Chapter Two Literature Review

2.1 Collaborative Commerce and Business-to-Business Integration

2.1.1 Collaborative Commerce (C-Commerce)

The definition of collaborative commerce (C-Commerce) is widely divided as shown in Table 2.1. Not only department-to-department inter enterprise but business-to-business document exchange including suppliers, partners, distributors, service providers, customers, et al, any type of collaboration such as product design, supply chain planning, forecasting, logistics, marketing, et al can be viewed as collaborative commerce. (黃貝玲,2001)

Table 2. 1 Definition of C-Commerce

Source	Definition
1.The American Heritage Dictionary	To work together, especially in a joint intellectual effort; To cooperate treasonably, as with an enemy occupation force.
2.PwC <Collaborative Processes in e-Supply Networks>	Process in which organizations exchange information, alter activities, share resources and enhance each others capacity for mutual benefit and a common purpose by sharing risks, responsibilities and rewards.
3.Deloitte Research <Collaborative Commerce-Going Private to Get Results>	A means of leveraging new technologies to enable a set of complex cross-enterprise business processes allowing entire value chains to share decision-making, workflow, capabilities, and information with each other.
4.Collaborative Strategies <Electronic Collaboration on the Internet and Intranets>	The ability of two or more people or groups to transfer data and information with the capability of on-line interaction. The distinguishing feature is the ability for many-to-many interactions and information sharing, unlike e-mail where the interaction is one-to-one or one-to-many.
5.InsightShare <The New Collaboration: A Business Imperative>	The interaction of two or more people creating value through common purpose and diverse thinking. For networked companies, collaboration extends far beyond traditional workgroups, involving employees, customers, suppliers, and partners alike.

Data source: 電子化企業經理人報告, 2002

Golden Sachs divides c-commerce into three types: “Unstructured Communication”, “Commerce Exchange”, and “Knowledge/ Process Exchange” in the report of <MatrixOne, Inc.-Technology: B2B e-commerce> as shown in Table 2.2.

Table 2. 2 Three Types of C-Commerce

Type of Collaboration	Defining Characteristics	Examples of Technology
Unstructured Communication	Ad-hoc communications with partners that typically lack any formalized process.	Phone, Fax, e-mail
Commerce Exchange	The processes around procuring goods/ services as well as the accompanying financial transactions.	Ariba, Commerce One, EDI
Knowledge/ Process Exchange	Exchange of business processes, content, and domain knowledge.	MatrixOne

Data source: 黃貝玲, 2001

When the enterprise wants to establish c-commerce environment successfully, it is not only the linking of technology but also the revolution of collaborative processes, organization behaviors, and standards as shown in Table 2.3.

Table 2. 3 Barriers of Establishing C-Commerce Environment

Collaborative Processes
In order to benefit from the Internet technology greatly, the enterprise has to redesign operational processes to strike across barriers between them. They will be able to exchange information, make decisions efficiently, and response to opportunities and challenges immediately.
Organizational Behaviors
Improving communicating tools in operational processes will strengthen the collaborative relationship among staff; they can increase opportunities or reduce risks cooperatively.
Collaborative Technology
Internet Technology connects the partners in a supply chain, ensuring more direct, quicker and safer data transportation between systems. Networked Technology not only guarantees the correctness and speed of transactions but offers transparent information such as inventory, requirements, and manufacturing progress to participants.

Standards
The purpose of standards is to reach an agreement to database encoding system, communication protocol, or collaborative process templates. In the same standard, participants will make a profit because of less time and cost spent on interaction with trading partners.

Data source: 黃貝玲, 2002

True collaborative commerce requires combining content management, process management, and integration technology to automate and streamline business processes among internal staff, external partners, suppliers, and customers (Harris, 2002). Both enterprise application integration (EAI) and business-to-business integration (B2Bi) are part of collaborative commerce. In this research, however, we concentrate on B2B integration discussed here.

2.1.2 Business-to-Business Integration (B2Bi) Models

The short history of integration evolves as follows. First, companies need to connect enterprise resource planning (ERP) systems to mainframes. Second, there comes enterprise application integration (EAI), which focuses on integrating and translating data among a broader array of applications. Then business-to-business integration (B2Bi) allows integration of data and transaction exchange beyond the enterprises (Harris, 2002).

In the May 2000 issue of the EAI journal (http://www.eaijournal.com), Greg Olsen described the laymen's view of B2Bi as one of the following:

"That is EDI (Electronic Data Interchange). It's about agreeing on standard datasets using X12, EDIFACT, or XML and then exchanging the data over Value-Added Networks (VANs) or the Internet.

B2B integration is application integration extended outside a single company. It's about using middleware technologies, such as distributed objects, remote procedure calls, message queueing, data transformation, and publish/subscribe, to connect different applications with the added complication of getting through firewalls.

B2B integration means sharing data beyond company boundaries by employing the Web. B2B integration is accomplished by putting a Web front end on your applications so information can be shared with suppliers, customers, and partners.

When contemplating B2B application integration for your organization, you must first understand the sum and content of the business processes and data in your

organization. It also needs to understand how these business processes are automated (or not automated, as the case may be) and the importance of all business processes. In brief, they must then use this understanding to determine which processes and data elements require integration. This process can take on several dimensions, as shown in Figure 2.1, including data-oriented, application interface-oriented, method-oriented, portal-oriented, and process integration-oriented (Linthicum, 2001).

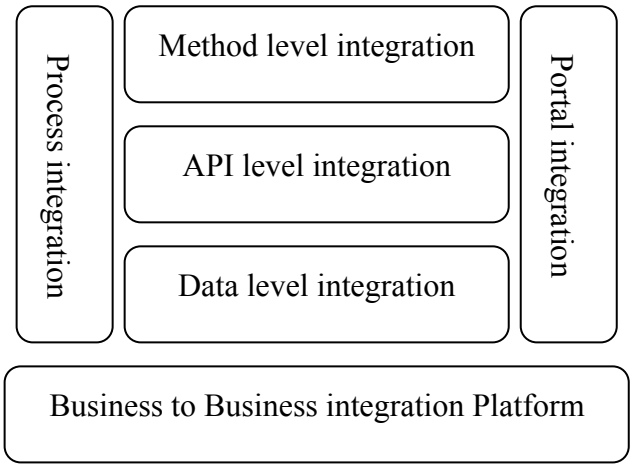

Figure 2. 1 Dimensions of B2B Application Integration

Data source: Linthicum, 2001

1. Data-Oriented

Data-oriented B2B application integration is the process of extracting information from one database, perhaps processing that information as needed, and updating it in another database within another organization. Although this process may sound simple and straightforward, in a typical B2B application integration-enable enterprise it might mean drawing from as many as 100 databases and several thousands of tables. It may also include the transformation and application of business logic to the data that is being extracted and loaded (Linthicum, 2001).

2. Application Interface-Oriented

Application interface-oriented B2B application integration refers to the leveraging of interfaces exposed by custom or packaged applications. Developers leverage these interfaces to access both business processes and simple information. Using these interfaces, developers are able to bundle any number of applications, allowing them to share business logic and information (Linthicum, 2001).

3. Method-Oriented

Method-oriented B2B application integration is the sharing of the business logic that exists within the enterprise. For example, the method for updating a customer record may be accessed from any number of applications, within or between organizations. These applications may access each other's methods without having to rewrite each method within the respective application. There are numerous mechanisms for sharing methods among applications. These include distributed objects, application servers, Transaction Processing (TP) monitors, frameworks, and even creating a new application that combines two or more applications (Linthicum, 2001).

4. Portal-Oriented

Portal-oriented B2B application integration is very popular today thanks to the mushrooming use of the Internet. Using this approach, application architects can integrate applications by presenting information from several local or partner applications within the same user interface. Enterprises are avoiding the complex and expense of traditional back-end integration by leveraging this integration approach as a means of integrating enterprise systems at the user interfaces (Linthicum, 2001).

5. Process Integration-Oriented

Process integration-oriented B2B application integration, at its core, is a sophisticated management system that places an abstract business-oriented layer on top of more traditional B2B information movement mechanisms. Process integration-oriented electronic business (e-Business) provides those who are supporting B2B application integration with a business-oriented and process automation-like view of how business information flows between trading partners. Collaboration-level B2B application integration does not typically deal with physical integration flows and physical systems but with abstract and shared processes such as people, invoices, orders, companies, and merchandise. An example of process integration-oriented B2B application integration is integration that provides a common abstract process between trading partners to support the development, construction, and delivery of durable goods, such as automobile (Linthicum, 2001).

According to Yee (2000), the most common models for B2Bi encompass four primary patterns: Direct Application, Data Exchange, Closed Process Integration, and Open Process Integration.

1. Direct Application B2Bi

This is the natural extension of EAI into the B2Bi arena. Direct Application B2Bi extends application integration beyond the traditional enterprise walls by integrating

applications from different corporate entities. It is often referred to as inter-enterprise integration and involves companies linking their applications directly to those of their partners or customers as part of an integrated value chain.

The use of this pattern necessitates the ability to interact directly with application APIs, translate native application data and support complex transformations. Integration brokers with built-in support for adapters, transformations and asynchronous-content-based routing are particularly suited to address this pattern. As shown in Figure 2.2, the pattern assumes that some component of the integration broker is running on each end of the flow. In practical terms, this means that both corporate participants need to run the same integration broker to engage in a transaction.

Security is vital because these inter-enterprise transactions will increasingly occur over a public network. This necessitates security services, such as secure transport, component authentication and user authorizations, to be defined and implemented. Since each corporation is an independent entity with its own data and security models, support for federated control is also important.

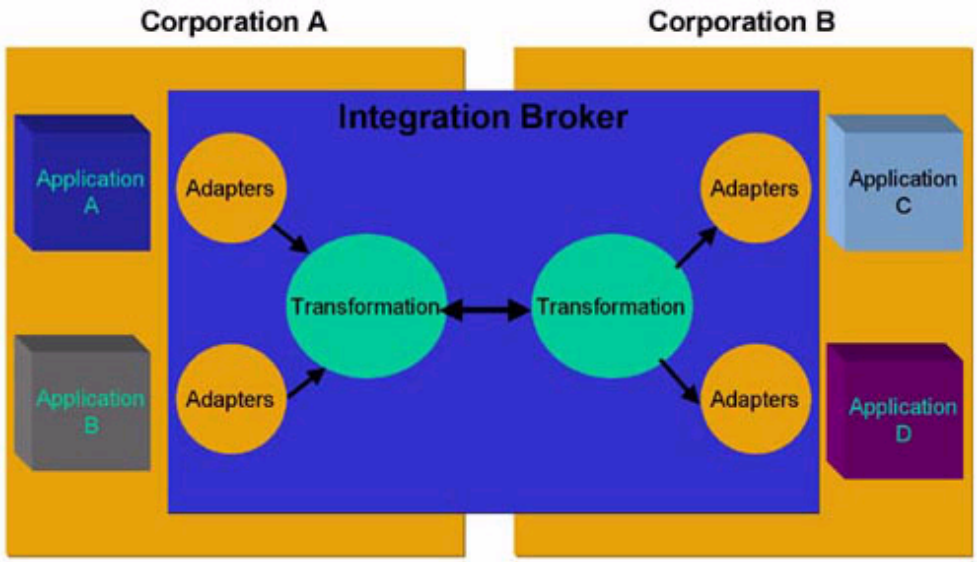

Figure 2. 2 Direct Application B2Bi

Data source: Yee, 2000

2. Data Exchange B2Bi

The Data Exchange B2Bi may be the most prevalent pattern in deployment. It has been in place since the early days of EDI. More recently, it has been applied by the first generation of Net marketplaces and trading exchanges, using XML as the base format.

Unlike the Direct Application B2Bi, which requires the presence of integration broker components on both ends of the exchange, the Data Exchange B2Bi places no such constraint. Instead, the Data Exchange B2Bi pattern enables B2B transactions via a common data exchange format. This reliance on a common data exchange format rather than a common infrastructure makes this pattern easier in some situations to implement and extend.

All exchanges in and out of the corporate entities occur through a managed data exchange gateway. For example, in Figure 2.3, Corporation A will translate relevant SAP application messages to the defined XML documents. These documents will be transmitted via a gateway to a logical address at the receiving participant site; Corporation B. Corporation B will interpret the documents, applying its own technology solution to integrate that information within its corporate enterprise.

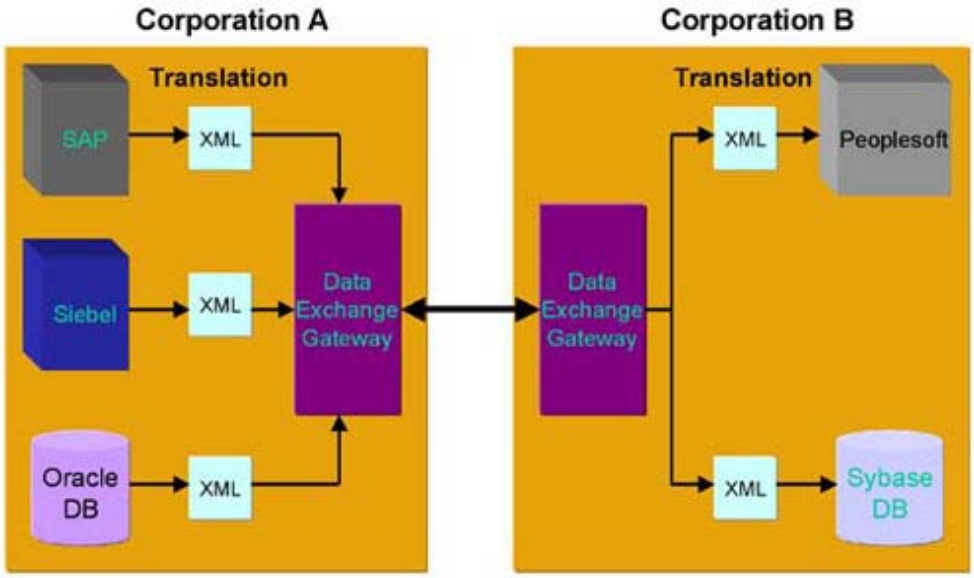

Figure 2. 3 Data Exchange B2Bi

Data source: Yee, 2000

3. Closed Process Integration B2Bi

Exchanging documents between partners tells only part of the story; the other part that must be addressed is the need to manage the interactions between the corporate entities involved. The Closed Process Integration pattern identifies a principal participant responsible for managing processes. In this operating model, shown in Figure 2.4, the other participants are secondary. They do not have visibility into the entire process, nor do they actively manage the process. Instead, they participate in response to the process managed by the principal. Hence, the process is

regarded as closed with respect to other secondary participants.

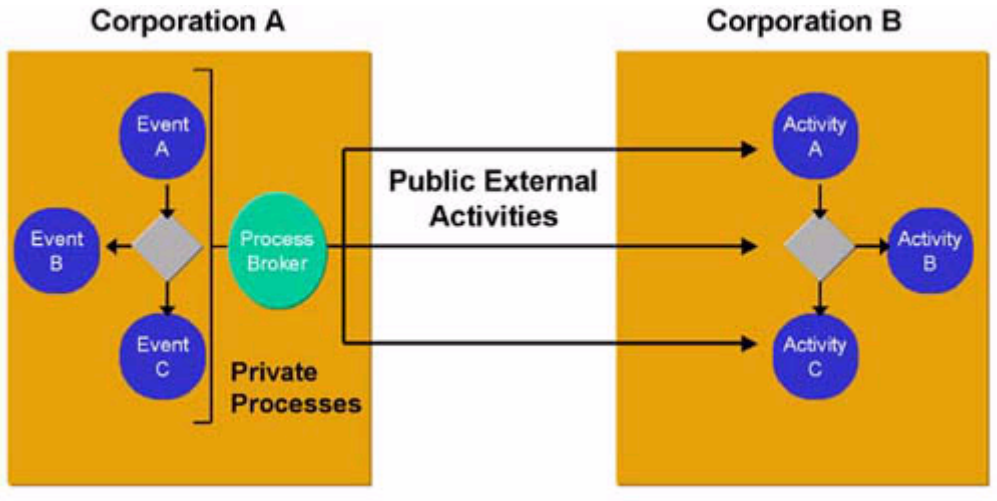

Figure 2. 4 Closed Process Integration B2Bi

Data source: Yee, 2000

4. Open Process Integration B2Bi

Unlike the Closed Process Integration pattern, which operates from a centralized master process manager model, the Open Process Integration pattern introduces the notion of shared processes. This means that the inter-company processes are managed at a peer level, with each participant actively managing business processes within its domain. This peer-level management of business processes imposes requirements on the BPI services layer. The business process integration (BPI) layer must support fine-grained control of managed processes. For instance, it must allow process elements to be managed as both private and public. As shown in Figure 2.5, each participant can choose to externalize elements of its managed process domain to be shared while limiting visibility into corporate internal processes.

The Open Process Integration pattern is the preferred model for the future because it offers the most flexible and sustainable operating model, especially in a Net market environment.

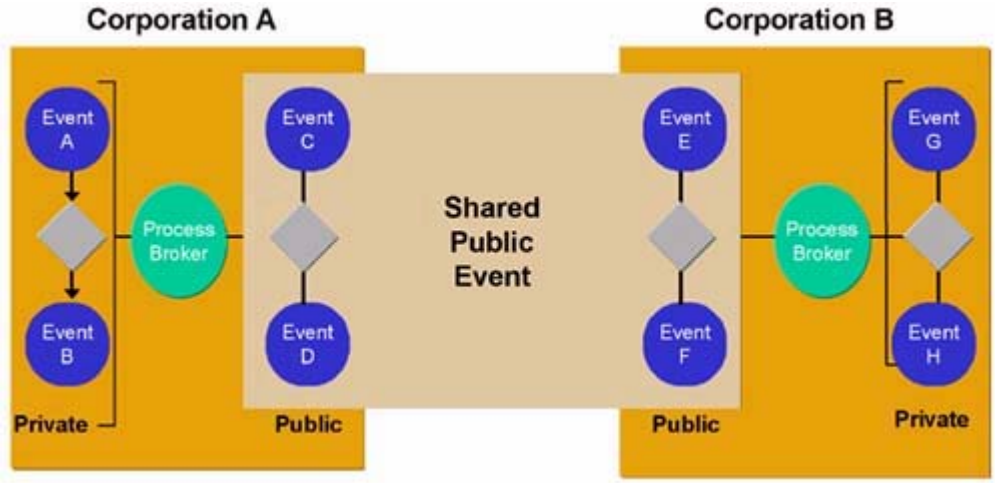

Figure 2. 5 Open Process Integration B2Bi

Data source: Yee, 2000

2.1.3 Process-Level Integration

Process integration is a science and mechanism of managing the movement of data and the invocation of processes in the correct and proper order to support the management and execution of common processes that exist in and between organizations (Linthicum, 2001). In conclusion from the definition above, process-level integration will be a preferable model in the future because it offers the most flexible and sustainable operating model in a C-Commerce environment.

The goal of B2B process integration is to automate the data movement, but it is accomplished by process flow. The “business process” means the “public process” in this research, and the opposite is “private process”. Public process is the interaction process of message exchanging, while private process is the internal process of enterprise. The top of Figure2.6 is public processes of company A, B, and C. The bottom of Figure2.6 is their private processes.

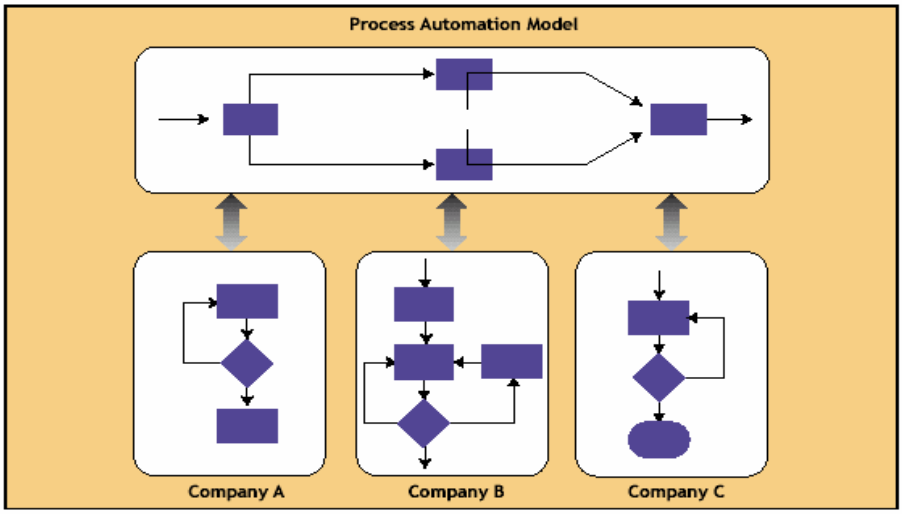

Figure 2. 6 Business Process Integration

Data source: Linthicum, 2000

According to Linthicum (2000), B2B process integration provides three layers of service:

1. Visualization of processes contained within trading partner systems

By visualizing enterprise processes contained within trading partners, business managers can begin to integrate systems within trading communities. The use of graphics and diagrams provides a tool for communications and consensus building. Moreover, this approach provides a business-oriented view of the integration scenarios, with real-time integration with the middleware, helping business analysts make changes to the process model, implement it within the trading community, and typically not involve the respective IT departments.

2. Interface abstraction

Interface abstraction refers to the mapping of the process integration model to physical system interfaces and the abstraction of both connectivity and system integration solutions from the business analyst. Process integration exists at the uppermost level in the B2B middleware stack. Those who use process integration tools can view the world at a logical business level and are not limited by physical integration flows.

3. Measurement of business process performance

The measurement of business process performance enables the B2B process integration layer analyze a business in real-time. By leveraging tight integration with the process model and the middleware, business analysts can gather business statistics

as they happen within a trading community. For instance, the minute-by-minute performance of a plant's ability to produce a product, as well as how the production rate relates to sales orders, can be gathered simultaneously.

2.2 B2B Integration Standard

2.2.1 RosettaNet and ebXML

1. RosettaNet

RosettaNet is a consortium of more than 400 the world's leading Electronic Components (EC), Information Technology (IT) and Semiconductor Manufacturing (SM) companies working to create, implement and promote open e-business process standards. RosettaNet was founded in February 1998 (RosettaNet.org).

Since RosettaNet is concerning processes rather than data, the most important aspect of RosettaNet is the development of common Partner Interface Processes (PIPs) and common dictionaries (Linthicum, 2001). RosettaNet dictionaries provide a common set of properties for business transactions and products (RosettaNet.org). This master dictionary, coupled with an established implementation framework, can be used to support the B2B application integration dialog (Linthicum, 2001). The process to create PIPs is depicted in Figure 2.7.

Concept development begins with business process modeling, or "as is" modeling, used to identify the elements of a business process and create a clearly defined model of trading partner interfaces which exist today. Business process modeling entails extensive research at every level of the supply chain followed by analysis to identify misalignments and inefficiencies. Through business process analysis of the "as is" model, a generic "to-be" process emerges, illustrating opportunities for re-alignment in the form of a PIP target list (RosettaNet.org).

In the PIP production process, supply chain company high-level process experts attend Cluster workshops to define the Cluster and divide it into Segments. Subject matter process experts attend Segment workshops to create detailed business processes, including interaction, data transmission and security and error-handling requirements. Business experts create the documents representing the business processes, PIP Blueprints and Message Guidelines, and they are agreed upon by workshop attendees and submitted for industry feedback (RosettaNet.org).

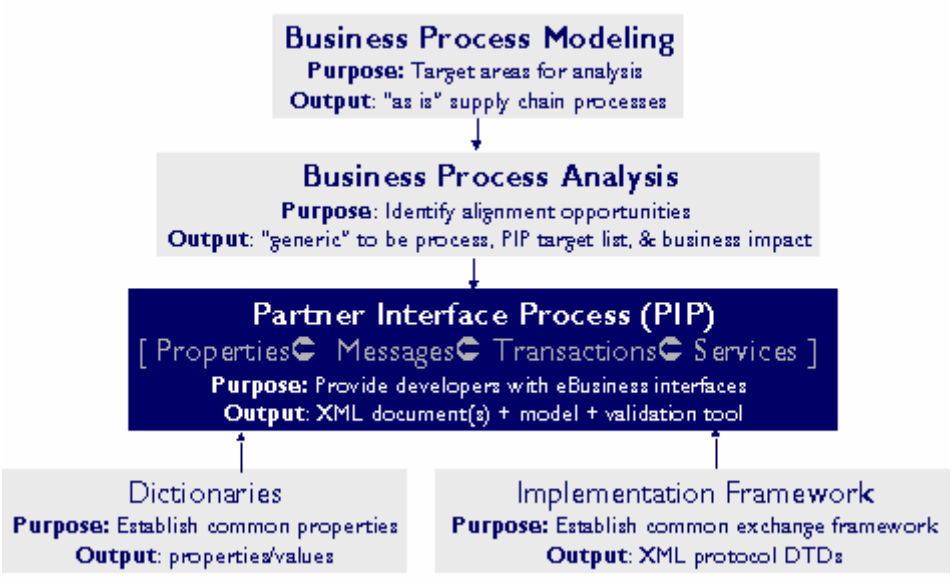

Figure 2. 7 RosettaNet Development Process

Data source: www.rosettanet.org

2. ebXML

ebXML (Electronic Business using eXtensible Markup Language), sponsored by UN/CEFACT and OASIS, is a modular suite of specifications that enables enterprises of any size and in any geographical location to conduct business over the Internet. Using ebXML, companies now have a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes (ebXML.org). The conceptual overview described below introduces the following concepts and underlying architecture of ebXML (ebXML Technical Architecture Specification, 2001):

(1) A standard mechanism for describing a Business Process and its associated information model.
(2) A mechanism for registering and storing Business Process and Information Meta Models so they can be shared and reused.
(3) Discovery of information about each participant including:
    a. The Business Processes they support.
    b. The Business Service Interfaces they offer in support of the Business Process.
    c. The Business Messages that are exchanged between their respective Business Service Interfaces.
    d. The technical configuration of the supported transport, security and encoding protocols.

(4) A mechanism for registering the aforementioned information so that it may be discovered and retrieved.
(5) A mechanism for describing the execution of a mutually-agreed upon business arrangement, which can be derived from information provided by each participant of item (3) above. (Collaboration Protocol Agreement – CPA)
(6) A standardized business Messaging Service framework that enables interoperable, secure and reliable exchange of Messages between Trading Partners.
(7) A mechanism for configuration of the respective Messaging Services to engage in the agreed upon Business Process in accordance with the constraints defined in the business arrangement.

The two well-known B2B integration standards both concentrate on public processes. However, there are differences between RosettaNet and ebXML as shown in Table 2.4. In the context of this paper the ebXML specification for business processes and partner agreement are of particular relevance.

RosettaNet pre-defines specific public processes, called Partner Interface Processes (PIPs), whereby ebXML allows defining arbitrary public processes through Collaborations. It means that in case of RosettaNet, two enterprises can interoperate by virtue of being RosettaNet compliance. In the case of ebXML two enterprises have to agree on a definition of their public processes first. This is facilitated by Collaboration Partner Agreements (CPAs) (Bussler, 2001).

RosettaNet does not address the approaches of how to identify the elements of a business process and create process model. On the contrary, ebXML Business Process Specification Schema (BPSS) adopts a subset of UN/CEFACT Modeling Methodology (UMM) needed to configure ebXML-compliant software (Hofreiter and Huemer, 2002). The UMM metamodel describes the business semantics that allows trading partners to capture the details for a specific business scenario using a consistent modeling methodology that utilizes Unified Modeling Language (UML). By using a single consistent modeling methodology, companies are likely to compare models to avoid duplication of existed business processes and facilitate the creation of consistent business processes and information models.

Table 2. 4 Comparison of RosettaNet and ebXML

	RosettaNet	ebXML
Implementation Framework		
- Protocol	◆	◆
- Message Structure	◆	◆

- Conversation	◆	◆
- Security	◆	◆
- Partner Agreement	◈	◆
Data Dictionaries	◆	◆
Vocabulary	◆	◆
Process		
- Process Model	◆	◆
- Process Meta-Model	◆	◆
Register and Repository	◆	◆
Illustration: ◆: Support ◆:Support, but only one half ◆: Support, but only one quarter ◈ :Not support		

Data source: 梁中平, 徐子淵, and 謝鎮澤, 2000

2.2.2 Comparison of Other Business Process Standards

Since business processes are the heartbeats of the business, it is important for organizations to understand them. One means of doing this is to create business process models. Business process modeling has become a major focus of attention in planning, designing, simulating and automatic execution of business process. The aim of representing processes in models is to gain a deeper understanding of organizational processes and related data (Wangler, Persson, and Söderström, 2001).

As O'Riordan (2002) pointed out, a business process standard should consider the following features:

1. Collaboration-Based Process Models

Experience in both EAI and B2B process modeling has led to the increasing adoption of collaboration-based process models, usually based on UML. In collaboration-based process models, processes are described as a set of collaborations between various participants. Usually participants can be abstracted in model descriptions using roles. The ability to recursively decompose process models is generally required.

2. Workflow

The workflow defines how the participants in a process work together to execute a process from start to finish, and is also called choreography or orchestration. There are two complementary parts to workflow: the control flow and the data flow. The control flow defines the sequencing of different activities in the process. The data flow defines how information flows between activities.

3. Transaction Management

Transactions are crucial building blocks of any business process and a comprehensive business process standard must provide a means for specifying how transactions are managed. Long-running transactions that may take hours or weeks to complete must be supported. If an enclosing transaction fails after an enclosed transaction is completed, some compensating actions may be needed. For example, if a hotel reservation is cancelled after a payment has been authorized; a compensating action may be required to cancel the payment. Time constraints for receiving responses or acknowledgements may also be required.

4. Exception Handling

If an exception is raised during the course of a business process, then it is important that the model allow appropriate recovery actions to be taken.

5. Service Interfaces

Web Services provide a basis for passing messages between participants in collaboration-based processes. Some recent proposed business process standards such as Web Services Flow Language (WSFL) and XLANG use Web Services Endpoint Language (WSDL) interfaces to describe the loosely coupled services exposed by participants to each other.

6. Message Security and Reliability

For mission-critical processes, reliable and secure message delivery is required. Additionally, B2B messages may need to be digitally signed and authenticated. These quality-of-service (QoS) semantics may vary for different transactions.

7. Audit Trail

It is generally very important for legal purposes in B2B processes that an audit trail of certain business transactions is kept. It ensures non-repudiation of the transaction by the partner. Digitally signed receipt acknowledgements of messages may be demanded.

8. Agreements

The notion of agreements is specifically for B2B processes. An agreement represents a contract between two or more partners to carry out specific functions (identified by roles) in a public business process.

9. Execution

Public processes describe only how information should flow between organizations. In order to be able to fully automate the execution of the business process within an organization, the complete information flow within that organization as well as across its firewalls must be specified. This requires the process models to fully describe the private as well as the public activities of the organization.

The following is a summary of O'Riordan's study about ebXML BPSS, XLANG, WSFL.

1. ebXML BPSS

ebXML BPSS is part of the comprehensive ebXML B2B suite of specifications, which also includes core specifications for reliable and secure messaging based on SOAP, collaboration agreements and profiles, a registry/repository, and core components.

2. XLANG

XLANG is Microsoft's proposal in this space, and like BPSS is currently focused entirely on public processes.

3. WSFL

WSFL is IBM's proposal in this area. It covers both public and private processes. WSFL is primarily focused on describing Web Service compositions, and like XLANG uses WSDL to describe the service interfaces.

Table 2. 5 Business Process Standards

Standard / Feature	ebXML BPSS	XLANG	WSFL
Collaboration-Based Modeling	It's a relatively simple but effective schema that describes public processes only. In a BPSS model different roles (seller, buyer, etc.) collaborate to carry out a set of transactions.	XLANG describes processes as interactions between Web Service providers so collaboration-based process modeling tools are possible.	WSFL describes processes as interactions between Web Service providers, which can be abstracted using roles. Therefore collaboration-based process modeling tools could certainly be used to generate WSFL descriptions.
Workflow	The orchestration of the transactions is defined using a control flow based on UML activity graph semantics.	In XLANG the workflow associated with each Web Service is defined by an XML <behavior> element. There is no support for specifying data flow between actions.	A flow model describes the workflow for a process. Both control flow and data flow can be defined using a state-transition model.
Transaction Management	The transaction part of the model is based on a proven, robust model for long-lived e-commerce business transactions used by previous B2B standards such as RosettaNet.	XLANG provides a flexible and comprehensive long-running transaction model. Transactions are scoped by context blocks, within which any number of actions can be defined.	WSFL doesn't support transactions. Transactional characteristics of Web Services are being addressed in another IBM project (WSTx).
Exception Handling	BPSS defines a number of possible exceptions and prescribes how these are communicated and how they affect the state of the transaction.	Exceptions can be caught and recovery specific operations.	WSFL can support handling different exceptions that are indicated in the content of messages by specifying transition conditions that examine the message for these exceptions.
Service Interfaces	BPSS process models implicitly contain service interface descriptions for each role.	XLANG uses WSDL to describe the service interfaces of each participant.	WSFL explicitly uses WSDL to describe the service interfaces for each participating Web

			Service.
Message Security And Reliability	BPSS assumes that processes will use reliable and secure messaging services such as the ebXML messaging service.	There is no support for security and reliability semantics in XLANG.	There is no support for security and reliability semantics in WSFL. This is delegated to the separate WSEL specification.
Audit Trail	There is explicit support for specifying quality-of-service semantics for transactions such as authentication, acknowledgements, non-repudiation, and timeouts.	There is no support for non-repudiation semantics in XLANG.	There is no support for non-repudiation semantics in WSFL. This is delegated to the separate WSEL specification.
Agreements	A BPSS process model can be referenced in an ebXML collaboration protocol agreement (CPA).	XLANG supports the notion of business process contracts, which could provide the foundation for business agreements.	In the IBM Web Services stack, agreements are a separate component (TPA) but WSFL global models give a foundation that could be used for business agreements.
Execution	As a public process schema, BPSS provides no support for internal execution semantics.	XLANG is focused on public processes and omits some details required to automate execution of a process, for example data flow constructs.	WSFL provides execution capabilities for activities through Web Service invocations or through Java, CICS or EXE/CMD based implementation.

Data source: O'Riordan, 2002

Table 2. 6 Business Process Standard Summary

	ebXML BPSS	XLANG	WSFL
Collaboration-Based Modeling			
Workflow			
Transaction Management			
Exception Handling			
Service Interfaces			
Message Security And Reliability			
Audit Trail			
Agreements			
Execution			

Illustration:

 :Support

 :Support, but not directly support

 :Support, but only one half

 :Not support, delegate to another standard

 :Not support

2.3 Global Logistics

2.3.1 Introduction

According to the Council of Logistics Management (CLM), logistics is a part of the supply chain processes that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements.

In fact, logistics in the economy has two dimensions: logistics management in manufacturing and distribution organizations, and logistics organizations providing services to the manufacturing and distribution companies (Brewer, Button, and Hensher, 2001). Furthermore, international logistics is not the same as domestic logistics with perhaps the addition of one or more international border crossings. International logistics certainly contains border crossing issue, but also must accommodate a significantly higher level of complexity comprising various combinations of cultural, political, technological, and economic variables (Wood, Barone, Murphy, and Wardlow, 1995). In this research, we replace international logistics with global logistics and focus on the global logistics industry which provides services to other industries and companies.

Traditionally, logistics is a second-order activity which is generated by other economic activities; the demand for logistics depends heavily on economic activities and consumption. Nevertheless, the concept of global logistic has clearly evoked growing interest in both the corporate and scientific worlds. Brewer et al. (2001) says, "...in part this is due to the fact that an increasing number of companies are getting involved in global markets, as greater emphasis is put on export and import trade. Globalization of production and trade generate substantial goods flows between countries that must be dealt with as efficiently as possible."

In recent years, Taiwan has become one of the largest manufacturers of information technology (IT) products and the largest original equipment manufacturing (OEM) country for other countries such as U.S. and Japan. In order to produce more competitive products, the global logistics industry plays an important role in the supply chain.

The global logistics, with complex nature, involves many different parties. Here are some roles in the global logistics industry:

1. Carriers

The carrier is responsible for freight of goods between two geographical points (Borén and Halvardsson, 1999).

2. Freight Forwarders

The freight forwarder is the most common intermediary in global logistics. After the sale is completed, a freight forwarder can handle nearly all the logistical aspects of the transaction. Indeed, large forwarders may assume responsibility for managing the firm's international distribution and supply channels. Smaller forwarders often specialize in air or ocean movements. Forwarders have a number of advantages, including daily pickup and distribution; global shipping capacity with choices from multiple carriers; local staff familiar with the shipper's needs; advice and preparation of documents; consolidation of freight from multiple shippers to a single destination, thus saving freight costs; and because of bulk booking of freight space, they will often have capacity available when the carrier reports "sold out." (Wood, Barone, Murphy, and Wardlow, 1995)

3. Customs House Brokers

Customs house brokers oversee the movement of goods through customs and ensure that the documentation accompanying a shipment is complete and accurate for entry into the country (Coyle, Bardi, and Langley, 1996).

4. Third-Party Logistics (3PL)

A third-party logistics firm may be defined as an external supplier that performs all or part of a company’s logistics functions (Coyle, Bardi, and Langley, 1996). Smaller shippers are able to convert in-house fixed costs of logistics management services into variable cost out-sourced activities, thereby reducing expenses and improving profitability (Brewer, Button, and Hensher, 2001).

Some 3PLs are freight forwarders who have traditionally provided a mix of services designed to meet a variety of logistics needs. Previously, their services were not structured and marketed as logistics services. Now, 3PLs are companies who have assets and related management capabilities in a part of logistics to which they have added other capabilities. They have done this particularity through the addition of information-system assets and knowledge-based expertise (Brewer, Button, and Hensher, 2001).

5. Integrators

Usually there are four worldwide covering integrators: FedEx, UPS, DHL and TNT. These companies do not isolate their mission to a special part of the transport

chain, but are responsible for the entire transport from supplier to customer. In order to transport goods rapidly over wide areas, companies view aircraft as an important factor (Borén and Halvardsson, 1999).

6. Fourth-Party Logistics (4PL)

4PL is a new concept in supply chain outsourcing. It is emerging as a path to achieve operating cost reductions and asset transfers of a traditional outsourcing arrangement. Through alliances between best-of-breed third party service providers, technology providers and management consultants, as shown in Figure 2.8, 4PL organizations can create unique and comprehensive supply chain solutions that cannot be achieved by any single provider (Deogade). 4PL is the planning, steering and controlling of all logistic procedures by one service provider with long-term strategic objectives (HOYER Company).

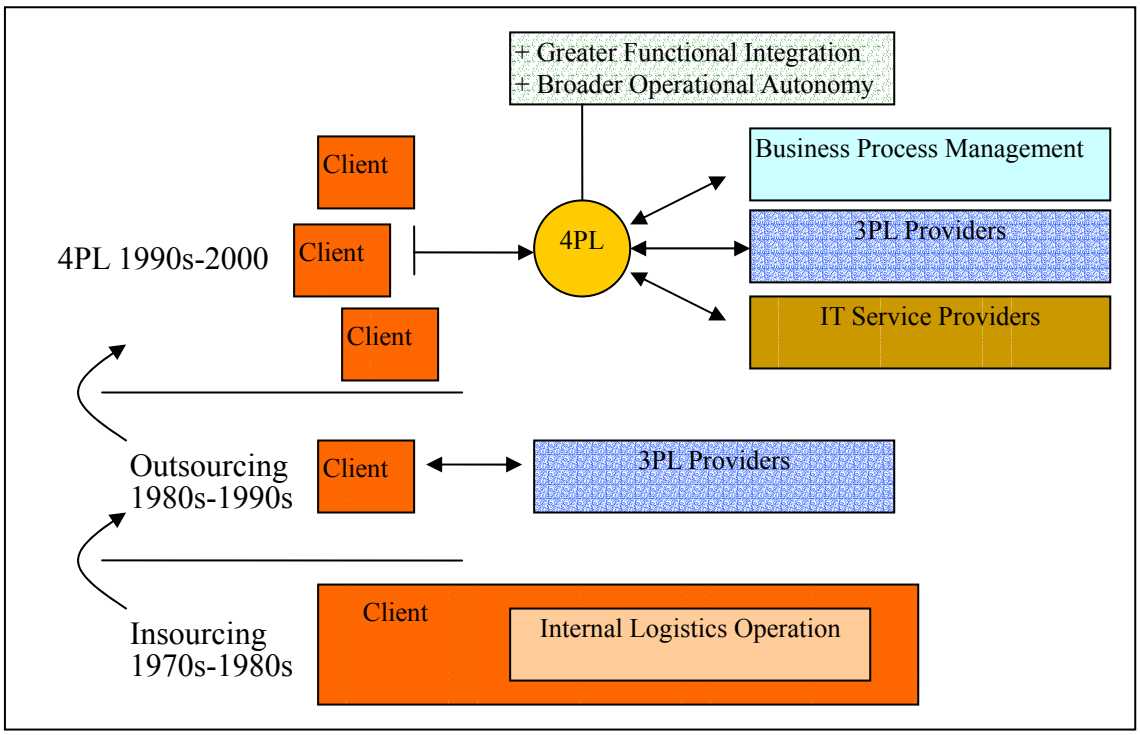

Figure 2. 8 3PL and 4PL

Data source: http://www.isr.umd.edu/~cdeogade/future.html

2.3.2 Application of Electronic Data Interchange in Global Logistics

Coyle et al. (1996), referring to Emmelhainz, "electronic data interchange (EDI) is the organization-to-organization, computer-to-computer exchange of business data in a structures, machine-processable format. The purpose of EDI is to eliminate duplicate data entry and to improve the speed and accuracy of the information flow by

linking computer applications between companies."

There are multiple EDI standards in use today. Perhaps the most commonly used standard in North America is ANSI X12. The current international standard of importance to logistics managers is UN/CEFACT, which has been developed jointly by the United Nations and the International Standard Organization. Many EDI applications can utilize third-party value-added networks, or VANs, to assist in transferring information from one party to another (Coyle, Bardi, and Langley, 1996).

The use of EDI helps to improve the timely availability of logistics information, enhance the breadth and accuracy of data, and make the process less labor-intensive (Coyle, Bardi, and Langley, 1996). Customs clearance has always been a problem for international commerce. During the days of break-bulk ocean trade, it was not as acute as in the post-container age, since cargo handling was so slow in the first place. Air freight, trucking, and intermodal shipments made radical improvements necessary. In the industry it is referred to as "facilitation." It reduced quantity and accelerated processing of paperwork. The major force in facilitation has been information technology and EDI. EDI began as a means of rapidly transferring documents, such as bill of lading, delivery notices, and invoices, with one of the most promising benefits being the swift clearance of customs (Brewer, Button, and Hensher, 2001). However, EDI requires companies to invest substantial sums on systems and services in order to translate commercial messages for use in disparate computer systems; XML, by contrast, would let companies exchange messages with their trading partner right over the Internet (Cooke, 2001).

The Ministry of Finance started a cargo clearance automation planning and promotion (CCAPP) task force on November 9, 1990 in Taiwan. The task force established the first EDI information exchange service network in Taiwan. TRADE-VAN was formed to ensure more effective utilization of Taiwan's first EDI information exchange network. Its original major goals were to improve and expand a range of value added information services, including customs clearance automation, and paperless trading. Currently, almost all customs clearance in Taiwan goes through this network. TRADE-VAN serves a wide range of customers including customs, warehouses, forwarders, customs brokers, airlines, shipping lines, banks, and distribution centers. Figure 2.9 depicts the Export Cargo Clearance Automation Processes.

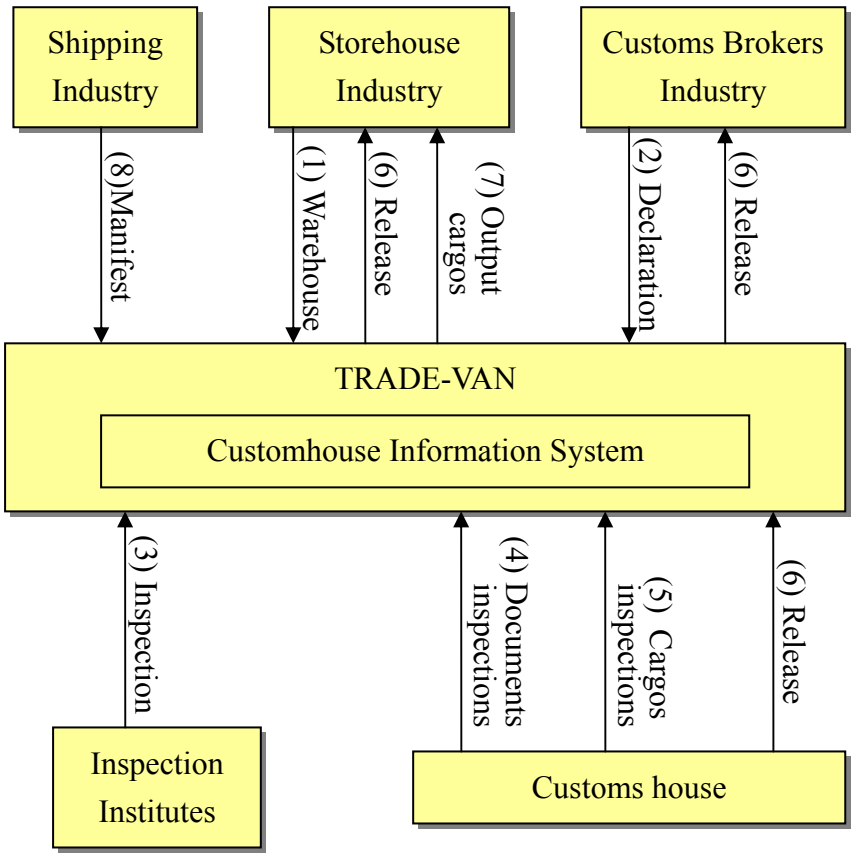

Figure 2. 9 Export Cargo Clearance Automation Process

Data source: TRADE-VAN Website (http://www.tradevan.com.tw/00-index/)

2.3.3 XML-based Standards for Global Logistics

1. TranXML

From the TranXML Principles white paper, TranXML is a new extensible markup language (XML) solution that is being proposed as a new industry standard for electronic commerce related transactions between shippers and carriers. TranXML developed by Transentric, is the common vocabulary to support logistics supply chain functions across vertical collaborative vocabularies. It was created specifically to serve needs surrounding the procurement and delivery of transportation and logistics services required for supply chain execution. Use of TranXML will supplement the extensive investment in EDI that has powered the transportation industry for many years. TranXML has leveraged this semantic repository by using the Value Chain Markup Language (VCML) document type definitions (DTDs) as a base for mapping from EDI to meaningful XML objects. VCML contains a set of industry-specific

vocabularies, transactions, elements, and guidelines for expressing EDI semantics in XML. TranXML currently includes some more common semantic structures for messages relating to tracing and load tenders, as shown in the Table 2.7.

Table 2. 7 Schema Directory of TranXML Version 4.0

Advance Car Disposition (419)	Shipment Information (858)
Car Handling Information (420)	Shipment Status Message (214)
Car Location Message (CLM)	Shipment Weights (440)
Confirmation Ocean (301)	Ship Notice Manifest (856)
Motor Carrier Bill Of Lading (211)	Shippers Car Order (422)
Motor Carrier Load Tender (204)	Simple Rail Bill Of Lading (404)
Purchase Order (850)	Simple Rail Carrier Waybill Interchange (417)
Purchase Order Acknowledgement (855)	Terminal Operations And Intermodal Ramp Activity (322)
Rail Advance Interchange Consist (418)	TranXML Acknowledgement
Rail Bill Of Lading (404)	TranXML Dictionary
Rail Carrier Freight Details and Invoice (410)	TranXML Envelope
Rail Industrial Switch List (423)	Vessel Schedule and Itinerary Ocean (323)
Rail Scale Rates (494)	Warehouse Inventory Adjustment (947)
Railroad Price Distribution Or Response Format (460)	Warehouse Shipping Advice (945)
Railroad Problem Log Inquiry Or Advice (452)	Warehouse Shipping Order (940)
Rail Rate Reply (463)	Warehouse Stock Transfer Receipt Advice (944)
Rate Docket Expiration (486)	Warehouse Stock Transfer Shipment Advice (943)
Rate Group Definition (490)	
Rate Request (466)	
Receiving Advice Acceptance Certificate (861)	

Data source: Transentric website (www.tranxml.org)

To ensure that the TranXML Dictionary is as interoperable as possible, Transentric is drawing upon work of other standard bodies such as ChemXML, RosettaNet, and EbXML; it also follows the design of logistics messages developed through CIDX (Chemical Industry Data Exchange) and Bolero.

2. boleroXML

Besides TranXML, boleroXML is developed by bolero.net. Bolero.net is created by the world's logistics and banking communities, and specializes in electronic trade documents. Its goal is to eliminate the need for bilateral data interchange agreements, which describe the structure and contents of electronic data exchanged between two parties. boleroXML incorporates the following components:

(1) The boleroXML Document Definitions

The boleroXML Document Definitions are a set of specifications that describe the standard structure and contents of the electronic version of a common trade document. The following provides a list of available documents in transport.

Table 2. 8 List of boleroXML Documents

Advance Shipment Notice	Firm Booking Request
Air Waybill	Forwarders Cargo Receipt
Arrival Notice	Forwarding Instructions
Bill of Lading	House Air Waybill
Booking Confirmation	House Bill of Lading
Cargo Analysis Voyage Report	NVOCC Bill of Lading
Cargo Movement Event Log	Packing List
Cargo Report Export	Provisional Booking Request
Cargo Report Import	Sea Waybill
Combined Transport Document	Shipping Instructions
Despatch Advice	Statement of Facts
Destination Declaration	

Data source: bolero.net website
(http://www.bolero.net/boleroxml/docdef/transport.php3)

(2) The bolero XML Analyzer (BXA)

This is a software application, which enables business users lacking knowledge of XML to familiarize themselves with the boleroXML Document Definitions and map the standard data requirements against their existing business data.

(3) The bolero XML Validator

With the implementation of Version 3.0 to the Bolero Core Messaging Platform (CMP), bolero.net introduced document content validation through the boleroXML Validator.

Bolero is now also committed to submit the boleroXML standards to UN/CEFACT as input into their core components work. boleroXML standards are currently used by key players in industries such as Banking, Coffee, Tobacco, Alcohol, Retail, Electronics, Iron Ore, Coal and Aluminium.

2.3.4 Discussion

In the past, optimization of internal information systems to serve the needs of employees and to streamline operations is most important of all in the global logistics industry. These information systems, for example, are Document System, Booking System, Equipment Control System, Yard Control System, et al. In addition, the declaration data is often transferred by EDI in the global logistics industry. Now, since XML provides a more extensive and flexible way to define data format and accommodates EDI as well, many organizations embark on the development of XML-based standard. Many efforts of the development have been centered on the common vocabulary and dictionaries, rather than on the common process model.