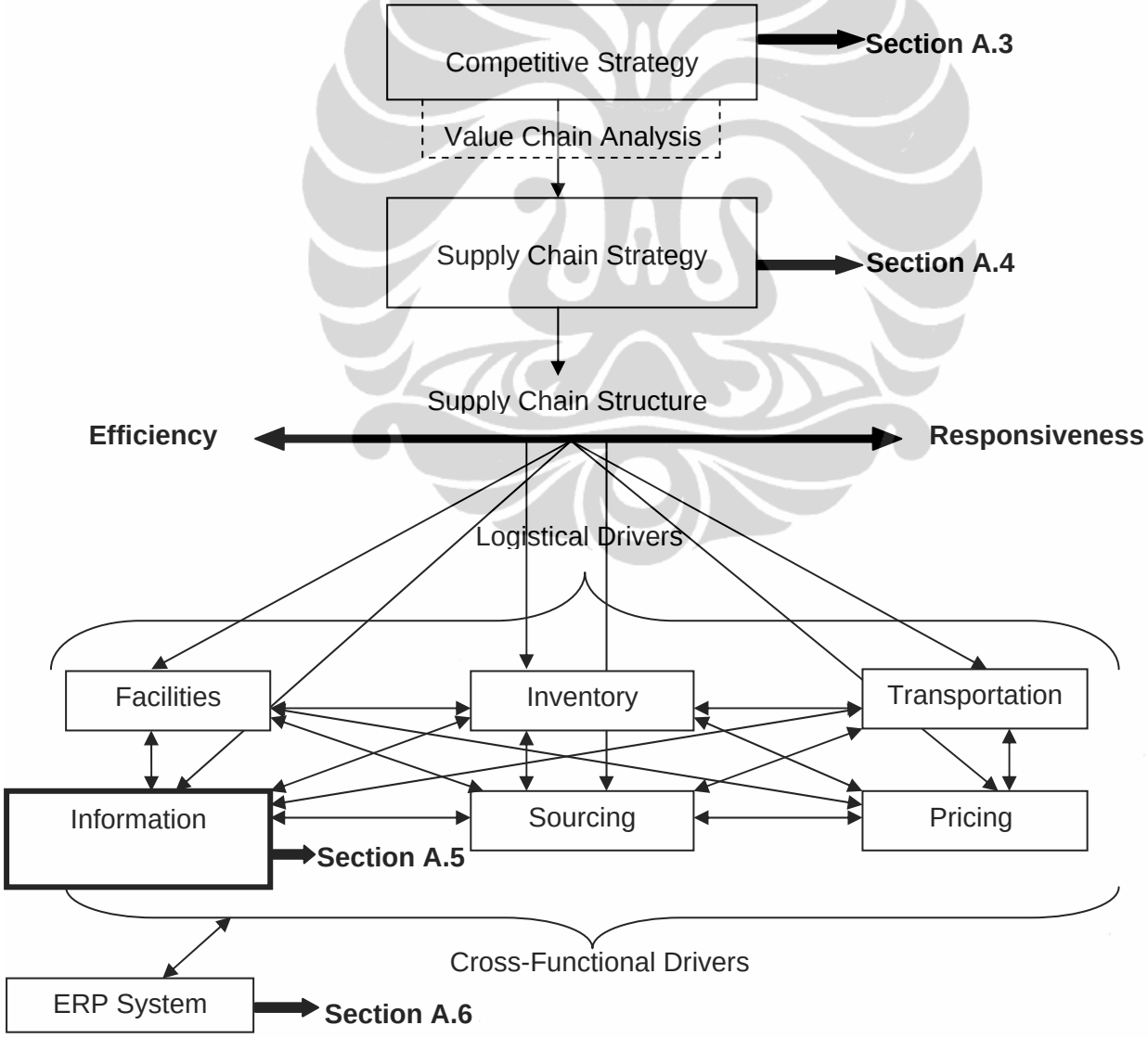
CHAPTER II

THEORETICAL FRAMEWORK

A. Literature Study

Overview of the theoretical framework underpinning this research can be described through following figure (Figure 2-1).

Figure 2-1 THEORETICAL FRAMEWORK



(Modified based on Supply Chain Decision-Making Framework, Chopra, 2007:63)

The value chain analysis in section A.3 is used to provide overview about company's strategy that is represented by its activities and management that are of value to customers. Theory of supply chain and supply chain management as detailed in section A.4 reveals how supply chain activities and possible problems are typically managed to meet customer's demand. Theory of management and information system in section A.5 is pinpointed to show the role of information technology to develop an efficient information flow within a supply chain. Finally, theory on ERP (Enterprise Resource Planning System) in section A.6 is underpinned to reveal the benefits of its application for managing cross-functional drivers of supply chain to achieve efficient and effective supply chain coordination.

A.1. Global Competition and Technology Advancement

In today's competitive business environment (Monk, 2006: 16), companies try to provide customers with goods and services faster and cheaper than their competition. The trend toward globalization (Douglas, 1995: 4) is occurring, not only downstream in end markets for consumer or industrial goods, but also upstream in markets for raw materials, technology, and other resources. In many industries, global sourcing is on the increase, resulting in the development of complex logistical systems designed to take advantage of differential labor, production, and raw material costs in different countries, as well as the increased efficiency in international transportation and communication networks. Such developments imply that all companies need to adopt a global perspective in their strategic marketing planning, irrespective of their interest in international markets. Companies already involved in, or contemplating entry into, international markets need to identify the most attractive opportunities worldwide and to determine their global strategic thrust, or key competitive advantage and investment strategy relative to these markets. Even companies not considering international operations need to develop with an eye to international developments and potential entry of foreign competition into the domestic market.

Recent developments (Douglas, 1995: 10-15) in communication technology and in electronic information-processing capabilities are a powerful factor encouraging the growth of international business. The much-heralded

information superhighway, in addition to dramatically altering communication networks and ways of doing business in domestic markets, also promises to bring radical change in the global marketplace. Technological forces are often closely intertwined with economic forces, especially insofar as technological developments impact the economic scale of operations and efficiency of production. The rapid evolution of technology, especially marked in industries such as computers, consumer electronics, home entertainment, and communications, requires continual adaptation and retooling for a firm to keep pace. Rapid product and knowledge obsolescence shortens the life cycle of products and heightens the pace of competition. The development of computerized global information systems, for example, has dramatically expanded and improved coordination of global production and distribution logistics. Inventory, ordering, and delivery systems can be established on a worldwide scale, minimizing inventory levels, while at the same time ensuring rapid filling of customer orders.

A.2. Competitive Strategy

Strategy (Grant, 2005: 19-22), at its most general level, is concerned with planning how an organization or an individual will achieve its goal. The nature of strategy depends on two factors: the type of arena within which strategy is being deployed and the stability and predictability of the environment in which strategies are applied. The goal of strategy is to ensure the survival and prosperity of the firm. Two routes determine the ability of a firm to earn a return on its capital that exceeds the cost of its capital. First, the firm may locate in an industry where favorable conditions result in the industry earning a rate of return above the competitive level. Second, the firm may attain a position advantage *vis-à-vis* its competitors within an industry, allowing it to earn return in excess of the industry average. These two sources of superior performance define the two basic levels of strategy within an enterprise:

- *Corporate Strategy* defines the scope of the firm in terms of the industries and markets in which it competes. Corporate strategy decisions include investment in diversification, vertical integration, acquisitions, and new

ventures; the allocation of resources between the different business of the firm; and divestments.

- *Business Strategy* is concerned with how the firm competes within a particular industry or market. If the firm is to prosper within an industry, it must establish a competitive advantage over its rivals. Hence, this area of strategy is also referred to as *competitive strategy*.

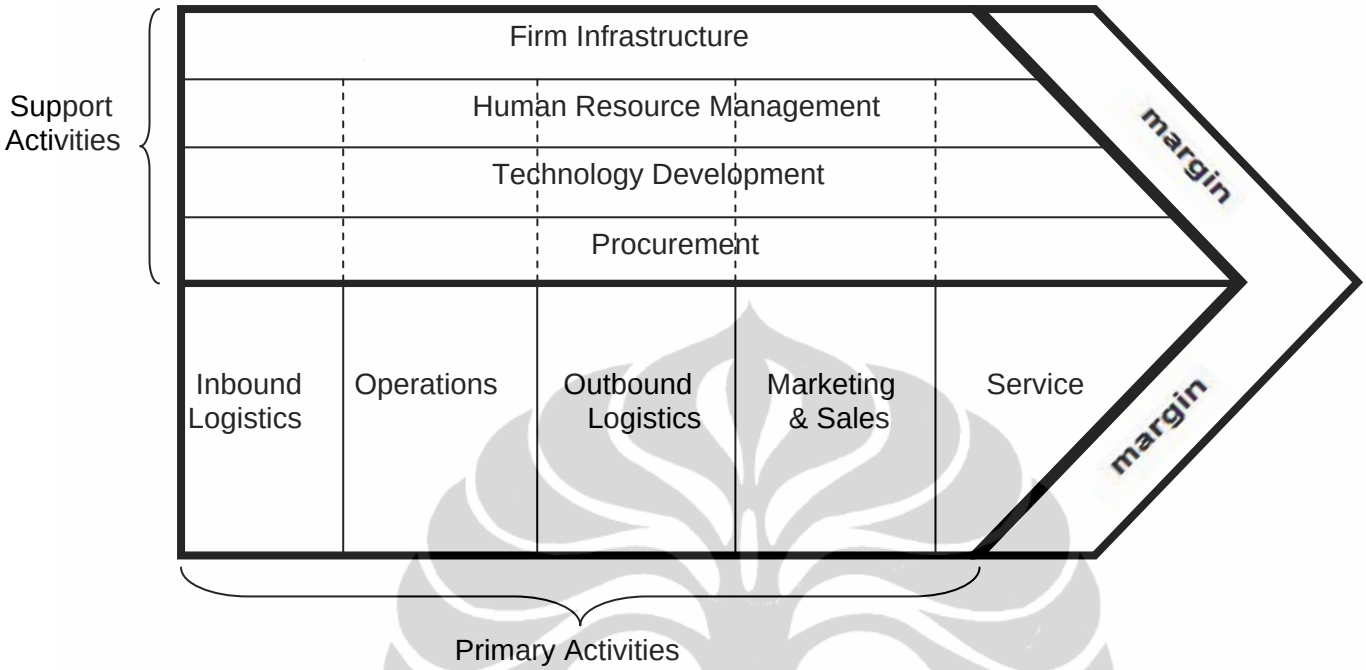
Competitive strategy (Porter, 1985: 1) is the search for a favorable competitive position in an industry, the fundamental arena in which competition occurs. The first fundamental determinant of a firm's profitability is industry attractiveness. Competitive strategy must grow out of sophisticated understanding of the rules of competition that determine industry's attractiveness. The ultimate aim of competitive strategy is to cope with and, ideally, to change those rules in the firm's favor.

A.3. Value Chain

Every firm is a collection of activities that are performed to design, produce, market, deliver and support its product. All these activities can be represented using a value chain, shown in Figure 1-1. A firm's value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach to implementing its strategy, and the underlying economic of the activities themselves (Porter, 1985: 36).

In competitive terms, value (Porter, 1985: 38) is the amount buyers are willing to pay for what a firm provides them. Creating value for buyers that exceeds the cost of doing so is the goal of any generic strategy. Value, instead of cost, must be used in analyzing competitive position since firms often deliberately raise their cost in order to command a premium price via differentiation. The value chain displays total value, and consists of value activities and margin. Value activities are the physically and technologically distinct activities a firm performs. Margin is the difference between total value and the collective cost of performing the value activities.

Figure 2-2 The Generic Value Chain



(Porter, 1985: 37)

Every value activity employs *purchased input*, *human resources* (labor and management), and some form of *technology* to perform its function. Each value activity also uses and creates *information,* such as buyer data (order entry), performance parameters (testing), and product failure statistics. Value activities may also create financial assets such as inventory and account receivables, or liabilities such as account payables.

A.3.1. Identifying Value Activities

Value activities (Porter, 1985: 38-43) can be divided into two broad types, *primary* activities and *suppor*t activities. Primary activities are the activities involved in the physical creation of the product and its sale and transfer to the buyer as well as after-sale assistance. In any firms, activities can be divided into the five generic categories as shown in Figure 2-2. Support activities support the primary activities and each other by providing purchased inputs, technology, human resources, and various firm-wide functions. The dotted lines in Figure 2-2 reflect the fact that procurement, technology development, and human resource

management can be associated with specific primary activities as well as support the entire chain. Firm infrastructure is not associated with particular primary activities but supports the entire chain. Identifying value activities (Porter, 1985: 39) requires the isolation of activities that are technologically and strategically distinct. Value activities and accounting classifications are rarely the same.

Primary Activities

There are five generic categories of primary activities involved in competing in any industry. Each category is divisible into a number of distinct activities that depend on the particular industry and firm strategy:

- ***Inbound Logistics.*** Activities associated with receiving, storing, and disseminating inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling, and returns to suppliers.

- ***Operations.*** Activities associated with transforming inputs into the final product form, such as machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations.

- ***Outbound Logistics.*** Activities associated with collecting, storing, and physically distributing the product to buyers, such as finished goods warehousing, material handling, delivery vehicle operation, order processing, and scheduling.

- ***Marketing and Sales.*** Activities associated with providing a means by which buyers can purchase the product and inducing them to do so, such as advertising, promotion, sales force, quoting, channel relations, and pricing.

- ***Service.*** Activities associated with providing service to enhance or maintain the value of the product, such as installation, repair, training, parts supply, and product adjustment.

Support Activities

Support value activities involved in competing in any industry can be divided into four generic categories, as also shown in Figure 1-1. As with primary

activities, each category of support activities is divisible into a number of distinct value activities that are specific to a given industry.

Procurement. Procurement refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves. Purchased inputs include raw materials, supplies, and other consumable items as well as assets such as machinery, laboratory equipment, office equipment, and buildings. Though purchased inputs are commonly associated with primary activities, purchased inputs are present in every value activity including support activities. Like all value activities, procurement employs a "technology", such as procedures for dealing with vendors, qualification rules, and information systems. Improved purchasing practices can strongly affect the cost and quality of purchased inputs, an interacting with suppliers.

Technology Development. Every value activity embodies technology, be it know-how, procedures, or technology embodied in process equipment. Technology development consists of a range of activities that can be broadly grouped into efforts to improve the product and the process.

Human Resource Management. Human resource management consists of activities involved in the recruiting, hiring, training, development, and compensation of all types of personnel. Human resource management supports both individual primary and support activities and the entire value chain.

Firm Infrastructure. Firm infrastructure consists of a number of activities including general management, planning, finance, accounting, legal, government affairs, and quality management. Infrastructure usually supports the entire chain and not individual activities. Firm infrastructure activity such as proper management information systems can contribute significantly to cost position, while in some industries top management plays a vital role in dealing with the buyer.

A.4. Supply Chain and Supply Chain Management

A *supply chain* (Chopra, 2007: 19-20) consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not

only the manufacturer and its suppliers, but also transporters, warehouses, retailers, and even the customers themselves. Within each organization, such as a manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service. A supply chain is dynamic and involves the constant flow of information, product and funds between different stages. The term supply chain conjures up images of products or supply moving from suppliers to manufacturers to distributors to retailers to customers along the chain. In addition, it is also important to visualize information, funds, and products flows along both directions of this chain.

While integrated supply chain spans operations between supplier, enterprise and distributive network, internal supply chain management (Chopra, 2007: 500-501) is focused on operations internal to the enterprise. Internal supply chain management (ISCM) includes all processes involved in planning for and fulfilling a customer order. The various processes included in ISCM are as follows:

- Strategic Planning
  This process focuses on the network design of the supply chain.

- Demand Planning
  Demand planning consists of forecasting demand analyzing the impact on demand of demand management tools such as pricing and promotions.

- Supply Planning
  The supply planning process takes as an input the demand forecasts produced by demand planning and the resources made available by strategic planning, and then produces an optimal plan to meet this demand. Factory planning and inventory planning capabilities are typically provided by supply planning software.

- Fulfillment
  Once a plan is in place to supply the demand, it must be executed. The fulfillment process links each order to a specific supply source and means

of transportation. The software applications that typically fall into the fulfillment segment are transportation and warehouse applications.

- Field Service

  Finally, after the product has been delivered to the customer, it eventually must be serviced. Service processes focus on setting inventory levels for spare parts as well as scheduling service calls. Some of the scheduling issues here are handled in a similar manner to aggregate planning, and the inventory issues are the typically inventory management problems.

Simchi-Levi (2008: 12) pointed out key issues in supply chain management which span a large spectrum of a firm's activities, from the strategic through the tactical to the operational level as follows:

- The strategic level deals with decisions that have a long-lasting effect on the firm. This includes decisions regarding product design, supplier selection, strategic partnering and decisions on the number, location, and capacity of warehouses and manufacturing plants and the flow material through the logistics network.

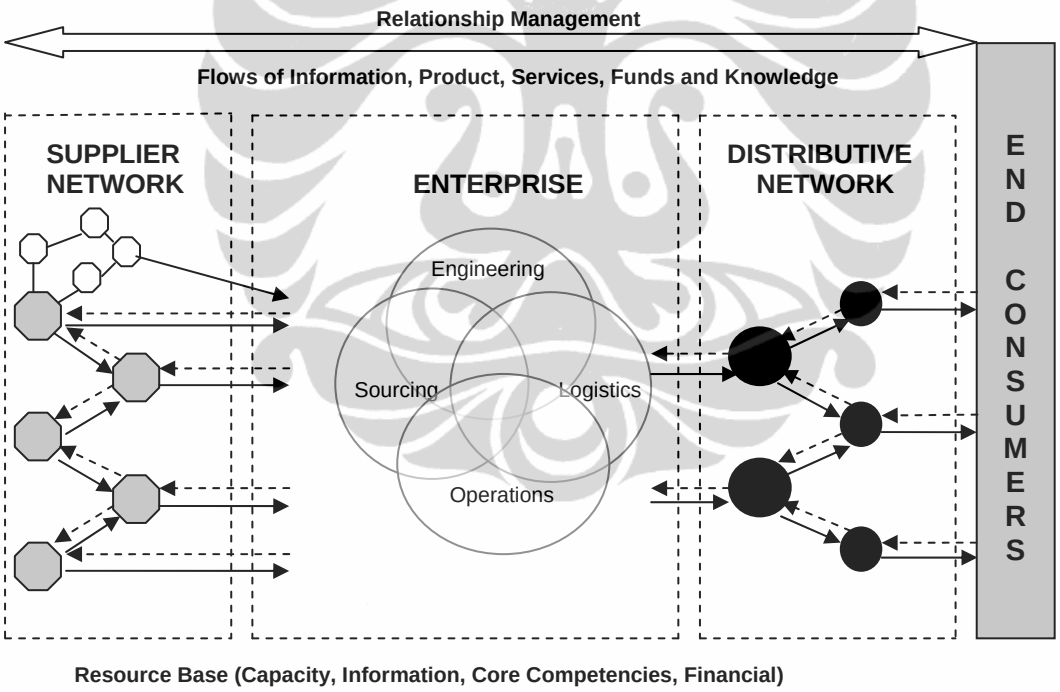
- The tactical level includes decisions that are typically updated anywhere between once every quarter and every year. These include purchasing and production decisions, inventory policies, and transportation strategies, including the frequencies which customers are visited.

- The operational level refers to day-to-day decisions such as scheduling, lead time quotations, routing, and trucking loading.

All processes involved in planning for and fulfilling a customer order represent the interplay among firm's resources including information, product and fund. It is recognized that all flows of information, products, or funds (Chopra, 2007: 22) generate costs within the supply chain. Thus, the appropriate management of these flows is a key to supply chain success. Effective supply chain management involves the management of supply chain assets and product, information, and fund flows to maximize total supply chain profitability.

The internal supply chain (Handfield, 2002: 48) is that portion of a given supply chain that occurs within an individual organization. Developing an understanding of the organization's internal supply is often an appropriate starting point for firms considering a supply chain management initiative. Supply chain in the context of an individual firm (Handfield, 2002: 9) includes both its upstream supplier network and its downstream distribution channel (see Figure 2-3). In this definition, supply chain includes managing information systems, sourcing and procurement, production scheduling, order processing, inventory management, warehousing, customer service, and after-market disposition of packaging and materials.

Figure 2-3 The Integrated Supply Chain



(Handfield, 2002: 9)

Supply chain management (Simchi-Levi, 2008: 1-2) is defined as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements.

The definition leads to several observations. First, supply chain management takes into consideration every facility that has an impact on cost and plays a role in making product conform to customer requirements: from supplier and manufacturing facilities through warehouses and distribution centers to retailers and stores. Second, the objective of supply chain management is to be efficient and cost-effective across the entire system. Total system-wide costs, from transportation and distribution to inventories of raw materials, work in process, and finished goods, are to be minimized. Thus, the emphasis is not on simply minimizing transportation cost or reducing inventories but, rather, on taking a systems approach to supply chain management. Finally, because supply chain management revolves around efficient integration of suppliers, manufacturers, warehouses, and stores, it encompasses the firm's activities at many levels, from the strategic level through the tactical to the operational level. Several issues to address in managing supply chain (Simchi-Levi, 2008: 2) include, but not limited, to the following:

- Supply chain strategies cannot be determined in isolation. They are directly affected by another chain that most organizations have. Supply chain strategies should be aligned with the specific goals of the organization, such as maximizing market share or increasing profit.

- It is challenging to design and operate a supply chain so that total system-wide costs are minimized, and system-wide service levels are maintained. It is frequently difficult to operate a single facility so that costs are minimized and service level is maintained. The difficulty increases exponentially when an entire system is being considered. The process of finding the best system-wide strategy is known as global optimization.

- Uncertainty and risk are inherent in every supply chain. Problems associated with customer order or firm capacity as well as recent industry trends (e.g. outsourcing, lean manufacturing) that focus on reducing supply chain costs, significantly increase the risk in the supply chain. Thus, supply chain need to be designed and managed to eliminate as much uncertainty and risk as possible as deal effectively with the uncertainty and risk that remain.

The objective of every supply chain (Chopra, 2007: 21) is to maximize the overall value generated. The value a supply chain generates is the difference between what the final product is worth to the customer and the costs the supply chain incurs in filling the customer's request. For most commercial supply chains, value will be strongly correlated with supply chain profitability (also known as supply chain surplus), the difference between the revenue generated from the customer and the overall cost across the supply chain.

Supply chain profitability or surplus is the total profit to be shared across all supply chain stages and intermediaries. The higher the supply chain profitability, the more successful is the supply chain. Supply chain success should be measured in terms of supply chain profitability and not in terms of the profits at an individual stages. Focus on profitability at individual stages may lead to a reduction in overall supply chain profits. Thus, supply chain management involves the management of flows between and among stages in supply chain to maximize total supply chain profitability. Handfield (2002: 57) pointed out specific supply chain activities exist on both an intra-organizational and inter-organizational basis that are possible candidates for review including:

- Material planning and scheduling
- Purchase order cycle
- Inbound transportation
- Material receipt/inspection
- Material review activities
- Manufacturing processes
- Customer order processing
- Warehousing operations
- Outbound transportation
- Return material/reverse logistics

A.4.1. Role and Impact of Supply Chain Drivers

To understand how a company can improve supply chain performance in terms of responsiveness and efficiency, functional drivers of the supply chain performance need to be examined (facilities, inventory, transportation,

information, sourcing, and pricing). Following are the definition, impact and role of each functional driver on the performance of the supply chain (Chopra, 2007: 61-76):

1. ***Facilities*** are the actual physical locations in the supply chain network where product is stored, assembled, or fabricated. The two major types of facilities are production site and storage sites. Decisions regarding the role, location, capacity and flexibility of facilities have a significant impact on the supply chain's performance. If we think of inventory as *what* is being passed along the supply chain and transportation as *how* it is passed along, then facilities are the *where* of the supply chain. They are the locations to or from which inventory is transported. Within a facility, inventory is either transformed into another state (manufacturing) or it is stored (warehousing).

2. ***Inventory*** encompasses all raw materials, work in process, and finished goods within a supply chain. Changing inventory policies can dramatically alter the supply chain's efficiency and responsiveness. An important role that inventory plays in the supply chain is to increase the amount of demand that can be satisfied by having the product ready and available when the customer wants it. Another significant role that inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution. Inventory is a major source of cost in a supply chain and has a huge impact in responsiveness. Inventory also has a significant impact on the material flow time in a supply chain.

3. **Transportation** entails moving inventory from point to point in the supply chain. Transportation can take the form of many combinations of modes and route, each with its own performance characteristics. Transportation choices have a large impact on supply chain responsiveness and efficiency. Transportation moves product between different stages in a supply chain (Chopra, 2007: 69-71). Like the other supply chain drivers, transportation has a large impact on both responsiveness and efficiency. Faster transportation allows a supply chain to be more responsive but

reduces its efficiency. The type of transportation a company uses also affects the inventory and facility locations in the supply chain.

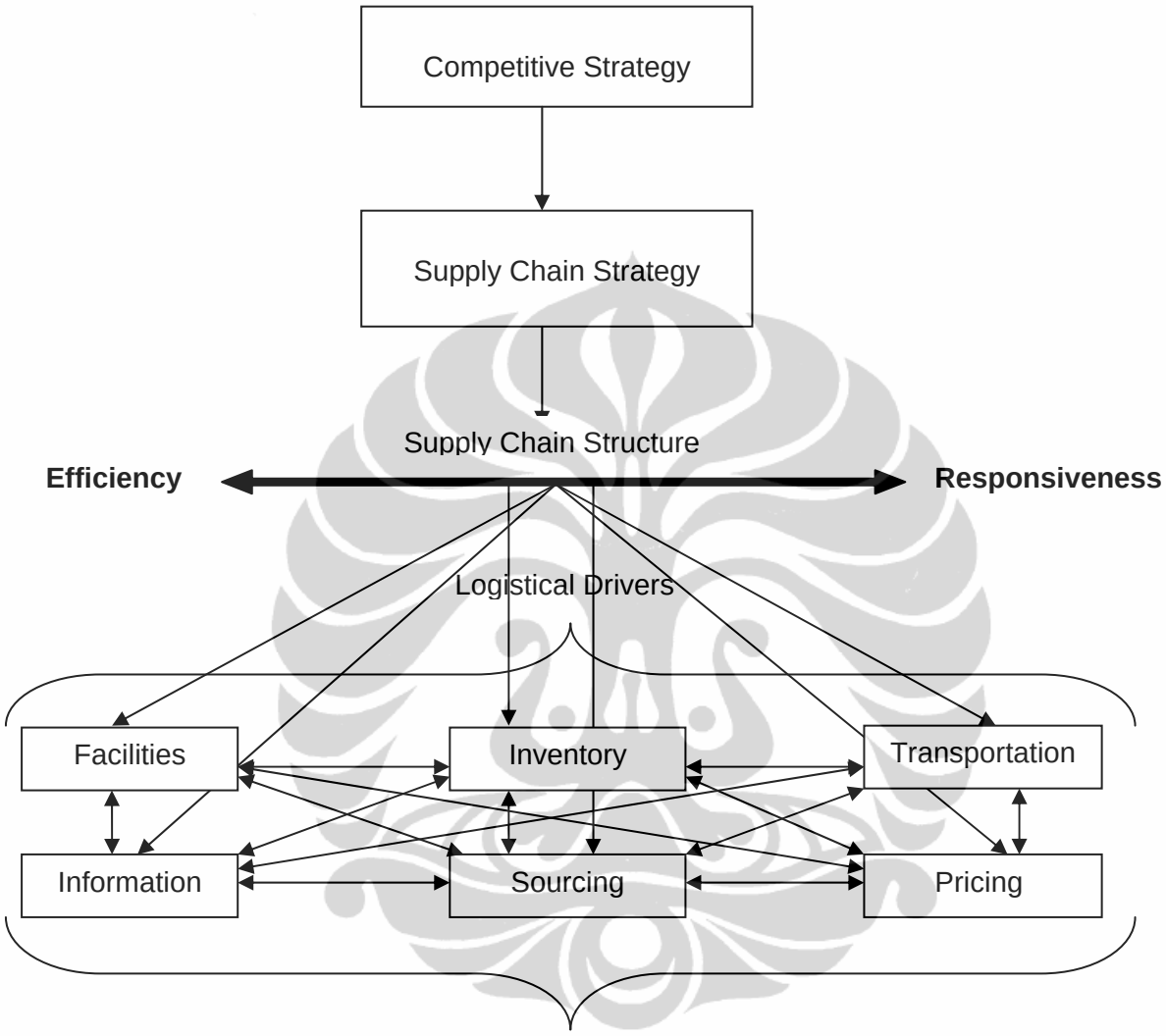
4. **Information** consists of data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain. Information is potentially the biggest driver of performance in the supply chain because it directly affects each of the other drivers. Information presents management with the opportunity to make supply chains more responsive and more efficient. Information deeply affects every part of the supply chain. Its impact is easy to underestimate, as information affects a supply chain in many different ways. Two important roles of information:

    1. Information serves as the connection between various stages of a supply chain, allowing them to coordinate and maximize total supply chain profitability.
    2. Information is also crucial to the daily operations of each stage in a supply chain.

5. **Sourcing** is the choice of who will perform a particular supply chain activity such as production, storage, transportation, or the management of information. At the strategic level, these decisions determine what functions a firm performs and what functions the firm outsources. Sourcing decisions affect both the responsiveness and efficiency of a supply chain. Sourcing is the set of business process required to purchase goods and services. Decisions related to sourcing include which tasks will be outsourced and those that will be performed within the firm. For each outsourced task, it should be decided whether to source from a single supplier or a portfolio of suppliers. If a portfolio of multiple suppliers is to be carried, then the role of each supplier in the portfolio must be clarified. The next step is to identify the set of criteria that will be used to select suppliers and measure their performance. Then suppliers are selected and contracts are negotiated with them. Contracts define the role of each supply source and should be structured to improve supply chain performance and minimize information distortion from one stage to the next. Once suppliers and contracts are in place, procurement processes that facilitate the placement and delivery of orders play a major role.

6. **Pricing** determines how much a firm will charge for goods and services that it makes available in the supply chain. Pricing affects the behavior of the buyer of the good or service, thus affecting supply chain performance. Pricing affects the customer segments that choose to buy the product, as well as the customer's expectations. This directly affects the supply chain in terms of the level of responsiveness required as well as the demand profile that the supply chain attempts to serve. Pricing is also a lever that can be used to match supply and demand. Pricing is one of the most significant factors that affect the level and type demand that the supply chain will face.

Figure 2-4 Supply Chain Decision-Making Framework



(Sunil Chopra and Peter Meindl, 2007: 63)

Figure 2-4 provides visual framework for supply chain decision making. These drivers interact with each other to determine the supply chain's performance in terms of responsiveness and efficiency. As a result, the structure of these drivers determines if and how strategic fit is achieved across the supply chain.

A.5. Management and Information Systems

The relationship (Grant: 211) between management systems and organizational structure is similar to that between the skeleton and bodily systems in the human body. The skeleton provides the framework; the respiratory system, digestive system, and nervous system are the means by which the body operates. Computer network offer another analogy: the hardware provides the structure and the software provides the systems that make the network operational.

Management systems provide the mechanisms of communication, decision making, and control that allow companies to solve problems of achieving both coordination and cooperation. Four management systems are of primary importance: the information systems, the strategic planning systems, the financial systems, and the human resources management systems.

Information system is fundamental to the operation of all management systems. Information systems technology (Porter, 1985: 168) is particularly pervasive in the value chain, since every value activity creates and uses information. Information systems are used in scheduling, controlling, optimizing, measuring, and otherwise accomplishing activities. Information systems technology also has an important role in linkages among activities of all types, because the coordination and optimization linkages require information flow among activities.

Information (Chopra, 2007: 71) is an important driver that companies have used to become both efficient and more responsive. The tremendous growth of the importance of information technology is a testimony to the impact that information can have on improving a company. To be successful in the new business environment, firms are recognizing the need for new information systems. New systems provide a distinct advantage: they promote the flow of information instantaneously up and down the supply chain. Handfield (2002, 87-92) defined role and impact of information system as follows:

- Strategic integration (internal and external)

As supply chain members begin to work together, integration must occur between functions between functions both internal to the organization (i.e. purchasing, engineering, manufacturing, marketing, logistics, accounting, etc.) and external to the organization (i.e. end customers, retailers, distributors, warehouses, transportation providers, suppliers, agents, financial institutions, etc.). Internal integration requires that all company members have access to an integrated information system, spanning multiple functions and locations. External integration refers to the systems that link external suppliers and customer to the focal company. External integration allows all supply chain members to share critical information such as forecast demand, actual orders, and inventory levels across the supply chain.

- Globalization of Market

While the notion of a global market is easy to envision, conducting business in different cultures and geographies are challenging. Companies require systems that enable them to: 1) manage suppliers and customers all over the world; 2) allow total global logistics costs calculations; 3) increase leverage and component standardization worldwide; and 4) improve communication of strategies across all of a company's global business units and supply chain partners.

- Powerful Information Systems and Technology

New forms of servers, telecommunication and wireless applications, and software are enabling companies to do things that were once never thought possible. These systems raise the accuracy, frequency, and speed of communication between suppliers and customers, as well as for internal users.

According to Bowersox and Closs, timely and accurate information is now more critical to American business than ever before. Three factors have fostered this change in the importance of information. First, pleasing customers has become something of a corporate obsession. Serving the customer in the best, most efficient and effective manner has become critical, and information about issues such as order status, product availability, delivery schedules, and invoices

has become a necessary part of the total customer service experience. Second, information is crucial to managers' abilities to reduce inventory and human resource requirements to a competitive level. Finally, information flows are essential to strategic planning for and deployment of resources.

- Enable New Business Processes

Although many companies underwent re-engineering efforts in the 1980s and 1990s, these changes are not one-time events. Companies are constantly modifying their business processes in response to rapidly changing external events. Such processes include customer order management, supplier evaluation and selection, and new product development. These processes are being mapped, studied, and changed in order to reduce redundancies, delays, and waste. In so doing, organizations can create a "rapid response" capability that allows them to quickly adapt to their customers' ever-changing requirements in an effective and efficient manner.

- Strategic Cost Management

Throughout the supply chain cycle, from order fulfillment to purchasing and order payment, millions of transactions take place among different parties. In order to determine specific cost drivers behind different business processes, companies often estimated costs based on outdated cost accounting systems. New systems promise to automate data capture throughout the supply chain, thereby automating the transactions that occur in the traditional procurement cycle. This will not only reduce costs of operating, purchasing, and logistics departments, but also will enable allocation of resources and reductions in inventory held throughout the supply chain. Prior to the 1980s, a significant portion of information flows among functional areas within an organization, and among supply chain member organizations, were paper-based. In many instances, these paper-based transactions and communications were slow, unreliable, and error-prone. Conducting business in this manner was costly and constrained a firm's ability to design, develop, procure, manufacture, and distribute their products in a timely manner. This approach also impeded efforts to develop and capitalize on successful inter-organizational ventures. During this period, information was often overlooked as a critical competitive resource because its value to supply chain members was not clearly understood. However,

firms now embarking upon supply chain management initiatives recognize the vital importance of information and the various technologies that make this information available. Increased use of information systems within supply chain management-related areas can result in the following benefits:

- Increased productivity that, in turn, allows people to focus on value-adding activities, rather than 'pushing papers".
- Expanded, more accurate and timely information to streamline the flow of materials both up and down the supply chain.
- Ability to manipulate multiple variables to support complex decision-making through detailed simulation and decision-support systems.
- Ability to modify data to determine the impact on a decision.
- Improved linkages across functions within organizations and among supply-member organizations.
- The ability to consolidate global purchase requirements
- Lower total operating costs. An example of this benefit includes the elimination of routine paper transactions. Purchasing transaction systems have reduced cost per transaction by 30% to 50%, while reducing the procurement cycle from weeks to days.
- Improved supplier performance measurement. Organizations that have implemented computerized supplier performance measurement systems have achieved significant improvements in both supplier quality (e.g. 20% reduction in defective parts per million) and delivery performance (e.g. improvement in shipments received on time from 60% to 95%).

A.5.1. Role and Impact of Information Technology in Supply Chain

Using information systems for supply chain management (Davenport, 2000: 238) is not a new topic.Some of the earliest uses of information technology in business were designed to make operations more efficient by keeping closer track of procurement, manufacturing, and distribution activities within a business. Information technology (IT) plays a major role in reengineering most business processes. The speed, information processing capabilities, and connectivity of computers and Internet technologies can substantially increase the efficiency of

business process, as well as communication and collaboration among the people responsible for their operation and management (O'Brien, 2004: 53).

Furthermore, Handfield (2002, 300) pinpointed the most important benefits of information visibility include reduced lead times, improved constraint management, better decision-making, lower cost, and increased profits. In addition, visibility systems may be able to reduce potential problems. When implemented properly, an information visibility solution results in the following additional benefits that promote improved supply chain performance:

- **Breaks organizational barriers**: Enable sharing of mission-critical information about business activities and interaction on a real-time basis across supply chain.
- **Builds visibility into supply chain**: provides people a real-time view of supply chain performance metrics.
- **Managing by metrics**: Aligns performance metrics with cross-organizational business processes and assigns ownership of processes and metrics to specific individuals.
- **Reduces process cycle time**: Allows supply chain members to respond to market or customer demand in hours or days, not weeks or months.
- **Encourages decision-making collaboration**: Facilitates the ability to make decisions collaboratively on the Internet, bringing relevant internal and external stakeholders into the process.
- **Reduces opportunity and problem resolution latency**: Measures and monitors supply chain activities iteratively, which allows people to quickly respond to events as they occur.

The major goals of supply chain management Davenport (2000: 238) are to cut costs by taking excess time, redundant effort, and buffer inventory out of the system, and to improve service by giving customers more options, faster delivery, and better visibility into order status. Mostly, this is a challenge of information integration. The idea is to allow everyone involved in the flow of

goods to make decisions based on the latest and best information from everyone else both upstream and downstream.

Lack of information or distorted information passed from one end of the supply chain to the other can create significant problems, including, but not limited to, excessive inventory investment, poor customer service, lost revenues, misguided capacity plans, ineffective transportation, and missed production schedules. These are not deliberate attempts to sabotage the performance of supply chain members. Rather, distorted information throughout the supply chain is a common result of what have been termed the *bullwhip effect* (Handfield, 2002: 295).

One of the most frequent suggestions for reducing the *bullwhip* effect (Simchi-Levi, 2008: 158) is to centralize demand information within a supply chain, that is, to provide each stage of the supply chain with complete information on the actual customer demand. To understand why centralized demand information can reduce the bullwhip effect, note that if demand information is centralized, each stage of the supply chain can use the actual customer demand data to create more accurate forecasts, rather than relying on the orders received from the previous stage, which can vary significantly more than the actual customer demand.

Further, to determine the impact of centralized demand information on the *bullwhip effect*, Simchi-Levi (2008: 159-160) distinguish two types of supply chains; one with centralized demand information and a second, with decentralized demand information. The difference in the two types of supply chains is in terms of how much the variability (*bullwhip effect*) grows as we move from stage to stage. The variance of the orders grows additively in the total lead time for the centralized supply chain, while the increase is multiplicative for the decentralized supply chain. Thus, it is clear that by sharing demand information with each stage of the supply chain, we can significantly reduce the *bullwhip effect*.

Key to using information systems to develop and maintain successful supply chain is the need for virtually seamless linkages within and between organizations. This means creating intra-organizational processes and links to facilitate delivery of required information between marketing, sales, purchasing,

finance, manufacturing, distribution, and transportation internally, as well as inter-organizationally, to customers and suppliers across the supply chain. More pointedly, it means that a firm must alter its way of seeing its business at the highest level. This involves alterations like aligning corporate strategies with the information technology (IT) paradigm; providing incentives for functions to achieve common goals through the sharing of information; and implementing the technologies to redesign the movement of goods to maximize channel value and lower cost.

A.5.2. Information Technology Application for Supply Chain

Information technology (IT) is an important enabler of effective supply chain management (Simchi-Levi, 407), which typically spans the entire enterprise and beyond, encompassing suppliers on one end and customers on the other. Many technologies exist to share and analyze information in the supply chain (Chopra, 2007: 73). Some of these technologies include the following.

1. Electronic data interchange (EDI) allows companies to place instantaneous, paperless purchase orders with suppliers. EDI is not only efficient, it also decreases the time needed to get products to customers because transactions are faster and more accurate than when they are paper based. Although EDI is a bit outdated and has limited capabilities, it still offers efficiency and responsiveness gains for some firms.
2. The Internet has critical advantages over EDI with respect to information sharing. The Internet conveys much more information and therefore offers much more visibility of information from within a company and across its supply chain. Internet communication among stages in the supply chain is also easier because a standard infrastructure (the World Wide Web) already exists. Thanks to the Internet, e-commerce has become a major force in the supply chain.

3. Enterprise resource planning (ERP) systems provide the transactional tracking and global visibility of information from within a company and across its supply chain. This real-time information helps a supply chain to improve the quality of its operational decisions. ERP systems keep track

of the information, whereas the Internet provides one method with which to view this information.

4. Supply chain management (SCM) software uses the information in ERP systems to provide analytical decision support in addition to the visibility of information. ERP systems show a company what is going on, while SCM systems help a company decide what it should do.

5. Radio frequency identification (RFID) consists of an active or passive radio frequency (RF) tag applied to the item being tracked and an RF reader/emitter.

When all of these applications work as they should (Handfield, 2002: 93), the result is a shared information system that spans all functions along the supply chain with the following characteristics.

- Centralized cordination of information flows, but cross-functional/cross-organizational decision-making.
- Total logistics management – integrating all transportation, warehousing, ordering, and manufacturing systems.
- Customer fulfillment systems that trigger a cascading series of modifications to production schedules, logistic plans, and warehouse operations.
- Coordinated transportation resources across business units and national boundaries.
- Global inventory management – the ability to locate, track, and predict the movement of every component or material anywhere upstream or downstream in the supply chain.
- Global sourcing – consolidation of the purchasing function accross organizational lines, facilitating purchasing leverage and component standardization accross business units and across multiple continents.
- Cross-organizational information access – clarity of production and demand information residing in organizations both upstream and downstream throughout the supply chain, but secure from competing members of the supply chain.

- Data interchange between affiliates and non-affiliates through wireless communication.
- Data capture – the abilty to acquire data about an order at the point of origin, and to track products during movement and as their characteristics change.
- Transformation of the business from within – managers who can see the "big picture" and accept the new forms of business processes and systems.
- Higher levels of trust between supply chain partners to justify investment in shared information systems.

A.6. Corporate Information Technology Application: Enterprise Resource Planning (ERP) System

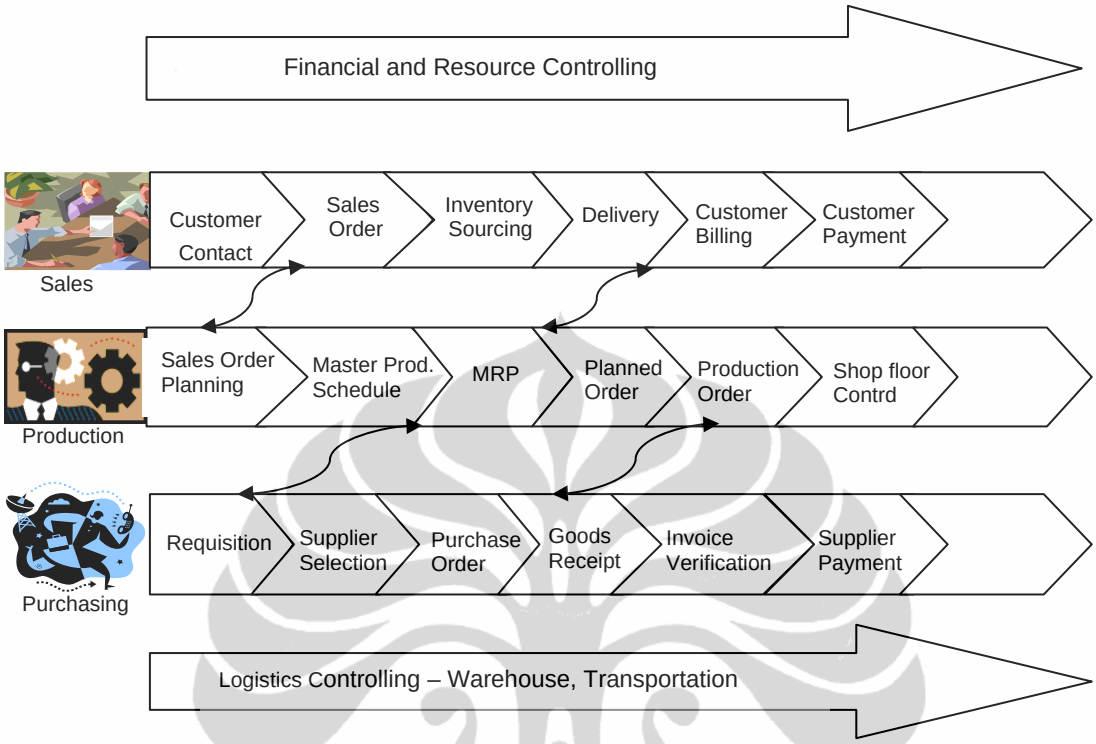
Monk (2006: 6-9) pointed out that ERP systems can create value to organizations through the use of best practices. Historically, legacy information systems have been functionally based and not integrated across multiple locations or functional areas. The same information was captured multiple times, in multiple places, and was not available in real time. Processes and job definitions saw to it that information remained a local good. When information did "go global", often there were different informational reports of the same events. Thus, there were information asymmetries between the different local and functional groups and top management.

Enterprise Resource Planning systems provide firms with transactions processing models that are integrated with other activities of the firm, such as production planning and human resources. By implementing standard enterprise processes and a single database that spans the range of enterprise activities and locations, ERP systems provide integration across multiple locations and functional areas. As a result, ERP systems have led to improved decision making capabilities that manifest themselves in a wide range of metrics, such as decreased inventory (raw materials, in-process and finished goods), personnel reductions, speeding up the financial close process, and others.

Understanding the resources consumed (Handfield, 2002: 94) allows an organization to leverage resources more productively. In the words of one ERP consultant, the system serves as the organization's backbone, in terms of providing the fundamental decision-making support throughout. As shown in Figure 2-5, ERP systems also create a process logic among the closely related areas of customer order management, manufacturing planning and execution, purchasing processes, and financial management and accounting. In effect, ERP system enable people in these very different parts of the business to communicate.

ERP systems (Handfield, 2002: 96) facilitate the integration of business processes by adopting a single customer, product and supplier database. One master record with multiple views is used for the enterprise. All processes use a common database. Furthermore, information is captured only once, reducing the possibility of inaccurate data entering the database. Information is provided to the effected business process in real time, eliminating delays as a result of information sharing. Specific transactions taking place in each business process are visible to everyone in the organization; theoritically, if anyone wants to find out where an order is in the process, or whether a supplier has been paid, etc., he or she can do so. Furthermore, all business processes are linked with the workflow, such that standard workflow templates for entering information about transactions are provided every step of the way.

Figure 2-5 Business Process Integration in ERP



(Handfield, 2002: 94)

Below definitions can be used to view role and impacts of ERP (Enterprise Resource Planning) in supply chain processes:

1. Monk (2006) defines Enterprise Resource Planning (ERP) systems as:

   - Core software used by companies to coordinate information in every area of the business.
   - Programs that help to manage company-wide business processes, using common database and shared management reporting tools.
   - Software that support the efficient operations of business processes by integrating activities throughout a business, including sales, marketing, manufacturing, logistics, accounting, and staffing.

2. Enterprise Resource Planning (ERP) defined by Wallace (2001: 4-5) is emphasized on its utilizations with details as follows:

   - An enterprise-wide set of management tools that balances demand and supply chain

- Containing the ability to link customers and suppliers into a complete supply chain
- Employing proven business processes for decision-making, and
- Providing high degrees of cross-functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development, and human resources, thereby
- Enabling people to run their business with high levels of customer service and productivity, and simultaneously lower costs and inventories, and providing the foundation for effetive e-commerce.

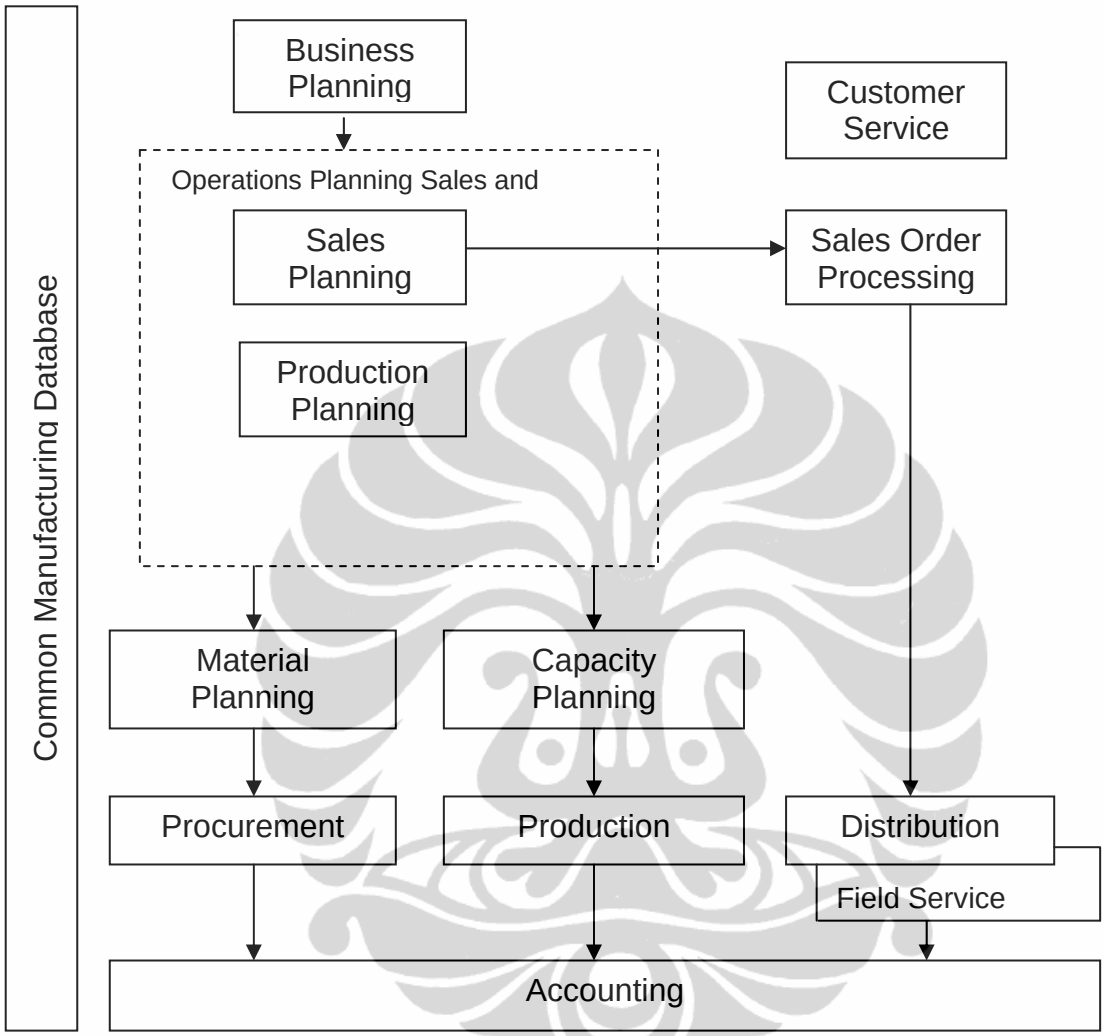
The new ERP systems (Handfiled, 2002: 95) hold the promise of providing a unified, organization-wide view of business processes and associated information, rather than the isolated functional perspective of these legacy systems. A typical ERP system is designed around four primary business processes.

1. Making a product: Manufacturing Planning and Execution process
2. Buying a product: Procurement process
3. Selling a product or service: Customer Order Management Process
4. Costing, paying the bills, collecting: Financial/Management Accounting and Reporting process

A.6.1. ERP System Application for Supply Chain

The basic architecture (Hamilton, 2003: 12-18) for an ERP system consist of 12 business functions utilizing a common manufacturing database, as shown in Figure 2-6. This top-down model shows how aggregate plan (the business, sales, and production plans) drive the detailed plans for coordinating supply chain activities. The accounting tracks the financial implications of supply chain activities.

Figure 2-6 Simplified Information Flows for ERP System



(Hamilton, 2003: 13)

Each business function builds on the foundations of a common manufacturing database. The heart of the common database consists of several master files about customers, vendors, products, inventory locations, and general ledger accounts. Below supply chain activities are embedded on ERP system application:

Business Planning

Business planning typically results in an annual budget that establishes the financial plan and a baseline for measurement purposes. An ERP system tracks actual costs stemming from supply chain activities for comparison to budget.

Budget revisions may be developed periodically to reflect contingency planning or anticipated changes.

Sales Planning

Sales planning defines all demands placed on the manufacturing enterprise, both actual sales orders and forecast. These demands form primary input to the sales and operations planning process for each product.

Production Planning

Production planning provides a game plan for each product that coordinates supply chain activities to meet demands. Coordination efforts in production and procurement typically focus on supply orders, while efforts in distribution, field service, and customer service focus on sales orders. Production planning formulates realistic game plan based on analyzing constraints identified by capacity and material planning.

Sales Order Processing

A key step in sales order processing – accept order – captures actual demands. Other steps involve configuring the order, making delivery promises, and monitoring order status. Sales order designations may affect an item's demands and supply chain activities. Sales order entry can trigger communication of needed actions to other functional areas. These include actions for distribution (to ship product), manufacturing (to final assemble products), procurement (to purchase material), field service (to perform service tasks), and customer service (to review holds).

Customer Service

The scope of customer service extends across the entire customer relationship life cycle, covering every customer contact. Several key events across the life cycle, such as quotations, sales orders, shipments and returned goods, represent basic transactions in an ERP system.

Capacity Planning

Capacity planning can be used to support sales and operations planning and production scheduling. Infinite capacity planning uses proposed schedules to calculate loads and identify potential overloaded periods for each resource.

Material Planning

Material planning is used to calculate material requirements based on the bills of material, and suggest changes to existing supply orders or new planned supply orders. It communicates recommended actions to planners and buyers, and provides the basic for production and vendor schedules, to synchronize supplies to meet demands.

Procurement

Procurement involves identifying and qualifying vendors, as well as negotiating agreements. It also involves daily coordination of external suppliers to align supplies with demands.

Production

Production and production control involve daily coordination of internal resources through a production schedule and manufacturing orders to align supplies with demands. Production activities involve different types of manufacturing orders, form normal orders (with indirect linkage) to custom product and final assembly orders (with direct linkage to sales orders). The approach to coordination and execution of production activities is contingent on the type of production.

Distribution

Distribution focuses on outbound shipments for sales orders, including packaging, shipping, and transportation activities, that represent the completion of supply chain activities.

Field Service

Field service involves daily coordination of personnel to perform field service tasks driven by sales order demands. Service work orders and schedules provide coordination of field service activities. A service work order identifies the required resources, material, tools and documents needed to perform the task.

Accounting

Accounting uses shipment data for generating invoices, receipt data for validating vendor invoices, labor data for payroll, and costed manufacturing transactions for updating the general ledger and tracking actual costs versus budget.

A.6.2. Role of Enterprise Resource Planning

Enterprise Resource Planning (Wallace, 2001: 15) , when operating at a high level of effectiveness , will do several things for company. First, it will enable the company's people to generate enormous benefits. Many companies have experienced, as a direct result of ERP dramatic increases in responsiveness, productivity, on-time shipments and sales, along with substansial decreases in lead times, purchase costs, quality problems, and inventories.

Further, ERP can provide the foundation upon which additional productivity and quality enhancements can be built – an environment where these other tools and techniques can reach their full potential.

Effective forecasting, planning and scheduling – knowing routinely what is needed and when via the formal system - is fundamental to productivity. ERP is vehicle for getting valid plans and schedules, but not just of materials and production. It also means valid schedules of shipments to customers, of personnel and equipment requirements, of required product development resources, and of cash flow and profit. ERP has proven itself to be the foundation for supply chain management. It helps bind the company together with its customers, distributors, and suppliers – all on a coordinated, cooperative basis.

Furthermore, Enterprise Resources Planning systems (Monk, 2006: 7-9) can be used to help firms creates value. In particular, ERP facilitates value

creation by changing the basic nature of organizations in a number of different ways.

- *ERP Integrates Firm Activities*

  ERP processes are cross-functional, forcing the firm out of traditional, functional, and locations silos. In addition, an organzation's different business processes are often integrated with each other. Further, data were formerly resident on different heterogeneous systems are now integrated into a single system.

- *ERPs Employ Use of "Best Practices"*

  ERP systems have integrated within them a thousand or more best practice business processes. Those best practices can be used to improve the way that firms do business. Choice and implementation of an ERP requires implementation of such best practices.

- *ERP Enables Organizational Standardization*

  Enterprise resource planning systems permit organizational standardization across different locations. As a result, those locations with substandard processes can be brought in line with other, more efficient processes. Moreover, the firm can show a single image to the outside world. Rather than receiving different documents when a firm deals with different branches or plants, a single common view can be presented to the world, one that puts forth the best image.

- *ERP Eliminates Information Asymmetries*

  Enterprise resource planning systems put all the information into the same underlying database, eliminating many information asymmetries. This has a number of implications. First, it allows increased control. Second, it opens up access to information to those who need it, ideally providing improved decision-making information. Third, information is lost as bargaining chip, since information is now available both up and down the organization. Fourth, it can "flatten" an organization: because information is widely available, there

is no need for non-value-adding workers whose primary activity is to prepare information for upward or downward dissemination.

- *ERP Provides On-Line and Real-Time Information*

  In legacy systems, much information is captured on paper and then passed to another part of the organization, where it is either repackaged (typically aggregrated) or put into a computer-based format. With ERP systems, much information is gathered at the source and placed directly into the computer. As a result, information is available on-line others, and in real-time.

- *ERP Allows Simultaneous Access to the Same Data for Planning and Control*

  Enterprise resource planning uses a single database, where most information is entered once and only once. Since the data is available on-line and in real time, virtualy all organizations users have access to the same information for planning and control purposes. This can facilitate more consistent planning and control, in contrast to the legacy systems.

- *ERP Facilitates Intra-Organization Communication and Collaboration*

  Enterprise resource planning also facilitates intra-organizations (between different functions and locations) communication and collaboration. The existence of interlocking processes brings functions and locations into communication and forces collaboration. The standardization of processes also facilitates collaboration, since there are fewer conflicts between the processes. Further, the single database facilitates communication by providing each location and function with the information that they need.

- *ERP Facilitates Inter-Organization Communication and Collaboration*

  The ERP system provides the information backbone for communication and collaboration with other organizations. Increasingly, firms are opening up their databases to partners to facilitate procurement and other functions. In order for such an arrangement to work there needs to be a single repository to which partners can go; ERP can be used to facilitate such exchanges.

A.6.3. Quantifiable Benefits of ERP System

There are quantifiable and intangible potential benefits in ERP implementation decision. The quantifiable benefits (Hamilton, 2003: 36-38) have a bottom-line impact on profitability and asset turnover and a potential effect on stock of value. ERP system when implemented effectively, will results in certain quantifiable benefits. The quantifiable benefits in terms of several areas of improvement include, but not limited to:

- *Inventory Reduction*

Improved planning and scheduling practices typically lead to inventory reductions of 20% or better. This provides not only a one time reduction in assets (inventory typically constitutes a large proportion of assets), but also provides ongoing savings of the inventory carrying costs. The cost of carrying inventory includes not only interest but also the cost of warehousing, handling, obsolescence, insurance, taxes, damage, and shrinkage. With interest rates of 10 percents, the carrying costs can be 25 percent to 30 percent.

ERP systems lead to lower inventories because manufacturers can make and buy only what is needed. Demands rather than demand-insensitive order points drive time-phased plans. Deliveries can be coordinated to actual need dates; orders for unneeded material can be postponed or canceled. The bills of material ensure matched sets are obtained rather than too much of one component and not enough of another. Planned changes in the bills also prevent inventory build-up of obsolete materials. With fewer part shortages and realistic schedules, manufacturing orders can be processed to completion faster and work-in-process inventories can be reduced. Implementation of JIT (Just In Time) philosophies can further reduce manufacturing lead times and the corresponding inventories.

- *Material Cost Reduction*

Improved procurement practices lead to better vendor negotiations for prices, typically resulting in cost reductions of 5 percents or better. Valid schedules permit purchasing people to focus on vendor negotiations and quality improvement rather than on expediting shortages and getting material at

premium prices. ERP systems provide negotiation information, such as projected material requirements by commodity group and vendor performance statistics. Giving suppliers better visibility of future requirements help them achieve efficiencies that can be passed on as lower material costs.

- *Labor Cost Reduction*

Improved manufacturing practices lead to fewer shortages and interruptions and to less rework and overtime. Typical labor savings from a successful ERP are a 10 percent reduction in direct and indirect labor costs. By minimizing rush jobs and parts shortages, less time is needed for expediting, material handling, extra setups, disruptions, and tracking split lots or jobs that have been set aside. Production supervisors have better visibility of required work and can adjust capacity of loads to meet schedules. Supervisors have more time for managing, directing, and training people. Production personnel have more time to develop better methods and improve quality and throughput.

- *Improved Customer Service and Sales*

Improved coordination of sales and production leads to better customer service and increased sales. Improvements in managing customer contacts, in making and meeting delivery promises, and in shorter order-to-ship lead-times, lead to higher customer satisfaction and repeat orders. Sales people can focus on selling instead of verifying or apologizing for late deliveries. In custom product environments, configurations can be quickly identified and priced, often by sales personnel or even the customer rather than technical staff. Taken together, these improvements in customer service can lead to fewer lost sales and actual increases in sales, typically 10 percent or more.

ERP systems also provide the ability to react to changes in demand and to diagnose delivery problems. Corrective actions can be taken early, such as determining shipments priorotites, notifying customers of changes to promised delivery dates, or altering production schedules to satisfy demand.

- *Improved Accounting Controls*

Improved collection procedures can reduce the number of days of outstanding receivables, thereby providing additional available cash. Underlying these improvements are fast, accurate invoice creation directly from shipment transactions, timely customer statements, and follow through on delinquent accounts. Improved credit management and receivables practices typically reduce the days of outstanding receivables by 18 percent or better.

Trade credit can also be maximized by taking advantage of supplier discount and cash planning, and paying only those invoices with matching receipts. This can lead to lower requirements for cash-on-hand.

A.6.4. Intangible Effects of ERP System

The intangible or nonfinancial benefits (Hamilton, 2003: 43-44) of an integrated ERP system can be viewed from several perspectives. From the overall company standpoint, ERP provides a framework for working effectively together and devising a consistent plan for action.

For illustrative purposes, intangible effects for accounting, product and process design, production, sales and MIS (Management of Information System) functions can be decribed as follow:

- *Effects on Accounting*

With a common database from ERP, accounting no longer requires duplicate files and redundant data entry. Product costing, for example, can be performed using accurate and up-to-date product structures. Product cost simulation can be used to analyze the impact of changing material costs, labor costs, labor rates, and overhead allocations as well as planned changes to bills and routings. Differences between actual and standard costs are highlighted as variances. Order-related variances help pinpoint problems areas.

Customer invoices can be based on actual shipments (without duplicate data entry), which help speed invoice processing. Payables can use purchase order and receipt data for three-way matching with suppliers invoices.

As manufacturing transactions are recorded, the financial equivalents are automatically generated for updating the general ledger. This provides a complete audit trail from account totals to source documents, ensures accurate and up-to-date financial information, and permits tracking of actual versus budgeted expenses. Detailed transaction activity can also be easily accessed online for answering account inquiries.

Since manufacturing transactions automatically update the general ledger, time-cosuming manual journal entries can be eliminated. Period-end closing procedures can be performed in hours or days, rather than weeks. This reduces clerical accounting work and improves the timeliness of financial reports.

Financial reports can be easily customized to meet the needs of various decision makers. Financial projections can be based on detailed ERP calculations for future requirements. Cash planning, for example, can account for current and projected sales orders and planned purchases, as well as current receivables and payables. Decision support tools (such as spreadsheets, graphics packages, and data managers) can use the financial data maintained in the ERP database.

- *Effects on Product and Process Design*

The product structure database offers engineering much greater control over product and process design, especially in terms of engineering change control. Planned changes can be phased in and emergency changes can be communicated immediately.

ERP systems offer numerous analytical tools for the engineering function. When diagnosing the impact of changes to materials and resources, for example, engineers can check where-used information to identify the affected products. Lead-time reduction efforts can use critical path analysis of item lead-times in multilevels bills to focus attention on those key components affecting cumulative manufacturing lead-time. Costed multilevel bills can be used to focus cost reduction efforts on high value items. Bill comparisons can be used to highlight differences between products, or between revisions of the same product (e.g., to identify upgrade kit requirements).

ERP systems support custom product configurations. Rules-based configurators reduce the need for expert assistance from engineers and ensure sales personnel (or even customers) can develop timely, accurate configurations. Cost estimates and pricing for custom product configurations can also be quickly calculated.

- *Effects on Production and Materials Management*

ERP systems help establish realistic schedules for production and communicate consistent priorities so that everyone knows the most important job to work on at all times. Visibility of future requirements helps production prepare for capacity problems, and also helps suppliers anticipate and meet demands. As changes to demands or suppliers do occur, ERP helps identify the impact on production and purchasing.

Finite scheduling capabilities in ERP ensure production activities are scheduled based on capacity, tool, and material constraints. Scheduling rules help minimize setup times and optimizing sequencing. Changes in factory demands, as well as changes in available machine time, labor headcount, skill levels, tools, and material can be immediately simulated to assess the impact on production and purchasing.

ERP helps eliminate many crisis situations, so people have more time for planning and quality. Buyers can spend more time in vendor negotiation and quality improvement. When the shortage list is no longer used to manage the shop, the quality of working life can improve.

- *Effects on Sales*

Customer service can be improved by making valid delivery promises and then meeting those promises. Custom product quotations can be developed faster and more accurately, which improves job estimating. Delivery lead-times can be shortened and customer inquiries on order status can be answered immediately.

- *Effects on MIS Function*

An ERP system implemented as an integrated software package offers several advantages to the MIS function. The software package can offer a growth

path from simple to comprehensive applications built on top of a database management system. It provides an upgrade path to technology and functional enhancements supported by the software vendor. It can reduce the development time and cost for software, documentation, and training classes. These costs would be incurred before the firm can start obtaining the benefits of an ERP system. It permits the MIS staff focus their attention on organizational change and servicing user needs for customization and professional assistance.

A.7. Organization and People Culture

Culture (Porter, 1985: 24) has implication for the role of culture in competitive success. Culture that difficult to define set of norms and attitudes that help shape an organization, has come to be viewed as an important element of a successful firm. Culture can powerfully reinforce the competitive advantage a generic strategy seeks to achieve, if the culture is an appropriate one. Culture is a means of achieving competitive advantage, not en end in itself.

Grant (2005: 216-217) noted the culture of the organization is a mechanism for achieving coordination and control. Corporate culture comprises the beliefs, values, and behavioral norms of the company, which influence how employees think and behave. It is embedded within national cultures, and incorporates elements of social and professional culture. As a result, a corporate culture may be far from homogenous. To this extent, culture is not necessarily an integrating device – it can contribute to divisiveness.

Culture can play an important role in facilitating both cooperation and coordination. The unifying influence of corporate culture is likely to be especially helpful in assisting coordination through mutual adjustment in large cross-functional teams of the type required for new product development. One of the advantages of culture as a coordinating device is that it permits substantial flexibility in the types of interactions it can support. The extent to which corporate culture assists coordination depends on the characteristics of the culture. Culture is far from being a flexible management tool. Cultures take a long time to develop and cannot easily be changed. As the external environment changes, a highly effective culture may become dysfunctional.

Information technology (Davenport, 1999: 2) has a polarizing effect; either bedazzling or frightening. Construction of elaborate technology architectures and enterprise information models to guide systems development can be viewed as the key catalyst of business change. But such technocratic solutions often specify the minutiae of machinery while disregarding how people in organizations actually go about acquiring, sharing and making use of information. Thus, while glorifying the information technology, they ignore the human psychology.

Developing and implementing supply chain information system (Handfield, 2002: 92) is costly. Without proper planning, the system can fail to meet the user's needs, and development costs can quickly escalate beyond budgeted volumes. Top management must provide vision, leadership, and resources to support information systems development throughout the process. They must also make certain that all supply chain "stakeholders" participate and remain actively involved throughout the process. Although the use of new information systems can lead to significant improvements, internal functions and supply chain partners must be willing to commit the resources to properly plan, develop, implement, train for, and use the system. If these conditions are not met, the resulting system may simply automate existing ways of doing business and fail to generate the expected benefits.

A different perspective on the challenges and opportunities of IT for supply chains (Simchi-Levi, 2008: 414) is to consider some of the desired goals of IT as they relate to supply chain management and its unique requirements. In order to utilize information, we need to collect it, access it, analyze it and have the ability to share it for collaboration purposes. Supply chain management system goals in these areas are:

- Collect information on each product from production to delivery or purchase point, and provide complete visibility for all parties involved.
- Access any data in the system from a *single point of contact*.
- Analyze, plan activities, and make trade-offs based on information from the entire supply chain.
- Collaborative with supply chain partners.

It is thereby recognized that although use of the new ERP system (Handfield, 2002: 96) seems reasonable, its implementation proves to be difficult, expensive and time consuming. The facts that organizations must adhere to a more rigorous set of business process are the main reasons. When it comes time to create an information system around the business processes, many companies discover that they need to "re-engineer" their business processes before they can build the information system around it. In some cases, changing these business processes is a huge undertaking that requires major organizationals and cultural change.

A.7.1. Coordination Problem

No matter how great the specialist skill possessed by individuals, unless these can coordinate their efforts, production does not happen. There are four different coordination mechanisms to reveal how individuals within organization coordinate their efforts (Grant: 193):

- **Price.** Coordination is achieved through the price mechanism. Price mechanisms work well in situations of "arm's-length" coordination. For example, in coordinating production and sales.

- **Rules and directives.** The key feature of corporations and other formal organizations is the existence of employment contracts. Employees enter general employment contracts where (within certain limits) they agree to perform a range of duties as required by their employer. Rules tend to work well for activities where standardized outcomes are required and the decision-making abilities of the operatives involved may be limited – most quality control procedures involves the application of simple rules.

- **Mutual adjustment.** The simplest form of coordination involves the mutual adjustment of individual engaged in related tasks. Mutual adjustment occurs in leaderless teams and work groups.

- **Routines.** Where activities are performed recurrently, coordination based on mutual adjustment and rules becomes institutionalized within organizational routines. These "regular and predictable sequences of coordinated actions

by individuals" are the foundation of organizational capability. If organizations are to perform complex activities at extreme levels of efficiency and reliability, coordination by rules, directives or mutual adjustment is not enough - coordination must become embedded in routines. Routines form the basis for coordination in most activities where close independence exist between individuals, whether a basic production (supplying customer) or a more complex activity (performing a heart by-pass operation or implementing a systems integration project for a multinational corporation).

Several activities should be addressed related to the issue of coordination within supply chain including, but not limited to:

1. ***Top management commitment for coordination.*** More than any other aspect of supply chain management, coordination can succeed only with top management's commitment. Coordination requires all stages of the supply chain to subordinate their local interest to the greater interest of the firm and even the supply chain. Coordination often requires the resolution of trade-offs in a way that requires many functions in the supply chain to change their traditional practices. These changes often run counter to approaches that were put in place when each function focused only on its local objective. Such changes within a supply chain cannot be implemented without strong top management commitment (Chopra, 2007: 535).

2. ***Devote resources to coordination.*** Coordination cannot be achieved without all parties involved devoting significant managerial resources to this effort. Companies often do not devote resources to coordination because they either assume that lack of coordination is something they have to live with or they hope that coordination will occur on its own. One of the best ways to solve coordination problems is through teams made up of members from different companies throughout the supply chain. These teams should be made responsible for coordination and given the power to implement the changes required (Chopra, 2007: 535).

3. ***Try to achieve coordination in the entire supply chain network.*** The full benefit of coordination is achieved only when the entire supply chain network is coordinated. It is not enough for two stages in a supply chain to coordinate.

The most powerful party in a supply chain should make an effort to achieve coordination in the entire network (Chopra, 2007: 535).

4. ***Share the benefits of coordination equitably.*** The greatest hurdle to coordination in the supply chain is the feeling on the part of any stage that the benefits of coordination are not being shared equitably (Chopra, 2007: 536).

5. ***Quantify the bullwhip effect.*** Companies often have no idea that the bullwhip effect plays a significant role in their supply chain. Evidence of the size of the bullwhip effect is very effective in getting different stages of the supply chain to focus on efforts to achieve coordination and eliminate variability created within the supply chain (Chopra, 2007: 534).

6. ***Limited Coordination*** – Coordinating supply chain process is another important factor in determining supply chain performance. It is included understanding of all parties about their respective roles and associated responsibilities and formal rules of engagement to ensure processes are effectively coordinated and desired level of coordination is maintained. (Handfield, 2002: 55).

7. Within supply chain environment, supply chain coordination (Chopra, 2007: 72) occurred when all stages of a supply chain work toward the objective of maximizing total supply chain profitability based on shared information. Lack of coordination can result in significant loss of supply chain profit. Coordination among different stages in a supply chain requires each stage to share appropriate information with other stages. Information sharing is thus crucial to the success of a supply chain.

A.7.2. Communication

Several issues related to the role and impacts of communication within an organization and supply chain can be described as below:

1. ***Focus on communication with other stages.*** Good communication with other stages of a supply chain often creates situation that highlight the value of coordination for both sides. Regular communication helps different stages

of the supply chain share their goals and identify common goals and mutually beneficial actions that improve coordination (Chopra, 2007: 535).

2. ***Ambiguous Goals and Objectives*** – Not all members of the organizations clearly understand the overall supply chain goals and objectives and what the organization must contribute to the overall supply chain to be successful (Handfield, 2002: 54).

3. ***Poor Communication*** – Intra-Organizational and inter-organizational communication are critical to overall supply chain performance. Necessary lines of communication should be established accross the supply chain member organizations (Handfield, 2002: 55).

4. ***Outdated Technology –*** Primarily stressed on how the supply chain member organizations making the best use of available technology: how the key information communicated across the supply chain or how works process performed either utilizing a high level of automation or manually (Handfield, 2002: 55).

5. ***Lack of Information –*** The cycle time for supply chain decision making is often lengthy owing to the time needed in gain access to the information required to make decisions (Handfield, 2002: 55).

A.7.3. Trust

Chopra (2007: 522) defined a trust-based relationship between two stages of a supply chain includes dependability of the two stages, and the ability of each stage to make a leap of faith. Trust involves a belief that each stage is interested in the others' welfare and will not take actions without considering their impact on the other stages. Cooperation and trust within the supply chain help improve performance for the following reasons.

1. When stages trust each other, they are more likely to take the other party's objectives into consideration when making decisions.

2. Action-oriented managerial levers to achieve coordination become easier to implement. Sharing of information is natural between parties that trust each other.

3. An increase in supply chain productivity results, either by elimination of duplicated effort or by allocating effort to the appropriate stage.

4. A greater sharing of detailed sales and production information results. This sharing allows the supply chain to coordinate production and distribution decisions. As a result, the supply chain is better able to match supply and demand, resulting in better coordination.

Chopra (2007: 534) noted that the biggest hurdle to making IT system works is the trust factor. Companies that do not have a degree of trust in their interactions are very unlikely to get much in the way of benefit from investing in coordination software, regardless of how good the technology is.

A.7.4. Information Sharing Culture

Obviously, people handle information (Davenport, 1999: 3-4) in myriad ways, from data processing to exchanging e-mail worldwide. For the many diverse information users in large organizations, effective information management must be begin by thinking about how people use information – not with how people use machines. While it is impossible to account for all the unforeseen consequences of information expansion and use in today's companies, the following three observations exemplify how human-centered approach to information management contrasts with the standard information technology view:

- Information evolves in many directions, taking on multiple meanings.

While IT specialists are drawn to common definitions of terms like customer or product, most information does not conform to such strict boundaries. Forcing employees to come to one common definition, as some technologies require, only truncates the conversations and sharing of perspectives that the technology is supposed to ensure. Rather than forcing

employess to simplify information so that it will fit into a computer, a human-centered approach to information calls for preserving the rich complexity in information field.

- People do not share information easily.

Assuming that different departments, professionals, or line workers will want to use technology to share information is one of the biggest mistakes in the IT implementation. Yet it is one of the fundamental assumptions made in planning any IT system. That is, if you build it, people will use it.

- Changing an IT system will not change a company's information culture.

The presence of technology, in and of itself, cannot wholly transform a corporation. Changing a company's information culture requires altering the basic behaviours, attitudes, values, management expectations, and incentives that relate to information. Changing the technology only reinforces the behaviors that already exist. Yet in most companies, assumptions that once the right technology is in place, the appropriate information sharing behaviour will inevitably follow.

In today's competitive business environment, it makes sense to give information particularism its due; but organization must also decide which aspects of a company's information are global as well to determine how such information is to be shared effectively. While information architecture can specify who control information, such rigid model do not account for the unpredictable growth of information or human nature (Davenport,1999: 13).

Typically, one or more of the following root causes are found when it comes to information sharing problems. Several causes and key issues to address when these situations are encountered (Davenport, 1999: 14-26) include, but not limited to, the following:

- Paranoia about dissemination. This situation has its roots in practical information issues. For information to be shared, it must first be structured and compiled, which makes it easier to steal or subpoena.

- Internal problems that arise with information sharing due to different information cultures. Different functions or departments may have different point of views related to information sharing issues.

- Noninformation generated by unwillingness to share information. Many people suffer from far too much noninformation, which companies seem to generate with ease and at the expense of useful information, rather than the "information overload" they complain about.

- Lack of information map that describes the location and availability of the needed information. Most large companies now have plenty of databases. But precisely because of the vast amounts of information circulating around organizations, few employees know where to find what they really need.

A.7.5. Training and Education

Issue of training and education for achieving supply chain objective and to a success of technology can be described as follows:

1. Lack of/Ineffective Training – Proper training reduces the time for people to become proficient in their jobs and also can lead to ongoing improvements (Handfield, 2001: 56)

2. Lack of training and human support. Companies will fail to take advantage of information technology without adequate training and human support. It is therefore a must for companies to provide both time and training for the employees to get used to handling information on a regular basis. (Davenport, 1999: 24-26)

3. Training to overcome technical risk

   Throughout the firm, new technologies require that emloyees gain new knowledge about how to implement and use that technology and how that technology facilitates ERP system usage. Either existing employees can be given the appropriate training or new employees can be sought out. In any case, the ERP system may require employees with different capabilities and

skills, forcing a change in personnel. Any major change in personnel is itself a risk concern (O'Leary, 2002: 220).

4. Training to overcome business risk

   Training should provide users with process and system information. Although training is frequently underestimated, it can entail a number of other business risks as well (O'Leary, 2002: 223).

5. Training to overcome organization risk

   ERP systems push data input closer to the source of the information. In some cases, this means that employees not accustomed to data input will take on the task. Lack of knowledge about how to use system can lead to ERP system failure. Hence, particular care must be taken care to ensure that the employees are given sufficient education to enable proper use of the system. However, the primary organization risk in training and personnel, is that there may not be adequately trained people after the system has been implemented (O'Leary, 2002: 225).

A.7.6. Role and Responsibility

SAP R/3 (a type of ERP system software) distinguishes between task, job, position and person. In SAP, an employee is a person who performs tasks, which can be assigned either to a job, which is a generic description of an employee's work responsibilities, or to the position that the person holds. By this means, an advantage of an integrated information system over a paper-based system is that controlling access to data is automated; managers can use the system to determine which users should have access to various data (Monk, 2006: 149-151).

B. Research Method

Research method used in this research is the Oliver Wight ABCD Checklist. ABCD Checklist is a way of benchmarking a company's planning and control process performance and how a company typically uses their ERP system (Wallace: 17-18). The ABCD Checklist developed by Oliver Wight in the

mid 1970's is still the most widely recognized way to evaluate how well a manufacturing company plans and control its business (http://www.bpic.co.uk).

B.1. Research Approach

The collected data in this research will be analyzed using Oliver Wight ABCD checklist on qualitative approach basis. Suparlan (1994:6) defined that qualitative approach focus on the symptoms without certain characteristics, and focus on general principals underlying symptoms forms in certain phenomenon. This approach analyzes the symptoms in order to obtain overview about existing patterns, and the observed patterns should be analyzed by objective theories.

Further in this research, qualitative method is quantified by scoring each item based on ABCD checklist guide. The scores is used to measure level of achievement for each item checked.

B.2. Research Type

Research is designed to describe ERP system implementation at PT. XYZ Indonesia against the best practices of business process and effective supply chain. The research is purposed to reveal constraints and obstacles diminishing ERP system effectiveness such as users' behavior and cultures underlying the system environment. Thus, this research type is classified as descriptive-analysis. According to Whitney (1960) in Nasir (1999:63), descriptive method is a research to find facts through correct interpretation. Descriptive research focus on problems and certain situations studies, including relation, activities, on-going process and impacts of a phenomenon.

B.3. Research Method and Strategy

B.3.1. Data Collection Method

Data collection for this research is conducted in two modes. First mode is designed for primary data collection purpose which is gained directly from PT.

XYZ Indonesia. Primary data collection is effected through distribution of the Oliver Wight ABCD checklist as samples and in-depth interview with respective manager and supervisors or power users of ERP system at PT. XYZ Indonesia. The Oliver Wight ABCD checklist was distributed to respondents consisting of respective managers and supervisors taking into consideration that these people are knowledgeable people who understand the business processes and ERP system application within their work area. The Oliver Wight ABCD Checklist pinpoints the characteristics of respondent to be knowledgeable people with good intention to gain objective results about business processes and the underlying tools and people. Thus, primary data is collected through purposive sampling method. Second mode is by collecting data from indirect sources. The secondary data collection is obtained through:

1. ERP Track Records
2. Company Profile
3. Literature Studies such as books, articles and web-sites related to information system in supply chain management.

B.3.2. Data Analysis Technique

ABCD checklist has a perspective of integrating people, process and tools. The answers reflect current levels of performance and reveal significant opportunities for improvement. The checklist is an important tool in appraising a company's effectiveness in developing the right processes to utilize the many technologies available to manufacturing companies today. By comparing performance against established best practices, people are motivated to work in a more effective manner (Wight, 2000:1).

The Oliver Wight ABCD checklist allows companies to improve their overall business performance and underlying technologies. The tools facilitate companies, in this case, PT. XYZ Indonesia, to improve the operational performance of the following business processes:

- People/Team Processes
- Planning and Control Processes

B.3.2.1. Scoring the Results

The responses to both overview and detail items are scored on a range from "Excellent" to "Not Doing", with three intermediate points. Performance measurement falls on following range.

Excellent *4 points*	Highest expected level of results from performing this activity
Very Good *3 points*	Fully performing this activity and has achieved original goals associated with it
Fair *2 points*	Have most of the processes and tools are in place, but not fully utilizing the process and/or not getting the desired results
Poor *1 point*	People, processes, and tools are not at the minimum prescribed level, resulting in little, if any, benefit
Not Doing *0 point*	This activity is required but currently not being performed

B.3.2.2. Qualitative Characteristic

Company's business performance in each business aspect is classified with letter grade and the characteristics as below:

1. People/Team Process

- Class A Trust, teamwork, mutual respect, open communications, and a high degree of employment security are hallmarks of the employee/company relationship. A formalized team structure is evident throughout the organization. Employees are very pleased with the company and proud to be part of it.
- Class B Employees have confidence in the company's management and consider the company a good place to work. Effective use is being made of small work groups throughout the organization.
- Class C Traditional employment practices are largely being used. Management considers the company's people to be an

important, but not vital, resource of the business. Use of small work groups is evident in some areas of the organization.

- Class D The employee/employer relationship is neutral at best; sometimes negative.

2. Planning and Control Processes

- Class A Planning and control processes are effectively used companywide, from top to bottom. Their use generates significant improvements in customer, employee, and stakeholder satisfaction as well as in customer service, productivity, inventory, and cost.

- Class B These processes are supported by top management and used by middle management to achieve measurable company improvements; opportunities still exist to upgrade planning and control as a whole.

- Class C The planning and control system is operated primarily as a better method for ordering materials; its contribution is to improve production and inventory management.

- Class D Information provided by the planning and control system is inaccurate and poorly understood by users; it provides little help in running the business.

3. People, Process and System Integration

The Oliver ABCD checklist covers multiple technologies and processes. This research is developed with focus on people/team and planning and control processes within ERP system environment to assess how PT. XYZ Indonesia integrates people, process and ERP system. Further, the checklist results will be used to determine PT. XYZ Indonesia's title as an ERP system user. Wallace (2001: 17-18) entitled company's class with following letter grade and the characteristics:

- Class A Effectively used company-wide; generating significant improvements in customer service, productivity and cost.
- Class B Supported by top management; used by middle management to achieve measurable quality improvements.
- Class C Operated primarily as better methods for ordering materials; contributing to better inventory management
- Class D Information inaccurate and poorly understood by users; providing little help in running the business

B.3.2.3. Letter Grade Calculation

Before any company can be rated with confidence, there should be at least three months of sustained performance. Once the overview items have been answered, complete process of determining the letter grade for the chapter by averaging the numerical scores for the overview items.

- Average greater than 3.5 means that firm is at the Class A level for that set of business processes.
- Average between 2.5 and 3.49 qualifies for Class B level
- Average between 1.5 and 2.49 means a Class C level
- Average less than 1.5 indicates a Class D level

B.3.3. Analysis Data Strategy

In qualitative research, the numbers and types of strategies approaches become more clearly visible during the 1990s. The qualitative approach strategy used in this research is classified as *case studies* approach (Stake, 1995) which described as a strategy in which researcher explores in depth a program, an event, an activity, a process, or one or more individuals. The case(s) are bounded by time and activity, and researcher collect detailed information using a variety of data collection procedures over a sustained period of time.

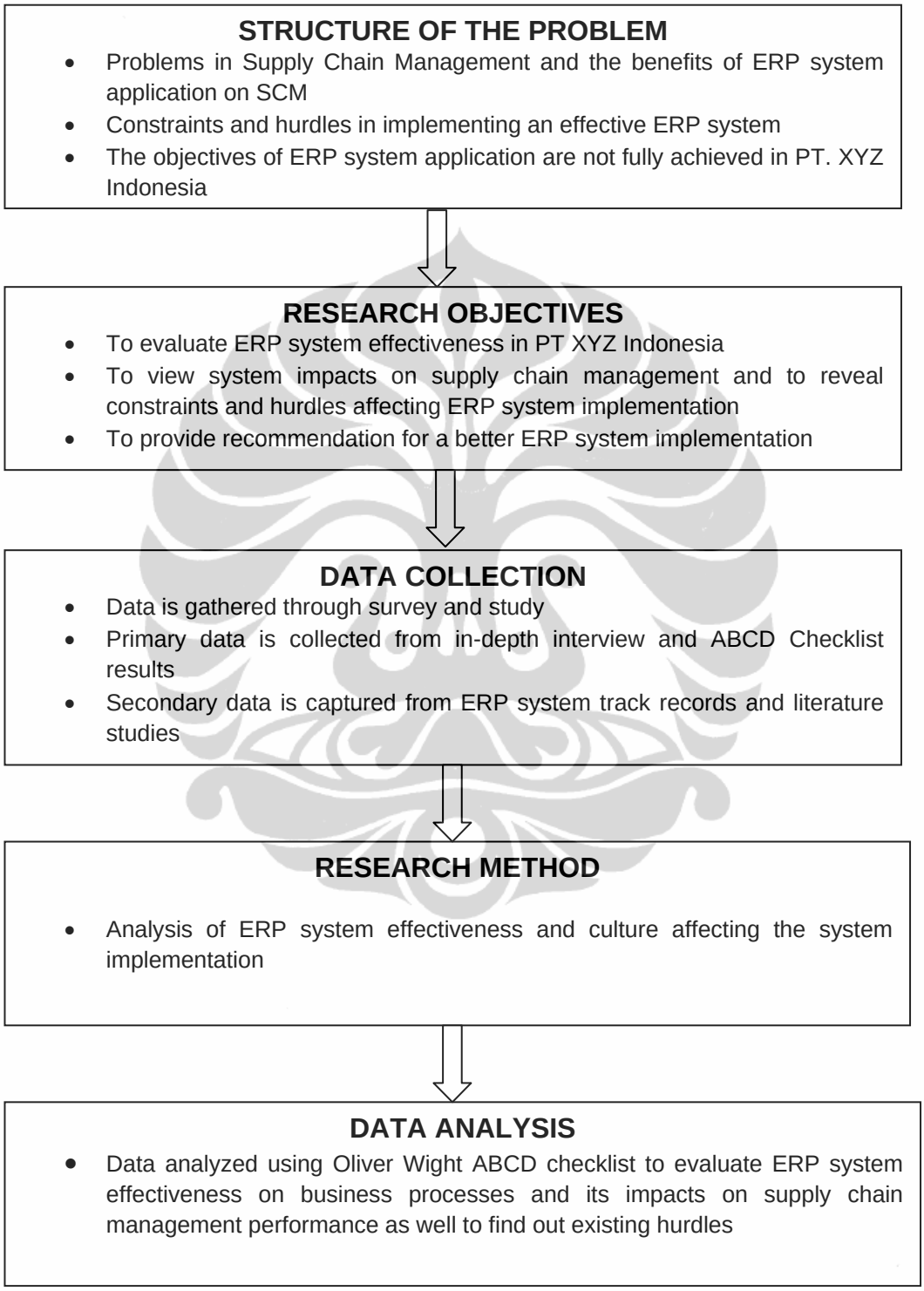
According to Neuman (1997: 428), method of qualitative data analysis used in this research is the illustrative method-parallel demonstration. This kind of method of analysis uses empirical evidence to illustrate or anchor a theory. With

the illustrative method, a researcher applies theory to a concrete historical situation or social setting, or organizes data on the basis of prior theory. Preexisting theory provides the empty boxes. The researcher sees whether evidence can be gathered to fill them. The evidence in the boxes confirms or rejects the theory, which researcher treats as a useful device for interpreting the social world. The parallel demonstration of a model is a method of analysis in which a researcher juxtaposes multiple cases (i.e. units or time periods) to show that the theory can be applied in multiple cases.

B.4. Research Object

Object of the research is PT. XYZ Indonesia which has some business units in Indonesia. Research is conducted in PT. XYZ head office in Jakarta and its animal feed plant in Gresik, East Java.

B.5. Research Process



B.6. Research Limitation

The selection of ABCD checklist items is concentrated to assess people/team and control and planning processes within export area only. Also, the survey and items checked are very limited and focus on ERP system implementation within planning and export, purchasing, accounting/finance, production and warehousing operations.