comparison, in a traditional business, the impact is likely to be felt relatively slowly and be limited in spread-
- An e-business, if operating in a problematic manner, cannot provide the benefits expected from such a business for both the organisation and its customers, and, hence, will eventually fail to provide its services;

| Inbound Logistics | ➢ Raw material acquisition  
|                   | ➢ Raw material shipping  
|                   | ➢ Raw material storage  
|                   | ➢ Raw material management  
|                   | ➢ ...............  
| Sales             | ➢ Order processing  
|                   | ➢ Order management  
|                   | ➢ .................  
| Outbound Logistics | ➢ Shipping management  
|                   | ➢ Transportation planning  
|                   | ➢ .....................  

Table 6.1: Business process performed as part of Primary Activity
When failures occur in e-business functions, they are likely to be perceived as faults in the Information Technology infrastructure operation or in the information and IS security provisions; customer expectations of e-business are high [18];

Customer perceptions of information security as the weakest link hinder the wide acceptance of e-business [197,241].

Studies of existing e-business companies (including the case studies reported later in this chapter and in chapter 9) suggest that the following major functions are likely to be performed in a typical e-business organisation:

- Logistics (including distribution)
- Finance
- Product development
- Manufacturing
- Marketing
- Sales and Customer service and support
- Human resources
- Technology
- Procurement.

From the discussion above (including tables 6.1 and 6.2), and using the Porter updated Value Chain model (incorporating applications of the Internet into the model, see [95]), we can now enumerate the e-processes likely to be present in any e-business. Table 6.3 presents these generic e-processes, classified by e-business function. Given a list of the e-processes for an e-business organisation, it is then possible to analyse the information flows associated with these processes. The execution of these processes will involve the exchange of information flows between participants.

**6.3 Summary**

In this chapter a definition of the term ‘information flow’ has been provided. The definition differs from those commonly given to the term, which is usually employed in the context of computing technology. In this thesis an information flow is process execution-related, in that it is made up of the various pieces of information exchanged between e-process participants, i.e. process agents. This discussion of information flows paves the way for the development of an Information Flow based security management model, presented in chapter 8.

<table>
<thead>
<tr>
<th>Function</th>
<th>Process</th>
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<tbody>
<tr>
<td>Administration</td>
<td>• Public Relations</td>
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<td>• Legal services</td>
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<tr>
<td>Trend analysis</td>
<td>Operational planning</td>
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<td>Organizational</td>
<td>Production in progress</td>
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<td>Information technology analysis</td>
<td>Production control</td>
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<td>Infrastructure planning</td>
<td>Quality control</td>
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<tr>
<td>Strategic planning coordination</td>
<td>Parts assembly</td>
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<td>Information system / Information technology</td>
<td>Real time coordination</td>
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<tr>
<td>Implementation</td>
<td>Maintenance facilities</td>
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<td>Operation</td>
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<td>Full network</td>
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<td>connectivity</td>
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Table 6.2: Support activity related Business processes

Table 6.3: Processes in an e-business organisation