THE EFFECT OF INFORMATION AND KNOWLEDGE SHARING ON SUPPLY CHAIN PERFORMANCE THROUGH SUPPLIER-BUYER RELATIONSHIP

by

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Choudhury Abul Anam Rashed

DEDICATION

To my Parents

To my wife

To my family

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ABSTRACT

Supply chain is an integration of both tangible and intangible resources including material, information and capital. The material flow is focused in supply chain practice while information flow is focused in information sharing. The main concentration of supply chain in last decade was on material movement. Recently information sharing is attaining the concentration of the researchers. Majority of the research work has emphasized the individual effect of information and knowledge sharing on supply chain (specifically buyer) performance and the individual effect of information and knowledge sharing on buyer-supplier relationship. The combined effect of information and knowledge sharing needs to be analyzed. This paper aims to focus on the combined effect of information and knowledge sharing on supplier's performance through supplier-buyer relationship. A conceptual model was formulated based on previous literature. A questionnaire based survey was performed. The questionnaire was developed based on the previous literature and the expert opinion. Data from 30 Bangladeshi Readymade Garments Industry were collected through interview and mail survey. The content validity; construct validity, and reliability are tested by the literature review and in-depth interviews conducted with business executives and researchers, exploratory factor analysis and measuring internal consistency with Cronbach's alpha. Structural Equation Modeling is performed for the identification of the validity of the model. The results show that (1) effective information sharing enhances the effective knowledge sharing and (2) effective supplier-buyer partnership type relation improves the supplier's operational performance. The findings show that information sharing is a prerequisite for knowledge sharing and the close supplier-buyer relationship is a vital factor for escalating the supplier's operational performance.

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CHAPTER 1
INTRODUCTION

1.1 Background of the Study

Supply chain involves the flow of both tangible and intangible resources including materials, information and capital across the entire supply chain. Supply chain practice focuses on material movement while information sharing focuses on information flow. Although the supply chain is frequently referred to as the logistic network in the literature, supply chain management emphasizes the overall and long-term benefit of all parties on the chain through cooperation and information sharing.

Two major aspects of information sharing are information content and information quality. Information content refers to the information shared between suppliers and buyers. Information quality measures the quality of information shared between suppliers and buyers.

There are two dimensions of information sharing- connectivity and willingness. Both dimensions are found to impact operational performance and to be critical to the development of a real information sharing capability. The value of information-sharing can be defined as the benefits derived from sharing information minus the associated costs.

High performing firms had a higher percentage of information exchanged via EDI with customers and suppliers. Their results demonstrated that information technology investment alone is not enough. Only when management teams emphasize on the technology investment and choose the appropriate information to share, a firm can achieve effective firm performance. The face-to-face communication can raise the level of information sharing. When companies are willing and able to share vital- and often proprietary decision-making information, trust can be established and collaboration will be promoted. Technology becomes a tool to augment and promote information sharing and real collaboration. But no research work attempted to differentiate between the information and knowledge sharing.

A knowledge shared supply chain is an evolution over an information shared supply chain. Knowledge in the business context is nothing but a more valuable and actionable information. Knowledge allows for making predictions, casual associations, or predictive decisions about what to do, unlike the information that simply gives us the fact.

Knowledge starts its life as data, unrelated facts that have little value of their own. As data is combined and placed in a context, it becomes information. Information becomes knowledge through critical and creative thought processes.

Knowledge can be classified as tacit and explicit. Tacit knowledge has two dimensions both personal and practical. It is embedded in people's ideas, values and emotions and is expressed more in people's actions. It is their 'know-how' and shapes the way they perceive the world.

The descriptions of relationships are relatively abstract and vary with the discipline from which they are being researched (e.g. strategy, economics or psychology). As soon as two or more parties (i.e. organizations) associate themselves in order to fulfill a mutual business purpose a relationship is established. Such an association leads to various joint activities, which are dependent on the specific business objective.

Buyer-supplier relationships are classified as- adversarial arm's-length approach and partnerships approach. The difference between, traditional arm's-length relationships and partnerships is clear – partnerships are closer than other types of relationship

Relationships are seen as having positive links to performance but little is known about the nature of this performance. Relationships themselves can be seen as generic; applying to all buyer-supplier exchanges. Relationships are viewed as mutual, two-way, involved exchanges between buyers and suppliers. It is apposite, therefore, to bring a relationship performance viewpoint to this key nexus of a firm's operation.

Past studies show that buyers benefit when suppliers are intensively and durably involved in information exchange, it is less clear under what conditions this improves supplier's operational performance. Majority of the research work has emphasized the individual effect of information and knowledge sharing on supply chain (specifically buyer) performance and the individual effect of information and knowledge sharing on buyer-supplier relationship. In this paper it is tried to show the combined effect of information and knowledge sharing on the buyer-supplier relationship and the effect of the relationship on supplier's operational performance.

1.2 Objectives with Specific Aims and Possible Outcomes

The objectives of the present study are-

1. To investigate the combined effect of operational information and knowledge sharing on supplier-buyer relationship.
2. To explore the impact of the mentioned relationship on supplier's operational performance.

Possible outcome of the research is determination of linkage between information and knowledge sharing with buyer-supplier relationship and evaluation of the effect of this relationship on suppliers' operational performance.

1.3 Outline of Methodology/ Experimental Design

The following procedures will be carried out step by step:

1. Development of a conceptual model based on the literature.
2. Development of hypotheses based on the paths of the model.
3. A survey will be conducted for primary data collection to measure the variables for the developed model. The survey instrument will be developed based on an extensive review of the literature. Many survey questions will be adapted from previous literature and new questions will be developed based on the literature and suggestions from academics and purchasing executives
4. Statistical analysis will be performed using structural equation modeling (SEM) to validate the developed model.

1.4 Scope of the Thesis

In chapter1, the general introduction is provided. The objectives and outline of methodology is also highlighted in this chapter. Then the literature review is revealed.

Chapter 2 depicts the theoretical background. In this chapter regarding the supply chain (including its material based resource and information based resource) is discussed. The general definition of information sharing, knowledge sharing, supplier-buyer relationship, operational performance is provided here. Also the importance of information based resources and their relationship or linkage has been highlighted.

Chapter 3 provides the main conceptual framework and the hypotheses. The conceptual model was first formulated and then its path denotes the hypotheses. The hypotheses are based on previous literature. Six hypotheses were formulated.

Chapter 4 highlights the research design and methodology. Here, the variables questions were provided the weight age by the relevant factories on 1-7 likert scale. Then the mean and variance were calculated. A factor analysis was performed and the reliability of the questionnaire was tested by cronbach's alpha.

In chapter 5 analysis and results were performed. The path analysis was done to find out the path coefficients and the correlation matrix was formulated. Then the result of each hypothesis was analyzed.

Chapter 6 highlights the discussion regarding the results obtained.

Finally, in chapter 7, the conclusion is drawn. Recommendation for future work is also provided.

CHAPTER 2

LITERATURE REVIEW

Information quality measures the degree to which the information exchanged between organizations meets the needs of the organizations [1, 2]. A number of researchers have identified several important characteristics of information quality [3, 4]. Neumann and Segev studied four information characteristics: content, accuracy, recency, and frequency. McCormack [5] measured information by accuracy, frequency, credibility, and availability of forecast. Petersen [2] measured information quality by currency, accuracy, and completeness. Vijayasarathy and Robey [6] measured information intensity and quality. Information quality is an important determinant of the usefulness of an information system. Sum et al. [7] found that data accuracy is critical in affecting operating efficiency and customer service. McGowan [8] argued that the information system is perceived useful when the information is high quality, readily accessible, accurate and relevant [9].

Fawcett et al. [10] in their research identified and analyzed two distinct dimension of information sharing – connectivity and willingness.

Supply chain visibility has been discussed and studied widely in recent years. Many researchers who have approached the issue have proved that increased visibility will improve the performance of the supply chain [11-15]. Supply chain visibility does not mean sharing all information with all partners in the supply chain, but rather that the shared information should be relevant and meaningful. The benefits of information-sharing include improved inventory management, higher sales, and better understanding of demand. [16]

Information's competitive value is widely indicated- it substitutes for inventory, speed product design, shortens order fulfillment cycles, drives process reengineering, and coordinate SC activities [17]. Information sharing is at the core of collaborative supply-chain based business models.

In research studies, it is assumed that information-sharing is beneficial and the investments are not considered. An exception is the result from Kaipia R. and Hartiala H. [16], where he states that if the manufacturer uses its available information about historical demand intelligently, there is no need to invest in information-sharing.

Zhenxin et al. [1] study illustrates the benefits of supply chain partnerships based on information sharing. For a decentralized supply chain comprising a manufacturer and a retailer, they derive the members' optimal inventory policies under different information sharing scenarios. They show that increasing information sharing among the members' in a decentralized supply chain will lead to Pareto improvement in the performance of the entire chain. Specifically, the supply chain members can reap benefits in terms of reductions in inventory levels and cost savings from forming partnerships with one another.

Of all the resources a company manages, information has perhaps received the greatest attention as critical to the implementation of the company's strategic SC response. To respond productively to rapid change, a company must "be aware of new information generated in its environment and adopt structures that enable fast decision making and practices that reduce information overload [18]. For this reason, companies are investing heavily in information technologies to enhance their ability to manage information and knowledge across the supply chain [19].

Many managers mistakenly concentrate their information sharing on only the hardware and software, ignoring the decision-making in the information sharing process [20]. Kaipia R. and Hartiala H. [16] suggested that what makes the performance difference is how information is used.

Knowledge transfer is very important in supply chains simply because it enables integrating knowledge that is spread across each of the nodes to facilitate smooth flow of entities leading to improved SCM synchronization. Lastly, knowledge is the key to the success of a supply chain as it affects decisions [21].

Most scholars divide knowledge into two types: (1) explicit knowledge or information, and (2) tacit knowledge or know-how [22, 23]. Information is defined as easily modifiable knowledge that can be transmitted 'without loss of integrity once the syntactical rules required for deciphering it are known. Information includes facts, axiomatic propositions, and symbols' [22]. By comparison, know-how involves knowledge that is tacit, 'sticky,' complex, and difficult to codify [22, 24]. The properties of know-how suggest that, compared to information, know-how is more likely to result in advantages that are sustainable [25].

Knowledge resides in the people, the quality of the relationships that are formed across the chain and the application of shared knowledge. The chain is a sum of all the parts and co-operative exchanges of information and knowledge across it ensures strategies and knowledge are aligned to its goals [26].

In the knowledge economy interest is growing in a person's tacit knowledge because "it is deeply rooted in action and individual commitment and to a specific context". Explicit knowledge is formal knowledge that is structured and recorded both in numbers and words. It is readily transmitted between people and "defines the intellectual assets of an organization independently of its employees" [26].

Knowledge is not static as it moves between people. The real value of both explicit and tacit knowledge is in its application. Tacit knowledge flows from the people in the organization to be made explicit in its policies, processes and practices [27]. When technical writers are developing manuals, they aim to make the tacit knowledge acquired by the designer during the design phase explicit to the reader.

Business relationships have been defined very differently in the literature, ranging from "good business relationships [are] relationships customized to fit the appropriate position on a continuum of possible relationship styles" [28] to "inter-organizational relationships are the relatively enduring transactions, flows, and linkages that occur among or between an

organization and one or more organizations in its environment" [29]. Researchers have developed descriptions of many types of relationships. Gummesson [30] defined 30 forms of relationship alone and this illustrates the diversity of viewpoints on the concept of relationships. A key business relationship, in which two parties associate, is that between a buyer and a supplier [31].

Supplier management is no longer focused on just transactions and price negotiations, but concentrates on a wider range of issues [32]. Today, the aim of supplier management is to achieve an optimal flow of high-quality, value-for-money materials and/or components from innovative suppliers [33]. In this situation, the new role of the purchasing manager has been described as an "information exchange broker" [34].

In the past, the objectives of buyer-supplier relationships have been focused on quality enhancements, delivery on time, and especially, cost reduction [35, 36]. The historical focus on costs in supplier management is explained by the goal of profit maximization. Drucker [37] concurred that this traditional mindset "has always somehow perceived business as buying cheap and selling dear. The new approach defines a business as the organization that adds value and creates wealth.

In the current business environment that buyers face, relationships should not be concerned simply with maximizing the difference between purchasing costs and the sales price – there needs to be the development of lasting relationships [38, 39]. The change of emphasis from reducing costs to improving quality and utilizing the innovative potential of the supplier to create value has influenced relationships with suppliers. Leenders and Fearon [40] highlighted this in saying that "the whole art of supplier relationship management from a supply perspective is to bring both sides into an effective working relationship"

Lamming [35] surveyed supplier-manufacturer relationships in the UK automotive industry and identified that at this time there was "a period of relative calm with domestic demand and supply well balanced for mass producers". This suited traditional purchasing, which is primarily price-

oriented. The pressure for change was low, but increased in the next decade so that logistic relationships were adopted. These added an emphasis on making the materials transfer from suppliers to manufacturers more efficient [41]. At the beginning of 1990s, relationships required an even greater degree of interaction due to the added need for product innovation and co-operation in technological developments – and this high level of interaction is termed partnership [35].

From a theoretical point of view, the difference between, traditional arm's-length relationships and partnerships is clear – partnerships are closer than other types of relationship [31, 36, 42, 43].

A close relationship means that channel participants share the risks and rewards and have willingness to maintain the relationship over the long term [44, 45]. Hahn et al. [46], in their conceptual study, provide some useful insights to compare the potential costs associated with different sourcing strategies and the companies will gain benefits by placing a larger volume of business with fewer suppliers using long-term contracts. Furthermore, through a well-developed long-term relationship, a supplier becomes part of a well-managed supply chain and ''it will have a lasting effect on the competitiveness of the entire supply chain'' [47]. De Toni and Nassimbeni [48] found that a long-term perspective between the buyer and supplier increases the intensity of buyer–supplier coordination. Carr and Pearson [49] investigate the impact of 'strategic purchasing' on 'buyer–supplier relationships' and the subsequent impact of 'buyer–supplier relationships' on the 'firm's financial performance.

The supply chain management literature has linked the management of demand and supply empirically to firm performance [50]. Authors such as Macbeth and Ferguson [51] and Watts et al. [52] have argued for the strategic role and potential of buyer–supplier relationships inherent in the development of co-operative relationships when compared to the traditional role that is directed by the benefits that accrue to one party only.

Dwyer et al. [53] describes a continuum of different types of buyer–supplier relationships. According to him Japanese auto firms cultivate their suppliers through investments, sharing of knowledge, and joint problem solving. Noordewier et al. [54], state that purchasing performance is an important determinant of a firm's competitiveness. Establishing long-term relationships with the key suppliers can lead to improved firm's financial performance [55]. According to Larson [56], purchasing coordination of the firm's activities with key suppliers can impact total costs. As demonstrated by the Ford Motor's use of long-term buyer–supplier relationships to help achieve a competitive advantage in the automobile industry. Under total quality management (TQM), Ford transformed buyer–supplier relationships from adversarial to cooperative. Ford's success demonstrates that businesses can increase their competitiveness by implementing cooperative supplier relationships [57]. All of the literatures were highlighted on the buying firm's performance. No research work was performed on the performance from the supplier's perspective. But the positive influence of buyer-supplier relationship emphasizes the probability of having positive link between relationship and suppliers performance.

CHAPTER 3

THEORITICAL BACKGROUND

3.1 Introduction

In this chapter, we provide a conceptual understanding of what a supply chain is and what the importance of information and knowledge sharing in supply chain. We will also highlight on supplier-buyer relationship and what operational performance means.

3.2 Supply Chain

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers and even 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, and are not limited to, new product development, marketing, operations, and distribution finance and customer service.

Consider a customer walking into a retail store to purchasing detergent. The supply chain begins with the customer and his or her need for detergent. Retail store stocks its shelves using inventory that may have been supplied from finished goods warehouse or a distributor using trucks supplied by third party. The distributor in turn is stocked by the manufacturer. The manufacturing plant receives raw materials from a variety of suppliers, who may themselves have been supplied by lower-tier supplier.

A supply chain is dynamic and involves the constant flow of information, product, and funds between different stages. The customer is an integral part of a supply chain. In fact, primary purpose of a supply chain is to satisfy customer needs and in the process, generate profit for itself [58].

A typical supply chain involves a variety of stages. These supply chain stages include- Customers, Retailers, Wholesalers/ Distributors, Manufacturers and Component/ Raw material suppliers. Each stage in a supply chain is connected through the flow of products, information

and funds. These flows often occur in both directions and may be managed by one of the stages or an intermediary.

3.2.1 *The Objectives of Supply Chain*

The objective of every supply chain should be to maximize the overall value generated. The value of a supply chain generates is the difference between what the final product is worth to the customer and the cost the supply chain incurs in filling the customer requests. For most commercial supply chain, value will be strongly correlated with supply chain profitability, the difference between the revenue generated from the customer and overall cost across the supply chain. 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 not in terms of the profit of an individual stage.

Having defined success of supply chain in terms of supply chain profitability the next logical step is to look for sources of revenue and cost. Effective supply chain management involves the management of supply chain assets and product, information, and funds flows to maximize total supply chain profitability.

3.2.2 *The Importance of Supply Chain Decisions*

There is a close connection between the design and management of supply chain flows and the success of a supply chain. The success of supply chain is facilitated by sophisticated information exchange. If the buyer provides real-time data to suppliers on the current state of demand, suppliers are able to access their components inventory level at the factories along with daily production requirement. Some buyers have created customized web page for its major suppliers to view demand forecasts and other customer-sensitive information, thus helping suppliers to get a better idea of customer demand ad better match their production schedule to that of buyer. When a new product is launched, supplier engineers can be stationed right in the plant of the buyer. The design and management of the supply chain plays a key role in the company's success. If the supply chain is well suited to provide a high degree of customization at a low cost, the success of the supply chain is a must.

3.3 Information

Of all the resources a company manages, information has perhaps received the greatest attention as critical to the implementation of the company's strategic Supply Chain response. To respond productively to rapid change, a company must be aware of new information generated in its environment and adopt structures that enable fast decision making and practices that reduce information overload. [18].

The role that information plays in the supply chain, as well as key information related decision that supply chain manager must make will be discussed in this section. Also the characteristics of information, the relation of information with performance and supplier-buyer relationship will be highlighted in this section.

3.3.1 *The Role of Information in Supply Chain*

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. Consider the following:

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. For instance, a production scheduling system uses information on demand to create a schedule that allows a factory to produce the right products in an efficient manner. A warehouse management system uses information to create visibility of the warehouse's inventory. The company can then use this information to determine whether new orders can be filled.

3.3.2 *The Role of Information in the Competitive Strategy*

Information is an important driver that companies have used to become both more 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. Like all other

drivers, however, even with information, companies reach a point when they must make the trade-off between efficiency and responsiveness.

Another key decision involves what information is most valuable in reducing cost and improving responsiveness within a supply chain. This decision will vary depending on supply chain structure and market segment served. Some companies, for example, target customers who require customized products that carry a premium price tag. These companies might find that investments in information allow them to respond more quickly to their customers.

3.3.3 *Components of Information Decisions*

The key components of information that a company must analyze to increase efficiency and improve responsiveness within its supply chain are:

3.3.3.1 *Push versus Pull*

When designing processes of supply chain, managers must determine whether these processes are part of push or pull phase in the chain. Push systems generally require information in the form of elaborate material requirements planning (MRP) systems to take master production schedule and roll it back, creating schedules for suppliers with part types, quantities, and delivery dates. Pull system requires information on actual demand to be transmitted extremely quickly throughout the entire chain so that production and distribution of products may reflect the real demand accurately.

3.3.3.2 *Coordination and Information Sharing*

Supply chain coordination occurs 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 a significant loss of supply chain profit. Coordination among different stages in a supply chain requires each stage to share appropriate information with other stages. For example, if a supplier is to produce the right parts in a timely manner for a manufacturer in a pull system, the manufacturer must share demand and production information with the supplier. Information sharing is thus crucial to the success of a supply chain.

3.3.3.3 *Forecasting and Aggregate Planning*

Forecasting is the art and science of making projections about what future demand and conditions will be. Obtaining forecasting information frequently means using sophisticated techniques to estimate future sales or market conditions. Managers must decide how they will make forecast and to what extent they will rely on forecasts to make decisions. Companies often use forecasts both on a tactical level to schedule production and on a strategic level to determine whether to build new plants or even whether to enter a new market.

Once a company creates a forecast, the company needs a plan to act on this forecast, Aggregates planning transforms forecasts into plans of activity to satisfy the projected demand. A key decision manager's face is how to collaborate on aggregate planning throughout the entire supply chain. The aggregate plan becomes a critical piece of information to be shared across the supply chain because it affects both the demand of a firm's suppliers and the supply of its customers.

3.3.4 *The Aspects of Information Sharing*

There are three aspects of information sharing- information sharing support technology, information content and information quality. Information sharing support technology includes the hardware and software needed to support information sharing. Information content refers to the information shared between manufacturers and customers. Information quality measures the quality of information shared between manufacturers and customers. In sum, the three aspects of information sharing measure the technologies used to support information sharing, the scope of information shared, and the quality of information shared, respectively.

3.3.4.1 *Information Quality*

Information quality measures the degree to which the information exchanged between organizations meets the needs of the organizations [2]. A number of researchers have identified several important characteristics of information quality [3, 4]. Neumann and Segev [3] studied four information characteristics: content, accuracy, recency, and frequency. McCormack [5] measured information by accuracy, frequency, credibility, and availability of forecast. Petersen [2] measured information quality by currency, accuracy, and completeness. Vijayasarathy and

Robey [6] measured information intensity and quality. Information quality is an important determinant of the usefulness of an information system. Sum et al. [7] found that data accuracy is critical in affecting operating efficiency and customer service. McGowan [8] argued that the information system is perceived useful when the information is high quality, readily accessible, accurate and relevant. In sum, there are nine aspects of information quality: accuracy; availability; timeliness; internal connectivity; external connectivity; completeness; relevance; accessibility; and frequently updated information.

3.3.4.2 *Information Content*

Information content can be classified as supplier information, manufacturer information, customer information, distribution information, and retailer information [1, 60]. This study measures one information flows: the information that manufacturers share with their suppliers (manufacturer information). As a result, information sharing in this study has three components: information sharing support technology, manufacturer information, and information quality.

3.3.4.3 *Information Sharing Support Technology*

Many technologies exist to share and analyze information in the supply chain. The organizations must decide which technologies to use and how to integrate these technologies into their companies and their partners companies. The consequences of these decisions are becoming more and more important as the capabilities of these technologies grow. Some of these technologies include the following.

1. Electronic Data Interchange (EDI) allows companies to place instantaneous, paper-less purchase orders with suppliers. EDI is not only efficient, it also decrease 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 than EDI. Better visibility improves the decisions across the supply chain. Internet

communication among stages in the supply chain is also easier because a standard infrastructure already exists.

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. A passive tag draws energy from the reader, whereas an active tag has its own battery and draws power from there. RFID has many potential uses. It can be used in manufacturing to check availability of the entire bill of materials. The technology can make the receiving of a track much faster and cheaper. Full implementation of RFID could eliminate the need for manual counting and bar code scanning at the receiving dock. It can also be used to get an exact count of incoming items.

3.3.5 *The Characteristics of Information*

Information must have following characteristics to be useful when making supply chain decisions.

1. Information must be accurate. Without information that gives a true picture of the state of the supply chain, it is very difficult to make good decisions. That is not to say that all information must be 100% correct, but rather that the data available paint a picture that is at least directionally correct.

2. Information must be accessible in a timely manner. Often, accurate information exists, but by the time it is available, it is either out of date, or if it is current, it is not in an accessible form. To make good decisions, a manager needs to have up-to-date information that is easily accessible.
3. Information must be of the right kind. Decision makers need information that they can use. Often companies have large amount of data that is not helpful in making a decision. Companies must think about what information should be recorded so that valuable resources are not wasted collecting meaningless data while important data goes unrecorded.

3.3.6 *Supply Chain Uncertainty and the Bullwhip Effect*

There are three distinct sources of uncertainty that affect a supply chain: suppliers, manufacturers and customers. Uncertainties are caused by delayed deliveries, machine breakdowns, and order fluctuations etc., which necessitate increased inventories. Uncertainties will propagate through the supply chain in the form of ordering variability, which leads to excess safety stock, increased logistics cost and inefficient use of resources.

In a supply chain, every member of the chain needs to make a forecast of its downstream site's product demand for its own production planning, inventory control and material requirement planning. Usually, the demand forecasting includes some uncertain terms, which can be described as demand variability. An important phenomenon observed in supply chain practices is that the variability of an upstream member's demand is greater than that of downstream member. This effect was found by logistics executives at Procter and Gamble (P & G) and called the "bullwhip effect". In recent year, it has become a major concern for many manufacturers, distributors and retailers. For a manufacturing system, this phenomenon can be described as the variance of production exceeding the variance of sales under the optimal behavior even if the manufacturer can backlog excess demand [60]. The causes of bullwhip effect have been identified as: demand forecasting, order batching, price fluctuation and rationing game [61]. Basically the bullwhip effect is largely caused by variability of ordering. To mitigate or eliminate this, information sharing between members of a supply chain should be increased to reduce

uncertainty. The expanding importance of information integration also prompts increasing attention to establish strategic supply chain partnerships.

3.3.7 *Information Sharing and Partnership*

The reason for uncertainties is that perfect information about the system cannot be secured. While every single member has perfect information about itself, uncertainties arise due to lack of perfect information about other members. To reduce uncertainties, the supply chain member should obtain more information about other members. If the members are willing to share information, each of them will have more information about others. Therefore, the whole systems performance will be improved because each member can gain improvement from information sharing. This cooperation mode for increasing information sharing among supply chain members can be called a supply chain partnership. With partnership, the negative impact of the bullwhip effect on a supply chain can reduced or eliminated because it can help the supply chain members share more information to reduce uncertainties.

3.3.8 *Uses of Information*

Information is used when making a wide variety of decisions about each of the supply chain drivers, as discussed here.

1. Facility. Determining the location, capacity, and schedules of a facility requires on the trade-offs among efficiency and flexibility, demand, exchange rates, taxes and so on. Suppliers use the demand information from the buyer to set their production schedules. Depending on the production schedule of the supplier the buyer decides where to place its new facility.
2. Inventory. Setting optimal inventory policies requires information that includes demand partners, cost of carrying inventory, costs of stocking out, and costs of ordering.
3. Transportation. Deciding on transportation networks, routings, modes, shipments, and vendors requires information including costs, customer locations and shipment sizes to make good decisions. If the buyer uses information to tightly integrate its operations with those of its suppliers, this integration allows buyer to implement cross-docking in its transportation network, saving on both inventory and transportation costs.

4. Sourcing. Information on product margins, prices, quality, delivery lead times and so on are all important in making sourcing decisions. Given sourcing deals with inter-enterprise transactions, there is also a wide range of transactional information that must be recorded in order to execute operations, even once sourcing decisions have been made.
5. Pricing and Revenue Management. To set pricing policies, one needs information on demand, both its volume and various customer segments' willingness to pay, as well as many supply issues such as product margin, lead time, and arability using this information, firms can make intelligent pricing decisions to improve their supply chain performance.

In summary, information is crucial to making good supply chain decisions at all three levels of decision making (strategy, planning and operations) and in each of the other supply chain drivers (facilities, inventory, transportation, sourcing, and pricing).

3.4 Knowledge

Knowledge starts its life as data, unrelated facts that have little value of their own. As data is combined and placed in a context, it becomes information. Information becomes knowledge through critical and creative thought processes. These processes generate meaning for the user that is verifiable. When insight is added to the accumulating knowledge then a person has moved to being educated, i.e., they have an understanding of how they know. Knowledge grows from the process of education where philosophical insight and moral judgments can be made though the skills of thinking, evaluation and decision making, and self-actualization is evident.

3.4.1 *Linkage between knowledge and Information*

Figure 3.1 distinguish the role of information and knowledge cycle expedites to understand the transformation of information to knowledge and knowledge management.

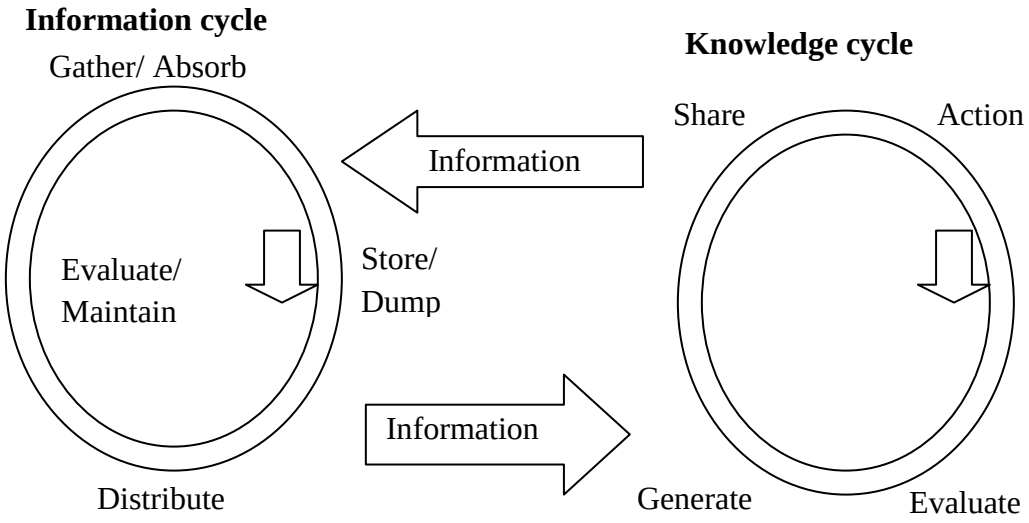

Figure 3.1 Linkage between Knowledge and Information

3.4.2 *Types of Knowledge*

Knowledge has been classified as being tacit and explicit [62]. Tacit knowledge has two dimensions both personal and practical. It is embedded in people's ideas, values and emotions and is expressed more in people's actions. It is their 'know-how' and shapes the way they perceive the world. In the knowledge economy interest is growing in a person's tacit knowledge because "it is deeply rooted in action and individual commitment and to a specific context". Explicit knowledge is formal knowledge that is structured and recorded both in numbers and words. It is readily transmitted between people and "defines the intellectual assets of an organization independently of its employees" [26].

Knowledge is not static as it moves between people. The real value of both explicit and tacit knowledge is in its application. Tacit knowledge flows from the people in the organization to be made explicit in its policies, processes and practices. When technical writers are developing manuals, they aim to make the tacit knowledge acquired by the designer during the design phase

explicit to the reader. When you consider all the communication issues of articulation and listening that occur during this process, it is not difficult to understand why some manuals are more successful than others.

Other scholars divide knowledge into two types: (1) explicit knowledge or information, and (2) tacit knowledge or know-how [22, 23]. Information is defined as easily modifiable knowledge that can be transmitted 'without loss of integrity once the syntactical rules required for deciphering it are known. Information includes facts, axiomatic propositions, and symbols' [22]. By comparison, know-how involves knowledge that is tacit, 'sticky,' complex, and difficult to codify [22, 24]. The properties of know-how suggest that, compared to information, know-how is more likely to result in advantages that are sustainable [25].

3.4.3 *Value Addition by Knowledge*

It is in the differentiation between information management and knowledge management that the value lays for business. Information management uses information technology to organize and deliver information about knowledge. Knowledge creation uses the tacit and explicit knowledge of the people across the network to develop new ideas, new ways of thinking leading to greater innovation and value creation. If the supply chain only focuses on information technology (i.e., the use of technology to manage information), "without consideration for how knowledge is applied, growth may be limited as the exploitation of collective knowledge to innovate and grow the business is unlikely" [26].

Value is added to the chain's business sustainability with the identification of relevant information and the application of knowledge to the strategic future planning. While productivity and product quality are components of the ultimate drivers of innovation - profitability, there are other dimensions where knowledge contributes towards a chain's sustainability. A growing number of organizations are realizing that sustainability involves meeting the environmental and social aspects of the triple bottom line as well as financial goals. Knowledge management across this complexity ensures that time is invested wisely in meeting the growing client demand for products to be developed in a sustainable manner.

Without a process for developing new knowledge across the chain there is a danger of 'brain stapling' where history and habit ensures the business focus remains on what has always been. History and habit ossify thinking processes and leave the chain without flexible strategies for managing the future. Rigidity reduces the value of any knowledge input to the chain.

Supply chains that develop structures for knowledge management across the chain are actively seeking to aggregate the total knowledge potential of stakeholders to create value that is greater than the sum of the parts. The Economic Development Institute at Georgia Tech, Atlanta defines waste as "Any activity that consumes resources and creates no value. The eight types of waste are overproduction, waiting, defects, excess inventory, motion, transportation, over processing and untapped human potential." Without structured and supported knowledge management throughout the chain much of stakeholder knowledge is never tapped and its potential value to the organization is wasted. Human potential and any competitive advantages for the chain are subsequently never realized. A chain that is truly open to change will have found ways of removing hierarchical structures which inhibit the flow of communication vertically within organizations and horizontally across the chain. Guptara [63] identified that communicating with "employees lower down in the hierarchy" would reveal whether an organization was "genuinely open to new ideas".

Value is increased in the chain when reciprocal activities occur between employees and organizations in the chain. As stakeholders synthesized their knowledge to benefit the chain, the chain invests in the development of capability in its stakeholders both formally and informally. In the long term this investment in employees further develops the capability of the organization and in the short term employees solve problems and create new knowledge that builds momentum in the chain [64].

3.4.4 *Knowledge Sharing*

Knowledge sharing is defined as transferring knowledge to others within the organization by individual's efforts [65]. Evolutionary psychology supports the notion that people have

developed tendencies to share with others. Some previous studies found people were socially programmed to cooperate when they solve problems, develop expectations regarding others' behavior through group communications and actions [66].

3.4.5 *Success Factors for Knowledge Sharing*

Several factors contribute to the development of knowledge across the supply chain. Furlong [26] identified business strategy, leadership, culture, context, organizational structure, technology and innovation as being enablers of knowledge sharing.

A value chain is a strategic network working co-operatively towards a common goal; therefore knowledge creation must be aligned to the business strategy and the output of quality products. Identifying the knowledge gaps in the chain that are aligned to the business strategy and processes to overcome these deficiencies ensures that the chain remains both competitive and sustainable. Processes to overcome gaps include education, training, mentoring or building a 'community of practice' around a particular interest area and aligned to the strategic goals. The alternative is to engage consultants and buy in the knowledge.

Leadership is essential in creating and supporting a positive learning environment. The leader is also a learner and a role model, developing a culture of that is committed to sharing knowledge and creating new ideas to meet customer demand. At the core of knowledge sharing is the quality of the relationships throughout the chain. Emotionally intelligent leaders with both personal and social competence (self-awareness, self-management/social awareness and relationship management) will be able to anticipate needs and develop appropriate processes to meet those needs [67]. This may be in the form of organizing appropriate resources, e.g., technology to facilitate the knowledge flow across the chain, leading communities of practice, and being open to new ideas from all levels of the chain.

The quality and relevance of the initial information that flows into an organization has a direct impact on the knowledge developed from its use. Information needs to be both timely and relevant to the context of the business. A toolbox of information and communication skills is

used when accessing, using, evaluating and applying information. People working together with contextual information develop competence in knowing how and when to use these skills which impact on the way in which knowledge is developed. That is knowledge is shared, people are open to new ideas and have the necessary skills to apply knowledge to the organization.

Networking core business activities throughout the chain builds the knowledge and skills in each of these areas and increases the opportunity for innovation throughout the chain. Positive attitudes and commitment underlie a person's motivation to participate in the flow of information within in an organization. Preventing the knowledge flow has implications for the whole chain in the quality of its products. Equally so, if a producer is unaware that their non-participation in a chain in the region affects the success of the chain, the chain will falter. Communities of practice could be centered on areas that involve people at all levels of the enterprise. Furlong [26] further suggests that this gives a competitive advantage to the chain as increased knowledge, skills and experience in core business areas become an entry barrier to competitors. New entries would not have developed that degree of knowledge and skill but could obtain it by takeovers.

Communities of practice as collectives of diverse stakeholders are subject to all the issues that impact on participative processes. Development of stakeholder's participation skills such as group cohesion, power sharing, communication and learning styles, conflict resolution, negotiation, active listening etc. ensures that these groups can contribute greater value to the chain.

3.5 Supplier-Buyer Relationship

In today's industrial environment, suppliers of components or assemblies can make a major contribution to a manufacturer's performance in the areas of quality, delivery, cost containment and new product development (NPD). Consequently, the "traditional" approach to manufacturer-supplier relationships – where the main focus is on price – can no longer deliver a competitive advantage for anything other than commodity parts. Therefore, the way in which manufacturers deal with their suppliers has been transformed [35].

3.5.1 *The Nature of Business Relationships*

Business relationships have been defined very differently in the literature, ranging from "good business relationships [are] relationships customized to fit the appropriate position on a continuum of possible relationship styles" [28] to "inter-organizational relationships are the relatively enduring transactions, flows, and linkages that occur among or between an organization and one or more organizations in its environment" [29]. Researchers have developed descriptions of many types of relationships. Gummesson [30] defined 30 forms of relationship alone and this illustrates the diversity of viewpoints on the concept of relationships. Typically, the descriptions of relationships are relatively abstract and vary with the discipline from which they are being researched (e.g. strategy, economics or psychology). Nevertheless, a consensus of opinion seems to have been reached which indicates that a business relationship is established, "as soon as two or more parties (i.e. Organizations) associate themselves in order to fulfill a mutual business purpose". Such an association leads to various joint activities, which are dependent on the specific business objective. A key business relationship, in which two parties associate, is that between a manufacturer and a supplier [31].

3.5.2 The Development of Supplier-Manufacturer Relationships

Traditional relationships in 1960s and 1970s were characterized by an adversarial arm's-length approach. Lamming [35] surveyed supplier-manufacturer relationships in the UK automotive industry and identified that at this time there was "a period of relative calm with domestic demand and supply well balanced for mass producers". This suited traditional purchasing, which is primarily price-oriented. The pressure for change was low, but increased in the next decade so that logistic relationships were adopted. These added an emphasis on making the materials transfer from suppliers to manufacturers more efficient [41]. At the beginning of 1990s, relationships required an even greater degree of interaction due to the added need for product innovation and co-operation in technological developments – and this high level of interaction is termed partnership [35].

Figure 3.2 shows the development in the nature of typical manufacturer-supplier relationships over the last 50 years.

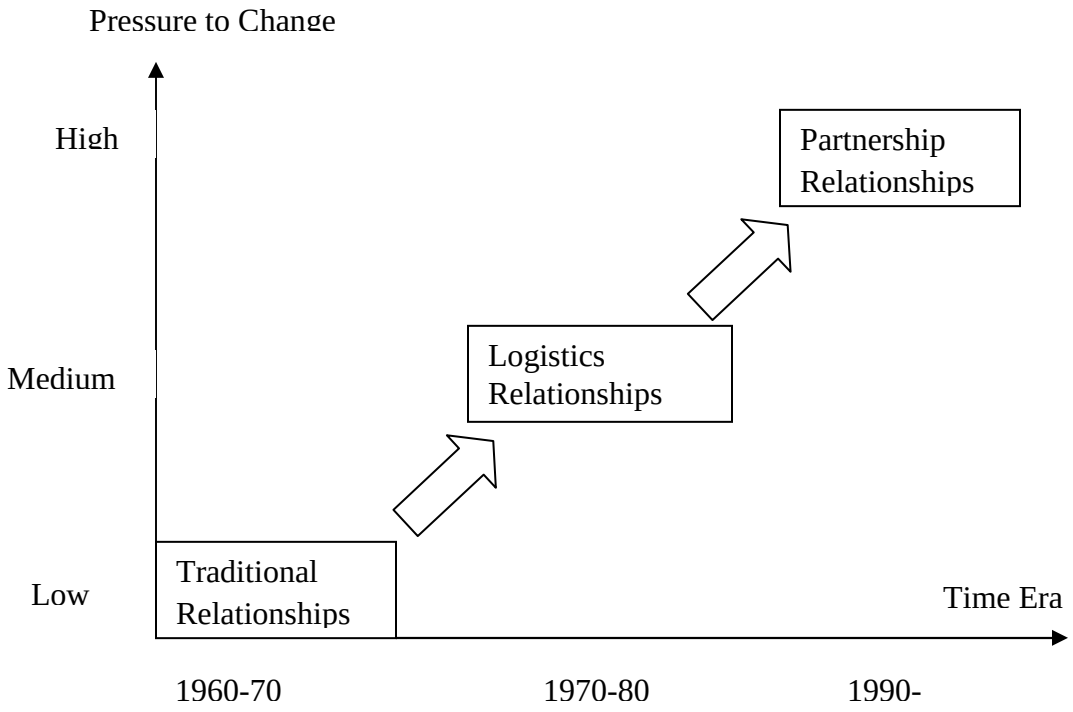

Figure 3.2: The steps in the evolution of buyer-supplier relationships driven by the pressure of change [41]

Unfortunately, it is unclear how exactly partnerships differ from other forms of relationship. Lemke et al.'s [36] study of the attributes of partnerships was a rare empirical investigation of this area. As it was based on a limited sample, however, the findings cannot be generalized. Similarly, it is unclear how the typical forms of supplier-manufacturer relationship will develop in near future.

3.5.3 *Transaction Cost Analysis of Buyer-Supplier Relationships*

Developed primarily by Williamson [68, 69] transaction cost theory may be viewed in a general sense as a paradigm whose primary focus is the design of efficient mechanisms for conducting transactions.

The main assumption on which the paradigm is built is that economic transactions have potential costs associated with them, say for example costs associated with writing, negotiating, and enforcing contracts [69]. Such costs become significant under certain conditions, in particular in the presence of transaction-specific investments and uncertainty.

Transaction-specific investments are assets that are uniquely tailored to a particular exchange relationship and which have low salvage value outside of the focal relationship. In Industrial purchasing relationships, buyers may make investments in tooling, equipment, and organizational procedures that uniquely tailored to the relationship with an individual supplier.

Uncertainty poses a transactional problem of a somewhat different nature. It is a property of the decision environment within which transactions take place and refers in general sense to a situation in which the relevant decision contingencies cannot be spelled out. In industrial purchasing contexts, one particular source of uncertainty is volume unpredictability. In operational terms, this is defined as the buyer's inability to specify in advance required purchase volumes from the supplier. Resulting in part from volatility in the buyer's downstream market, this form of uncertainty creates an adaptation problem, which in turn gives rise to transaction costs in connection with modifying agreements to new circumstances.

In the context at hand, one key relationship feature is the time dimension of the buyer-supplier interaction. As noted by both industry observers and academic researchers, one dominant characteristic of the new buyer-supplier relationships is their length, not only in terms of the formal length of the contracts that are signed, but also in terms of their anticipated time horizon. Specifically, higher levels of relationship continuity represent a distinct departure from conventional relationships.

3.5.4 *The Role of Trust in Buyer-Supplier Relationships*

As firms shift from arm's length to closer buyer-supplier relationships, they are discovering the unique challenges associated with jointly coordinating value adding activities in the supply chain [70]. Closer strategic partnerships between firms often entail investments in assets that are

customized to the buyer's or seller's requirements [68]. These investments increase the level of dependency between the parties and expose them to greater risk of exploitation. Further, a long-term orientation and the uncertainty associated with future unknowns create the need to protect investments against exploitation [71]. As a result, buyers and suppliers must develop procedures and practices for efficiently managing their relationship in a way that allows them to derive the benefits of closer collaboration while minimizing the risks of exploitation [69].

Trust is one factor that has been strongly suggested as having an important role in facilitating closer buyer-supplier relationships by reducing the tendency of firms to take advantage of each other [72]. Trust in the buyer-supplier context is the belief that an actor: (1) can be relied upon to fulfill obligations, (2) will behave in a predictable manner and (3) will act and negotiate fairly when the possibility of exploitation exists.

In a buyer-supplier situation where the behavior of purchasing manager and supplier contacts is nested within their respective organizations, interactions take place not only between individuals but also between organizational agents in boundary-spanning roles. In such a situation, organizational culture, structure and policies are also likely to affect the level of trust in the partners' organization. Thus, organizations are vehicles through which individual-level behavior is directed, constrained and facilitated in a way that promotes or invites trust in buyer-supplier relationships.

At the same time, the processes and routines jointly developed by buyers and suppliers to manage their relationship also influence trust in buyer-supplier relationships. The management practices become codified and stable over time and create a set of common expectations about the terms of the relationship and what is considered appropriate and fair behavior. In turn, the level of trust in buyer-supplier relationships is an important driver of the performance of supplier relations.

3.6 Performance

Performance can be categorized as- operational performance and financial performance. The variables that are used to characterize operational performance are- on-time delivery, perfect order fulfillment rate, delivery reliability/ dependability, quality, speed of response and Manufacturing capability etc. The variables that represents the financial performance are- Return on investment, profit as a percent of sale, the firm's net income before taxes, the present value of the firm etc.

3.6.1 *Link of Buyer-Supplier Relationship to Performance*

Much of the relationship literature argues for improved operational performance as a primary expected outcome of strong buyer–supplier relationships. In fact, at least three prominent business theories incorporate the influence of relationships on performance as their fundamental differentiation basis. Relationship marketing theory proposes that sellers gain higher benefits from engaging in strong customer relationships rather than attempting to profit via larger numbers of weak-linked, short term transactions [73]. Resource advantage theory [73, 74] suggests that a strong relationship is an important resource or asset that can result in higher performance and a comparative advantage if it is not easily replicable by competitors. In addition, transaction cost economics has been applied to buyer– supplier relationships to show that stronger relationships crafted in response to uncertainty and asset specificity have positive performance implications [75]. Recent cross-sectional studies grounded in these theories have found empirical support for a variety of performance variables as outcomes of relationship strength [76-78]. In one particularly salient article, Palmatier et al. [79] present a model synthesizing 17 years of relationship marketing research. Their model demonstrates that customer loyalty and firm performance are consequences of relationship quality, as they ‘‘offer the best assessment of relationship strength’’, and find further that successful relationship marketing improves these outcomes ‘‘through stronger relational bonds’’. As this group of studies evidences, the literature is replete with research depicting performance advantages as accruing from strong buyer–supplier relationships. Relational closeness cannot develop if one party does not have information on the other party's past performance in relationships. So, if the

buyer-supplier relationship is to be established there need to be sharing of information as well as knowledge.

3.7 Structural Equation Modeling

A more direct approach than multiple regression analysis for solving problems are to use techniques called path analysis (PA) and Structural Equation Modeling (SEM). Over the past few years, PA has been replaced in many cases by a more sophisticated technique called structural equation modeling (SEM). Although both PA and SEM are extensions of multiple regressions, they rely very heavily on pictures called path diagrams to visualize what's going on. In fact, most of the computer programs that do PA and SEM allow the user to start off with a path diagram, and they then figure out the fancy stuff. All of the variables are represented by rectangles, and each path is represented by a straight line with an arrow head at one end. The predictor variables are joined by curved lines with arrow heads at both ends. The straight arrows (this is a geometric term, not a description of moral fiber) are the paths, and the curved ones represent the correlations among the variables.

In SEM, the variables are not called "independent" and "dependent" variables. Instead, the variables are called exogenous variables and endogenous variables. This shift in terminology isn't totally arbitrary. Exogenous variable has paths coming from it and none leading to it (the curved arrows are simply describing correlations among the variables and are not considered to be paths). Similarly, an endogenous variable has at least one path leading to it. So both relationship and performance would be called endogenous variables. All endogenous variables have an error term tacked on, which corresponds to the assumption in multiple regressions that the dependent variable is measured with some degree of error [80].

SEM can be used to develop theoretical models. PA and SEM are model-testing procedures, not model-developing ones. The models should always be based on theory, knowledge, or even hunches. Modifying our model simply because it results in a more significant finding can lead the user down the garden path, even though with a very low *p* level.

Start down a path, if the arrows go in one direction and never end up back where it started. Then it is called recursive model.

3.7.1 *Definitions (Terms of Structural Equation Modeling)*

- Exogenous Variable- a variable whose causes are outside of the model
- Endogenous Variable- a variable whose causes are inside the model.
- Recursive Model- a causal model that is unidirectional (one-way causal flow). It has neither feedback loops nor any reciprocal effects. In a recursive model, a variable cannot be both cause and effect at the same time.
- Non-recursive Model- a causal model with feedback loops and/or reciprocal effects.
- Path coefficient- standardized regression coefficient predicting one variable from another [80].

3.7.2 *Assumptions for Structural Equation Modeling*

Some assumptions should be made for path coefficients of structural equation modeling-

- Relations among models are linear, additive and causal. Curvilinear, multiplicative or interaction relations are excluded.
- Residuals are uncorrelated with all other variables and residuals in the model.
- There is one-way causal flow
- The variables are measures on an interval scale

CHAPTER 4

CONCEPTUAL FRAMEWORK AND HYPOTHESES

4.1 Introduction

Much has been written about SCM in recent years. While the discussion typically revolves around closer collaboration among members of the chain, the perspectives and prescriptions vary greatly. However, one tenet appears as a common thread tying the discussion together: success depends on managers' ability to identify changes in the competitive environment and then to structure SC resources to help the company compete more effectively. This contingent response determines how well the firm, and the entire chain, adapts to dynamics of an evolving and intensely competitive market.

4.2 Conceptual Model

Figure 4.1 shows the effect of operational information on performance and on supplier-buyer relationship. It also depicts the link between information and knowledge sharing and then the impact of knowledge based information sharing on supplier-buyer relation and the links of supplier-buyer relation to operational performance of supplier. The paths in the model are denoting the hypotheses.

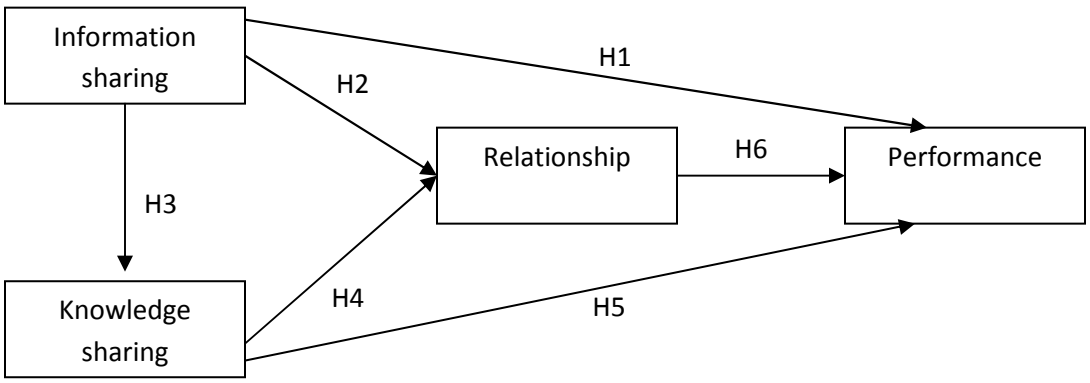

Figure 4.1 The Conceptual Model

4.3 Hypothesis

Hypothesis is a "tentative assumption or preliminary statement about the relationship between two or more things that needs to be examined" [81].

4.3.1 *Hypothesis 1*

Of all the resources a company manages, information has perhaps received the greatest attention as critical to the implementation of the company's strategic SC response. To respond productively to rapid change, a company must "be aware of new information generated in its environment and adopt structures that enable fast decision making and practices that reduce information overload [18]. For this reason, companies are investing heavily in information technologies to enhance their ability to manage information and knowledge across the supply chain. [19].

Information technologies play a central role in SCM. They enable companies to collect, analyze and disseminate information among members of the chain to improve decision making. Connecting managers across functional and organizational boundaries and providing them with relevant, accurate and timely information reduces temporal and spatial distance enabling them to make better, more collaborative decisions. Recent technological advancements have dramatically increased companies' ability to connect. The goal of enabling individuals anywhere in the chain to seamlessly interact with one another is becoming a technological possibility.

Connectivity creates the capability to share information. However, people make the decisions regarding what will be shared and when. The old saying, "information is power" holds true in today's business world. As a result, many individuals are unwilling to share information that they perceive may place their organizations at a competitive disadvantage. Regardless of whether these perceptions are accurate, tremendous amount of potentially useful information that could enhance SC decision making is shared remains unavailable to decision makers. A company's willingness to share information- that is, its openness to sharing relevant information honestly and frequently- ultimately determine the extent of sharing that takes place [13, 18]. Huge investments in technology can be negated by an unwillingness to share needed information.

Organizational theory suggests that company culture influences how willing its people are to share information. This cultural influence holds for sharing across internal functions such as marketing and engineering as well as across organizations in the chain. Indeed, each organization may have a different attitude toward information sharing. Thus, for a supply chain to take full advantage of the benefits of information integration, the diverse firms that comprise the chain must cultivate a high degree of willingness among all key players. Mangers can influence the level of information sharing by supporting programs that enable individuals to develop initiatives and opportunities of sharing. To justify investments in information sharing, it is important to determine whether a verifiable relationship exists between information sharing and performance. The need to examine this relationship leads to our first hypothesis:

H1: Information sharing is positively correlated to a company's performance.

4.3.2 *Hypothesis 2*

Modern organization management theory suggests that decentralizing decision rights is an effective way of managing a large organization. To make timely decisions effectively, decision rights should be assigned to the person is just at the decision spot and has specialized knowledge of his or her surroundings. In a supply chain, the participants may belong to different organizations (within the same company or across companies). Each member has its own decision rights to make control policies at its spot, i.e., it acts as a single decision maker to optimize its costs or benefits. Thus, the supply chain is operated in a decentralized fashion. One problem of this decentralized control is, however, the whole system may not achieve the optimum performance even though each member optimizes its performance. For example, in a supply chain with multi-echelon, one site decides to reduce its inventories. In order to maintain its service level, the inventory pressure is often put on its upstream sites (suppliers). If this sites improvement is achieved by only increasing the upstream sites' inventories, it will hardly yield improvement for the whole systems performance. A "broken" supply chain will have substantial stock held one site to enable another site's stock reduction [82]. This deficiency caused by decentralized control has led to the evolution of the partnership relations between buyers and

suppliers. Therefore, it is expected that if each member of the SC has more information about other members then they treats each other as strategic partner.

Among existing quantitative studies of information sharing and supply chain partnerships, Iyer and Bergen [83] examined the impact of quick response (QR) on fashion apparel industry. Baganha and Cohen [84] presented a hierarchical model as an analytical framework to examine the stabilizing effects of inventories in supply chains. EDI implementation can incorporate information flow between a supplier and a buyer, which will benefit a dyadic supply chain relationship [85]. However, there exists a large amount of literature on the concepts of supply chain partnerships projecting extremely optimistic views about their promise as win-win partnerships without rigorous analysis to support the cause of optimism [86].

With its origin in lean supply, information (cost) transparency was originally introduced as: "The sharing of costing information between customer (buyer) and supplier, including data which would traditionally be kept secret by each party, for use in negotiations. The purpose of this is to make it possible for customer and supplier to work together to reduce costs (and improve other factors). Information transparency is of no value unless it is two-way" [35]. It was proposed that the information sharing must be reciprocal, selective and justified- but not necessary symmetrical. It was central to the initial conceptualization that transparency should go beyond simply better "communication". Underlying the concept is the joint sharing or pooling of risk. This pooling of risk fundamentally distinguishes transparency (i.e. "two-way" or "reciprocal" sharing) from customer driven approaches. The risk taken on by supplier in revealing sensitive information might be balanced by a similar advance by the customer. In this way, within a carefully bounded arena, the parties to the transaction become interdependent- for simple commercial reasons on both parts and not as part of any philosophical standpoint (such as espoused partnering). To do this, the purchaser, in the person of the buyer, must manage risk in pursuit of improved added value. To justify investments in information sharing, it is important to determine whether a verifiable relationship exists between information sharing and supplier-buyer relationship. The need to examine this relationship leads to our second hypothesis:

H2: Information sharing promotes partnership and trust based relationship

4.3.3 *Hypothesis 3*

It is indeed a wise person who knows what he does not know but it is even a wiser person who knows how to access information and develop this into knowledge. Knowledge starts its life as data, unrelated facts that have little value of their own. As data is combined and placed in a context, it becomes information. Information becomes knowledge through critical and creative thought processes. These processes generate meaning for the user that is verifiable. When insight is added to the accumulating knowledge then a person has moved to being educated, i.e., they have an understanding of how they know. Knowledge grows from the process of education where philosophical insight and moral judgments can be made though the skills of thinking, evaluation and decision making, and self-actualization is evident.

It is in the differentiation between information management and knowledge management that the value lays for business. Information management uses information technology to organize and deliver information about knowledge. Knowledge creation uses the tacit and explicit knowledge of the people across the network to develop new ideas, new ways of thinking leading to greater innovation and value creation. If the supply chain only focuses on information technology (i.e., the use of technology to manage information), "without consideration for how knowledge is applied, growth may be limited as the exploitation of collective knowledge to innovate and grow the business is unlikely" [26].

Information or intelligence comes into an organization in many formats - paper, internet, television, radio. Each person who uses that information will process it differently depending on their preference for receiving information, learning and communication combined with their values and previous knowledge. The information becomes personal knowledge as critical thinking processes of analysis, evaluation, review and reflection are applied. As tacit internalized knowledge it may be expressed in action but the chain may not be benefited from this new insight.

When a critical mass of stakeholders comes together to participate in purposeful knowledge sharing a greater diversity of ideas is generated. It is the synergy of the interaction that creates the value in processing of information. A chain encompassing a variety of personality types, communication and cognitive styles along with different operational knowledge, has a catalyst for innovation. Socialization is the vehicle for externalizing tacit knowledge, processing and then re-internalizing new knowledge leading to action. A result of this process may also be that some knowledge is regarded as redundant at this point and put aside – another step in developing wisdom.

Redundant knowledge also includes "questioning the relevance of past experiences and its appropriateness in current and future situations" to produce "radical behavior changes in the value chain, resulting in innovative actions and processes that increase competitiveness". Reviewing current practice in light of new knowledge is essential if the chain is to ensure that 'best practice' remains just that, that core competencies remain relevant and that threats and opportunities are recognized and realistically analyzed [26].

Knowledge sharing is defined as transferring knowledge to others within the organization by individual's efforts [65]. Evolutionary psychology supports the notion that people have developed tendencies to share with others. Some previous studies found people were socially programmed to cooperate when they solve problems, develop expectations regarding others' behavior through group communications and actions [66].

Developing knowledge in the supply chain is a participative process for no one person in a climate of discontinuity can have all the solutions. Hierarchical structures tend to silo knowledge and discourage sharing. Opposite to this are bottom-up groups of interest or communities of practice established around a common interest and co-ordinate across the chain. These groups bring together implicit and explicit knowledge from a range of perspectives [65].They are a means of mentoring new members in a supportive learning culture with regard to the business strategy and how they can contribute. Lave and Wenger [64] identified that "learning is an integral part of social practice" and that this type of learning involves the whole

person rather than being just a cognitive activity. The social nature of the 'community of practice' is an ideal forum for members to integrate the knowledge gained from formal learning into the chain, increasing the value of that learning both for the participant and the chain.

The quality and relevance of the initial information that flows into an organization has a direct impact on the knowledge developed from its use. Information needs to be both timely and relevant to the context of the business. A toolbox of information and communication skills is used when accessing, using, evaluating and applying information. People working together with contextual information develop competence in knowing how and when to use these skills which impact on the way in which knowledge is developed. The need to check the relationship between information sharing and knowledge sharing leads to third hypothesis:

H3*:* Information sharing has a positive effect on knowledge sharing

4.3.4 Hypothesis 4

In business-to-business relationships, several conditions that make exchange processes difficult must be managed. The most important characteristics of buyer-supplier relationships are the different cultures of the business partners, their communication problems and technological distances. Technological distances have largely been ignored in the extant literature but are important in the consideration of buyer-supplier relationships. If the product technologies and specifications in different organizations are distinct, (technological distance or knowledge gap between buyer and supplier), the buyer must become acquainted with other standards when collaborating with a supplier.

Recently, knowledge-sharing with supply chain members, i.e., with suppliers and customers, has received increasing research attention [87-92]. For example, Dyer and Singh [93] suggest in their conceptual work that learning and knowledge play a significant role in inter-firm buyer–supplier relationships. Andersen and Christensen [89] discuss a conceptual model of inter-partner learning processes in supply chains and extend the model through a single case study. In the case study involving a customer as the main contractor in a construction project with 30 suppliers, Ha

˚kansson et al. [87] revealed that firms learn best when their customer relationship is embedded in a network. The development of Toyota's knowledge-sharing with suppliers and among its supplier network has been presented in several in-depth case studies [88, 90, and 94]. However, research to date has been primarily of a conceptual or qualitative nature. Bessant [95] remark that, in the face of ''the potential which supply chains offer for enabling learning, there is, as yet, little research-based information on the topic.'' In view of the potential advantages of sharing knowledge with suppliers and customers, and considering the predominantly prescriptive nature of the research and the lack of empirical research, it seems quite clear that research on this phenomenon should be expanded.

If knowledge transfer is expected to affect the outcome of buyer–supplier relationships, then the extent and complexity of the knowledge transfer deserve attention. Knowledge transfer can be classified as- Technical Exchange and Technology Transfer. A technique consists of discrete know-how required to solve a particular operational problem, so technical communications pertain to the relatively narrow and simple informational resources necessary to handle engineering issues case by case. By contrast, a technology is a broader body of knowledge encompassing a set of related techniques, methods, and designs applicable to an entire class of problems [96, 97]. Thus its sharing or transfer involves higher-level capabilities [24, 98 and 99]. The associations between technology and capability, and between technique and resource, add meaning to the distinction between technical and technological knowledge. Relative to discrete resources, capabilities are higher-order, more complex sets of routines with broader applications. Technical knowledge, consisting of narrower and more independent pieces of information, is a form of resources. By contrast, capabilities are related to higher-level, cumulative technology that is harder to develop and mold [100, 101]. Transferring technology, sharing it, or using it in support of a partner is a challenging collaborative process. For simplicity, we use the term technology transfer to refer to scenarios where firms transfer, share, and/or deploy technology on their partner's behalf. These scenarios all involve complex challenges of codification and communication capacity, and are intertwined in practice [102, 103]. While exchanging technical knowledge can also be difficult, the challenge is more circumscribed.

The value of knowledge may influence one's willingness to share said knowledge. The psychology literature suggests a negative relationship between value and sharing [104-106]. However, this depends upon the sharer losing all or part of the value of the object as a result. Since the sharer of knowledge may not lose value from the act of sharing, then a different relationship may hold true for knowledge sharing (e.g., a positive relationship or a curvilinear relationship where an individual is more willing to share their knowledge as its value increases up to a point). Until we better understand how people determine the value of their knowledge and the impact on what knowledge people are willing to share, the relationship between values and sharing is difficult to predict and warrants further investigation.

Learning and sharing knowledge with suppliers play an important role in inter-firm buyer–supplier relationships [93]. Suppliers may possess resources that complement those of the focal firm. This may generate positive externalities and allow the firm to capture spillover from its suppliers. Research has documented the benefits of knowledge-sharing networks in which suppliers are involved [88, 90 and 94]. For manufacturing firms, long-term, cooperative relationships with suppliers can provide a unique capability that establishes a source of competitive advantage. Thus, the hypothesis is as follows:

H4*:* Knowledge sharing promotes partnership and trust based relationship

4.3.5 *Hypothesis 5*

Knowledge is the competitive advantage in a supply chain – it not only transforms the production but also the ability to foresee and manage complexity and change. The challenge is to create a value chain where people have the necessary skills to add value by developing, acquiring, exploring, sharing and applying knowledge - not just to resolve issues but to be innovative. Knowledge acquisition and application within the supply chain underpin the intellectual capital of the chain and its ability to ensure a competitive product and increased profit margin. Each component in the supply chain adds value for the client, derived from its specialist knowledge, to the final product. The quality and application of the knowledge

throughout the chain has a direct impact on the quality and competitiveness of the product. It is a 'wise' supply chain that values the thinking capacity of its people [27].

The 'value' in a value chain resides within the flow of thinking processes throughout the chain. The power to drive innovation within the chain lies within the people rather than the technology. The degree of value placed upon the acquisition and application of knowledge underlies the chain's ability to foresee and manage complexity and change. A wise supply chain engenders a climate of knowledge growth and acquisition as part of its business strategy realizing that the decision making capacity of the people within the chain creates the value for the client.

In this segment of the study the focus is on the transfer of knowledge that exists in the form of 'know-how' rather than on the transfer of knowledge that exists in the form of 'operational information'. The greater we will focus on knowledge sharing, greater will the knowledge management effectiveness in improving the enterprise system performance. This study also suggests that buyers typically can focus on dissemination of new knowledge and knowledge advancements. Similarly the supplier can focus on knowledge acquisition, knowledge adaptation and knowledge application. The synergy between buyer and supplier through concurrent thinking is important. Each member of the supplier-buyer relationship is an autonomous body that takes knowledge decisions motivated by self-optimization at the local level. Due to a clear lack of collaborative-knowledge sharing and associated concurrency, such decisions often become counterproductive. So, we propose the following hypothesis:

H5: The level of knowledge-sharing with suppliers positively influences performance.

4.3.6 *Hypothesis 6*

The literature on supplier management shows that supplier-manufacturer relationships have evolved and a partnership approach is now preferable, particularly for components where suppliers can help in the development of innovative designs. Partnerships are characterized by closer contacts and are sometimes embedded in manufacturers' single-sourcing strategies. A long-term perspective is a prerequisite for a higher degree of integration among partners and

greater level of information exchange. Purchasing managers became information brokers as they form the interface between the manufacturers' site and their supplier base [107].

Dwyer et al. [53] describes a continuum of different types of buyer–supplier relationships. They believe that firms engage in cooperative buyer–supplier relationships because the firms expect to benefit from the relationship. Only as long as the firms perceive a benefit from the relationship do they continue in the cooperative buyer–supplier relationship. According to Clark [108] Japanese auto firms cultivate their suppliers through investments, sharing of knowledge, and joint problem solving. As a result, suppliers search for ways to meet the needs of the buying firm's product design and development; and, the better suppliers seek to create value for the buying firms. Noordewier et al. [54], state that purchasing performance is an important determinant of a firm's competitiveness. Their empirical research shows that long-term cooperative agreements have a positive impact on purchasing performance in terms of acquisition cost when the level of uncertainty is relatively high. However, long-term cooperative agreements have no effect on performance when the level of uncertainty is relatively low. Establishing long-term relationships with the key suppliers can lead to improved firm's financial performance [55]. According to Larson [56], purchasing coordination of the firm's activities with key suppliers can impact total costs. As demonstrated by the Ford Motor's use of long-term buyer–supplier relationships to help achieve a competitive advantage in the automobile industry. Under total quality management (TQM), Ford transformed buyer–supplier relationships from adversarial to cooperative. Ford's success demonstrates that businesses can increase their competitiveness by implementing cooperative supplier relationships [57]. All of the literatures were highlighted on the buying firm's performance. No research work was performed on the performance from the supplier's perspective. But the positive influence of buyer-supplier relationship emphasizes the probability of having positive link between relationship and suppliers performance.

Buyer-supplier relationships involve ongoing mutual adjustment between the buyer's and the supplier's design and production operations. Many such adjustments are made readily by personnel sharing explicit engineering information and knowledge. This entails small-scale

exchanges of technical information (technical exchanges, in short). Past studies have argued that these help improve the buyer's performance [35]. Suppliers stand to benefit likewise when the partners steadily share technical knowledge to solve problems and enhance products and processes [109].

We expect strong supplier-buyer relationship, because they allow more relation-specific assets to develop, to magnify some of the performance effects hypothesized below. The longer a buyer–supplier link endures the more the relation specific-assets between the two parties stand to make pair wise knowledge transfer efficient relative to alternative partner sets. In simple technical exchanges, the scope of each knowledge transfer is narrow. Under these circumstances, relation-specific assets need not be at their most useful. Nevertheless, Uzzi [110, 111] found that solidly embedded relationships facilitated the continuous exchange of 'fine-grained' information, akin to simpler technical exchanges, that in turn benefited each firm's ability to anticipate market changes and respond to unforeseen circumstances. This suggests that the benefits of technical exchanges may increase with link duration, though the magnitude of this interaction is in question.

The open sharing of information helps reduce uncertainty by allowing customers insights into the supplier's future plans. For example, early information about changes in a supplier's product line enables the customer to make timely changes in acquisition and operational procedures, thus avoiding costly crash programs. Furthermore, knowledge provided by supplier's can enable the customer to make better use of the product purchased, which lowers costs and increases benefits [112]. In addition, the exchange of information sets the stage for closer cooperation. Intensive communication is also prerequisite for building trust [113], which in turn positively affects performance.

We define a buyer-supplier relationship, or partnership, as the set of practices and routines that support economic exchanges between the two firms. A buyer-supplier link refers to the fact that the two firms have been doing business continuously for a given period of time of time. A supplier's operational performance refers to the combination of on-time delivery, perfect order

fulfillment rate, delivery reliability/ dependability, quality (ability to meet specifications), speed of response and manufacturing capability (e.g, capacity). We consequently propose the following:

H6*:* Buyer-supplier partnership relationship has positive influence on Suppliers performance.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 Introduction

The purpose of this study is to investigate (1) the link between information sharing with supplier on company's performance (2) the relationship between information sharing and supplier-buyer relationship, (3) the effect of information sharing on knowledge sharing, (4) the influence of knowledge sharing on supplier-buyer relationship (5) the effect of knowledge sharing on firms performance and (6) the impact of supplier-buyer relationship on supplier performance. The primary research instrument for the study is a rigorously validated questionnaire. A summary of the survey questions is shown with the summary statistics in Table 5.1, 5.2, 5.3 5.4 and 5.5.

Table 5.1: Survey questions and descriptive statistics (Information Relevant)

Survey Questions	**Mean**	**S. D.**
How often does your major customer provide your firm with its information in the following dimensions [1 = never, 2 = annually, 3 = semi-annually, 4 = quarterly, 5 = monthly, 6 = weekly, 7 = daily]		
Price	4.13	1.570
Quality	4.73	1.639
Changes in purchase order information	4.60	1.545
Planned order information	4.80	1.400
Inventory level information	4.73	1.721
Product specifications	5.13	1.074
Design drafts and sketches	4.77	1.431
Performance evaluation information	3.33	1.709
Future demand forecasting information	3.77	1.223
Production planning information	5.03	1.245
Negotiation records, contracts	4.17	1.315
Confirmation of orders	5.23	0.898

Table 5.2: Survey questions and descriptive statistics (Knowledge Relevant)

How often does your major customer provide your firm with its (knowledge based) information in the following dimensions [1 = never, 2 = annually, 3 = semi-annually, 4 = quarterly, 5 = monthly, 6 = weekly, 7 = daily]		
Organizational philosophy	2.53	1.224
Skills, suggestions, ideas, expertise	3.77	1.755
Markets trend	3.20	0.997
Problems (including personal issues)	5.10	1.845
New business directions and new scenarios	3.23	1.455
Changes in product and process designs	4.37	1.732

Table 5.3: Survey questions and descriptive statistics (Relationship with Buyer)

The following questions relate to the relationship with your customer firm. Please indicate your opinion on the following dimensions [1 = strongly disagree, 2 = disagree, 3= apparently disagree, 4= not completely disagree, 5= apparently agree, 6= agree, 7 = significantly agree]		
We enter into special agreements with customer relationships who have judged our improved performance.	5.27	1.530
We are loyal to key customers.	5.97	1.217
We have very frequent face-to-face planning/communication with key customers.	5.73	1.048
There is high corporate level communication on important issues with key customers.	5.77	1.251
There are direct computer to computer links with key customers.	4.87	2.030

Table 5.4: Survey questions and descriptive statistics (Relationship with supplier)

The following questions relate to the relationship with your supplier firm. Please indicate your opinion on the following dimensions [1 = strongly disagree, 2 = disagree, 3= apparently disagree, 4= not completely disagree, 5= apparently agree, 6= agree, 7 = significantly agree]		
We enter into special agreements with supplier's relationships who have judged our improved performance.	5.43	1.223
We are loyal to key suppliers.	5.23	1.612
We have very frequent face-to-face planning/communication with key suppliers.	5.53	1.196
There is high corporate level communication on important issues with key suppliers.	5.57	1.331
There are direct computer to computer links with key suppliers.	4.90	2.295

Table 5.5: Survey questions and descriptive statistics (Supplier's Operational Performance)

The following questions relate to the performance of your supplier firm. Please indicate your opinion on the following dimensions [1 = significantly poor, 2 = poor, 3= apparently poor, 4= between poor and good, 5= apparently good, 6= good, 7 = significantly good]		
On-time delivery	5.40	0.770
Perfect order fulfillment rate	5.17	1.053
Delivery reliability/dependability	5.30	1.149
Quality (e.g., ability to meet specifications)	5.67	0.922
Speed of response	5.43	0.858
Manufacturing capability (e.g., capacity)	5.53	1.167

5.2 Instrument Design and Data Collection

The study involves two data collection stages: pilot survey and formal survey. The pilot survey is designed to test the viability of the study and purify the data collection instrument. Four academic researchers and three industry executives critiqued the research instrument for relevance and clarity. The questionnaire for the main study was refined based on feedback from the pilot study. The study includes a wide variety of manufacturing industries. A total of 105 surveys were sent (interviewed and mailed). Of the 44 returned questionnaires, 30 were usable.

The response rate was approximately 42%. The data analysis is based on the 30 useable questionnaires.

5.3 The Sample List

The data represents a cluster of Garments Industries those have started to use modern technologies of information sharing. The sample list consisted of individuals at decision-making levels, and in strategically oriented positions. The targeted respondents were senior executives (i.e. Vice President, Director, and General Manager, Assistant General Manager, Plant Manager, Production Manager, Merchandising Manager, Industrial Engineering Executives and Managers). The average number of employees in the respondents' firms was about 5000. Eight companies had more than 10,000 employees. To test the non-response bias, the responses of those who returned early were compared with those who returned late to determine if there are any statistical differences [114]. There were no statistical differences between the early and late responses.

5.4 Measurement Scales

Descriptive statistics for each survey statement are presented in Table 5.1, 5.2, 5.3, 5.4 and 5.5. Each statement required responses based on a 7-point Likert scale. There are five variables: information sharing, Knowledge based information sharing, supplier's relationship with buyer, Buyers relationship with supplier, Supplier Performance. Among the five variables information is the only independent variable. Knowledge and relationship are acting as an independent variable and also as a dependent variable. The performance of the supplier is always the dependent variables.

5.5 Validity and Reliability of Measurement Scales

The validation process for the survey instrument had three steps: content validity; construct validity, and reliability. The literature review and in-depth interviews conducted with business executives and researchers established the basis of content validity for the survey instrument. The purpose of construct validity is to show that the items measure what they purport to measure. Uni-dimensionality was established with exploratory factor analysis, where 0.30 is

generally considered to be the lowest significant factor loading to define the construct [115]. The internal consistency in this study is measured by Cronbach's alpha. The lower limit of 0.6 is considered acceptable for newly developed scales and 0.7 for established scales [116]. Cronbach's coefficient alphas were calculated for the items of each survey construct.

5.6 Validity of the Measurement Scales

The results of the measurement scales are shown in Table 5.6. Form the table it is clear that all factor loadings except Information question 12, meet the criterion of larger than 0.3 and all constructs satisfy the uni-dimensionality requirement. We than reconsider the factor loading without considering the question of confirmation of order (question 12 of information sharing), negotiation records, contract (question 11 of information sharing) and product specifications (question 6 of information sharing). Because the factor loading of question relating to confirmation of order is below 0.3 and the negotiation records, contract and product specification is very adjacent to 0.3. The revised factor loading and the correlation table are shown in Appendix-A.

All scales have Cronbach's alpha values of 0.70 or higher, which is acceptable for the developed scale [115]. It was also expected, because all the questions were based on previous literature and expert opinion.

Table 5.6: Results of measurement validation

Scale name	Variable name	Factor loading	Scale statistics
Information Sharing	Info Q1	0.420	Cronbach's alpha: 0.762
	Info Q2	0.742	
	Info Q3	0.616	
	Info Q4	0.738	
	Info Q5	0.708	
	Info Q6	0.384	
	Info Q7	0.451	
	Info Q8	0.553	
	Info Q9	0.425	
	Info Q10	0.662	
	Info Q11	0.357	
	Info Q12	-0.055	
Knowledge Based Information Sharing	Know Q1	0.677	Cronbach's alpha: 0.757
	Know Q2	0.681	
	Know Q3	0.620	
	Know Q4	0.795	
	Know Q5	0.571	
	Know Q6	0.707	
Relationship(From Supplier's perspective + From Buyer's perspective	Rel Q1	0.731	Cronbach's alpha: 0.785
	Rel Q2	0.474	
	Rel Q3	0.641	
	Rel Q4	0.532	
	Rel Q5	0.460	
	RelQ6	0.825	
	RelQ7	0.567	
	RelQ8	0.656	
	RelQ9	0.695	
	RelQ10	0.510	
Performance (Supplier Performance)	Perf Q1	0.784	Cronbach's alpha: 0.803
	Perf Q2	0.726	
	Perf Q3	0.828	
	Perf Q4	0.724	
	Perf Q5	0.467	
	Perf Q6	0.728	

CHAPTER 6

RESULTS AND DISCUSSIONS

6.1 Structural Equation Model

The beginning is by drawing a path diagram of a simple multiple regressions, as shown in Figure 6.1. In the figure 6.1, information sharing and knowledge sharing are predictor variables and that the performance is the outcome, but relationship is both a dependent and independent variable. It's the outcome (dependent variable) with respect to the information and knowledge sharing, but it's the predictor (independent variable) for performance. That is the variable 1 (i.e information sharing) is exogenous. Variable 2, 3 and 4 (knowledge sharing, relationship and performance) are endogenous. The P_{ij} represents path coefficients predicting variable i from variable j, e_i represents errors or residuals for variable i.

Assume, F_1= Information

F_2= Knowledge

F_3= Relation

F_4= Performance

1st Equation: $F_1 = e_1$ ----------6.1

2nd Equation: $F_2 = P_{21}F_1 + e_2$ ----------6.2

3rd Equation: $F_3 = P_{31}F_1 + P_{32}F_2 + e_3$----------6.3

4th Equation: $F_4 = P_{41}F_1 + P_{42}F_2 + P_{43}F_3 + e_4$----------6.4

Estimated equations:

$$\hat{F}_2 = P_{21}F_1 \quad \text{----------6.5}$$

$$\hat{F}_3 = P_{31}\hat{F}_1 + P_{32}F_2 \quad \text{----------6.6}$$

$$\hat{F}_4 = P_{41}F_1 + P_{42}F_2 + P_{43}F_3 \quad \text{----------6.7}$$

Estimated path coefficients from multiple regression analyses:

P_{21}= 0.424

P_{31}= -0.000015

P_{32}= 0.166

P_{41}= -0.313

P_{42}= 0.261

P_{43}= 0.536

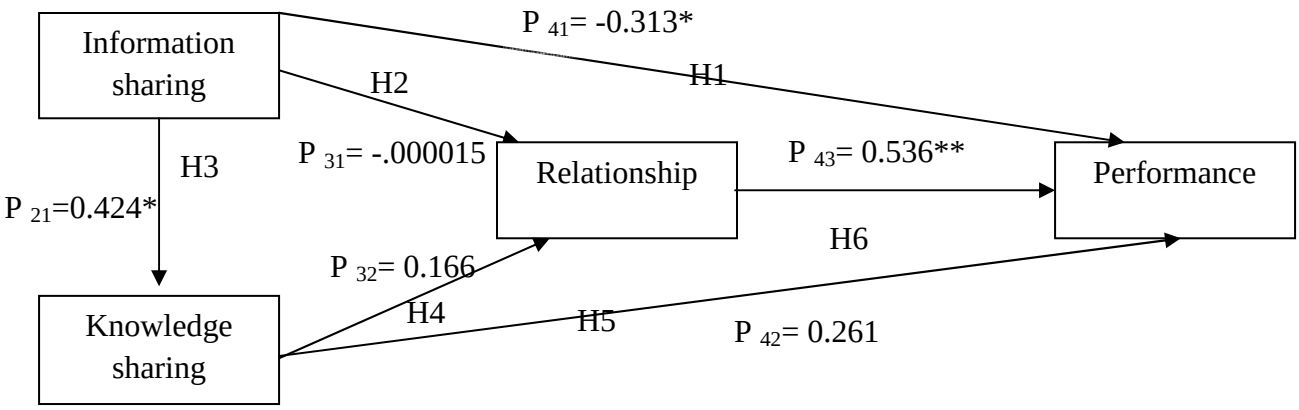

Figure 6.1 Information sharing, knowledge sharing, Relationship and Performance

** indicates significance at $p < 0.05$ and * indicate significance at $p > 0.05$

These tests—looking at the signs of the path coefficients and their significance levels—tell us about the individual component of the model. We can also look at the model as a whole, with a R^2 value. The value of R^2; the bigger the better and at the same time the significance level should be checked.

First consider the model of information and knowledge. Here, information is the predictor/ independent variable and knowledge is the dependent variable. The result of table 6.1 and 6.2 shows a value of R^2 = 0.180 and the result is significant at $p< 0.05$ level. It indicates that the dependent variable knowledge is 18% represented by the independent variable information and in this case the representation of the variance of the dependent variable is not remarkable. In case

of R^2 value the bigger the better means that the independent variable is better capable to represent the variance of the dependent variable.

Table 6.1: Model Summary (for independent variable information)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.424(a)	0.180	0.150	0.92176459	0.180	6.132	1	28	0.020

(a) Predictors: (Constant), Information

Table 6.2: ANOVA (for dependent variable Knowledge where information is the independent Variable)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.210	1	5.210	6.132	0.020(a)
	Residual	23.790	28	0.850		
	Total	29.000	29			

(a) Predictors: (Constant), Information, and Dependent Variable: Knowledge

Then, consider the model of information sharing, knowledge sharing, buyer-supplier relationship and supplier's performance. Here the value of $R^2 = 0.406$ and the model is significant at $p < 0.05$ level. The table of this value is shown in Appendix –B. This means that the independent variables information, knowledge and relationship are significantly capable to represent the variance of the dependent variable performance. Thus, the model is validated. The independent variables are explaining the 40.6% variance of the dependent variable.

6.1.1 *Decomposition of Correlation*

Each correlation can be decomposed into one or more of the following four types of effects.

- Direct Effect (DE) - Path coefficient from one variable to another.

- Indirect Effect (IE) - sequence of paths through one or more intermediate variables.
- Unanalyzed effect due to correlated causes (U) – correlation of variable with cause of the second.
- Spurious effect due to common cause (S) - variable that causes both first and second variable
- Sum of Direct Effect (DE) and Indirect Effect (IE) = total causal part of the correlation between two variables.
- Sum of Unanalyzed effect (U) and Spurious Effect (S) = total non-causal part of the correlation between two variables [80].

6.1.2 *Comparison of Actual and Reproduced Correlation*

To tests whether the model fits the data compare actual correlations to reproduced correlations based on paths in the model. We denote actual correlation by 'r' and reproduced correlation by 'r*' the actual correlations are in bracket below.

$r^*_{12} = P_{21}$ (DE) = 0.424 (0.424)

$r^*_{13} = P_{31}$ (DE) + P_{32} P_{21} (IE)

= -0.000015 + 0.166* 0.424

= 0.070384 (0.070)

$r^*_{14} = P_{41}$(DE) + $P_{42}P_{21}$ (IE) + P_{43} P_{31} (IE) + P_{43} P_{32} P_{21} (IE)

= -0.313 + 0.261* 0.424 + 0.536*(-0.000015) + 0.536*0.166*0.424

= -0.165 (-0.165)

$r^*_{23} = P_{31}$ P_{21} (S) + P_{32} (DE)

= 0.166 (0.166)

$r^*_{24} = P_{41}$ P_{21} (S) + P_{42} (DE) + P_{43} P_{31} P_{21} (S) + P_{43} P_{32} (IE)

= 0.217 (0217)

$r^*_{34} = P_{41}$ P_{31} (S) + P_{41} P_{32} P_{21} (S) + P_{42} P_{31} P_{21} (S) + P_{42} P_{32} (S) + P_{43} (DE)

= 0.557 (0.557)

In this conceptual model the reproduced and original correlations have the same value. i.e. this model has all possible paths among the variables and hence no path deleted.

6.1.3 *Consideration of Indirect Effect*

In the model shown in figure-6.1 there are 5 Indirect Effects (IE). First, consider the indirect effect of Information sharing on Relationship via Knowledge sharing and the value is = P_{32} P_{21} = 0.166* 0.424 = 0.070; which indicates that information sharing has a weak linkage with buyer-supplier relationship via knowledge sharing.

Secondly, consider the impact of information sharing with suppliers Operational Performance via knowledge sharing and the value is = $P_{42}P_{21}$ (IE) = 0.261* 0.424 = 0.110664; which also indicates a weak relationship among the variable information and performance via Knowledge.

Third, the influence of information on performance via supplier-buyer relationship and the value is = P_{43} P_{31} (IE) = 0.536*(-0.000015) = (-8.04* 10^{-6}); which is sufficiently small. This indicates a very weak relationship.

Fourth, the impact of information sharing on suppliers operational performance via knowledge and relationship and the value is = P_{43} P_{32} P_{21} (IE) = 0.536*0.166*0.424 = 0.0378; which also indicates a weak relationship.

Lastly, the effect of knowledge sharing with supplier on suppliers operational performance via buyer-supplier relationship and the value is = P_{43} P_{32} (IE) = 0.536* 0.166 = 0.0889; which is also significantly very low. That is there is a weak linkage between knowledge sharing and performance via buyer-supplier relationship.

6.3 Results and Findings

The developed hypotheses have some significant characteristics. The features need to be highlighted. The results of each hypothesis are discussed in details.

6.3.1 *Findings related to Hypothesis 1*

We hypothesized that Information sharing is positively correlated to a company's performance (Hypothesis 1). The result of the study suggests that Hypothesis 1 is not supported as shown by

the standardized coefficient of -0.313 in figure 6.1. The value of path coefficient doesn't support the hypothesis. The value is significant at the $p > 0.05$ level.

6.3.2 *Findings related to Hypothesis 2*

We hypothesized that Information sharing promotes partnership and trust based relationship (Hypothesis 2). The results of the study suggest that Hypothesis 2 is not supported (i.e. information Sharing doesn't promote relationship) as shown by the standardized coefficient of -0.000015 for H2 in Figure 6.1 and the result is insignificant. This is due to the fact that the sample size is too small for this particular type of analysis.

6.3.3 *Findings related to Hypothesis 3*

We hypothesized that Information sharing has a positive effect on knowledge sharing (Hypothesis 3). The result of the study suggest that Hypothesis 3 is strongly supported (i.e. information sharing influences knowledge sharing) as shown by the standardized path coefficient of 0.424 and the value is significant at $p < 0.05$ level. This result provides empirical evidence for enabling effect of information sharing on knowledge sharing. The result ensures that as the level of information sharing between buyer and supplier increases, it promotes the knowledge sharing. We categorized information as day to day operational information and knowledge as the know-how. So, it supports the previous literature (i.e Information becomes knowledge through critical and creative thought processes) [27].

6.3.4 *Findings related to Hypothesis 4*

We hypothesized that Knowledge sharing promotes partnership and trust based relationship (Hypothesis 4). The results of the study suggest that Hypothesis 4 is weakly supported as shown by the path co-efficient of 0.166 but the value is insignificant. The insignificance of the data is due to the small sample size (unfortunately only 30 usable data were obtained). But it is evident from the result that there is a link between the sharing of knowledge with supplier-buyer relationship.

6.3.5 *Findings related to Hypothesis 5*

We hypothesized that the level of knowledge-sharing with suppliers positively influences performance (Hypothesis 5). The results of the study suggest that Hypothesis 5 is weakly supported as shown by the path co-efficient of 0.261 but the value is insignificant. The insignificance of the data is due to the small sample size (unfortunately only 30 usable data were obtained). It is evident from the result that knowledge sharing influences performance better than information sharing. In case of the linkage of information sharing and performance a negative relationship was obtained but the result is positive for knowledge sharing,

6.3.6 *Findings related to Hypothesis 6*

We hypothesized that Buyer-supplier partnership relationship has positive influence on Suppliers performance (Hypothesis 6). The result of the study suggest that Hypothesis 6 is strongly supported (i.e. Buyer-supplier partnership relationship has positive influence on Suppliers performance) as shown by the standardized path coefficient of 0.536 and the value is significant at $p < 0.05$ level. Though the previous research has emphasized on buyer-supplier's relationships effect on buying firms performance but from the result of the conceptual model it is evident that buyer-supplier relationship (partnership relationship) not only affects the buying firm's performance but also the supplying firms performance.

6.4 Regression Models and Results

Regression analysis is used to test the influence of information sharing and knowledge sharing on relationship and on performance and then identifying the influence of supplier-buyer relationship on supplier's operational performance. The correlation is shown in the correlation Table 6.3.

Table 6.3: Correlation Table

	Information (F1)	Knowledge (F2)	Relationship (F3)	Performance (F4)
Information (F1)	1.00	0.424 **	0.070	-0.165
Knowledge (F2)		1.00	0.166	0.217
Relationship (F3)			1.00	0.557 **
Performance (F4)				1.00

** Indicates significance at $p < 0.05$ and * indicate significance at $0.05 < p < 0.10$

From the correlation table 6.3 it is clear that information sharing has a strong correlation with knowledge sharing and the p-vale is also significant within $p < 0.05$. Also information sharing has a weak relationship with buyer-supplier partnership relationship but the p-value is insignificant. The effect of information sharing on performance is negative. This is the thinking of the buying or manufacturing firm of Bangladesh readymade Garments Industries.

It is also evident from the correlation table that knowledge sharing also has a impact on buyer-supplier relationship though the correlation is weak. Knowledge sharing with supplier firm influences the performance of the buying firms.

The most significant and strong correlation was obtained between supplier-buyer partnership relation with suppliers performance. The previous studies have argued that buyer-supplier partnership relation influences the buying firm's performance. But from the study we have performed it is evident that buyer-supplier close relationship/ contact also influence the supplier's operational performance.

6.5 Discussions

The objective of the research was to determine the linkage between information and knowledge sharing with buyer-supplier relationship and evaluation of the effect of this relationship on suppliers' operational performance. Also to assess, the direct impact of information and

knowledge sharing on performance. Another objective was to identify the influence of information sharing on knowledge sharing. The result of the analysis indicates that there is a strong linkage between supplier-buyer relationship and supplier's operational performance. The result also indicates that information sharing promotes knowledge sharing. Interestingly the information's influence on performance was negative. The effect of information and knowledge sharing on supplier-buyer relationship is weak. But it was not expected. If the information sharing has effect on knowledge sharing and relationship between buyer and supplier has influence on suppliers operational performance it is expected that information sharing with supplier should promote supplier-buyer relationship. The reason behind that might be the transaction between the buyer and supplier promotes a dependence on the supplier which ultimately affects the performance of the supplier. The analysis is based on the Garments Industries of Bangladesh. In Bangladesh the supply chain relevant topics are pretty new. The concept is still in starting level. So, by transaction of materials there a bonding is created between the buyer and supplier which ultimately promote the performance. That is what the buyer is thinking regarding the supplier, he/ she are revealing it oppositely. But the supplier is motivated with the good behavior of the buyer.

Among the six paths three paths are significant and the rest three are insignificant. The insignificance is due to the small sample size. The no. of sample is only 30.

The effect of information and knowledge on performance is weak due to two reasons: (1) improper information support technology, and (2) unwillingness of the information base to share the adequate information. First cones the information support technology. The sharing of information in Bangladesh is still paper based. Because form the survey it is evident that approximately 25% of the supplier doesn't have computer to computer link with their supplier. Approximately 13% of the suppliers have a very weak computer to computer link with their buying firm. So, in case of using the Electronic Data Interchange (EDI), e-mail, Radio Frequency Identification or Supply Chain Management Software they are still relying on paper based communication. So, the information that is shared between them are becoming a burden for them rather than becoming an asset. Secondly the top management has a tendency of preserving the

information or knowledge (i.e. to make a silo of knowledge for them). This tendency of top management becomes a barrier for the middle management though they have a tendency to share information. These are the reasons for having weak influence of knowledge or information on supplier's operational information.

The reason for weak linkage between the information and knowledge sharing with supplier is due to the information quality and content. The accuracy, availability and timeliness of the information are the major quality of the information. The buyers are not providing the accurate information and the information is also not available at the right time. That's why it is not supporting the decision making process of the supplier and which is ultimately having a negative impact on their performance. The content of the information is only containing the manufacturing or buying firm's needs. But they are not reflecting the needs of the buying firm's customer's voices. This is ultimately affecting the buyer-supplier relationship.

And anonymously while there is a continuous communication between the buyer and supplier, the buyer is sharing information like price, quality, and confirmation of order as well as information like markets trend, organizational philosophy. Therefore, it is ultimately promoting the knowledge sharing.

The effect of buyer-supplier relationship on supplier's operational performance is significant. This is due to the fact that due to having a long lasting business with one another trust based atmosphere is established between the two firms, which are ultimately promoting the motivation level of the supplying firm. And ultimately this reflection is outlined in their performance.

CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The previous research works have considered the individual effect of information and knowledge sharing on supplier's operational performance. The aim of the study was to identify the combined effect of information and knowledge sharing on supplier's operational performance. The supplier's performance linkage with supplier-buyer relationship has been discussed. The effect of knowledge and information sharing on performance via supplier-buyer partnership based relationship has also been considered. In regards to the present analysis following conclusions can be drawn:

- The information sharing with key supplier does not affect the supplier's operational performance. This is due to the fact that few companies understand how to turn operational or knowledge based information sharing into a competitive advantage. The interviews and mail survey confirmed that most companies yet to leverage combined information support technology and willingness strategy. Technology is capable to enhance management decision making, not replacing it. When human and technology systems work together, higher levels of performance become possible. Processes needed to be redesigned to take advantage of new capabilities made possible by the technology.
- The information sharing with supplying firm has a very weak linkage with supplier-buyer relationship. This is due to the inaccuracy, late response of relevant information. That is the right information is not shared at the right time.
- The information sharing with supplier promotes knowledge sharing. This is the reflection of the previous literature. If there is a continuous flow of information like quality, price, future demand forecasting information, the buyer is then interested to share information like organizational philosophy, future market trend, and the new market directions with their supplier.

- The knowledge sharing with key supplier does not have a strong linkage with supplier-buyer relationship. The reason for this sort of outcome indicates that the supplying firms are not capable to utilize the knowledge based information effectively and efficiently.
- The knowledge sharing with the supplier has a weak positive relationship with supplier's operational performance. This was the representation of the previous literature. That is if the markets trend and problem solving procedure relevant information is shared with the supplier then it ultimately develops keenness in supplier. The buyer's interest on supplier promotes the operational performance of the supplier. That is the supplier ensure the quality, responds to the buyer's need rapidly and confirm on-time delivery.
- Finally, the buyer-supplier relationship has a strong influence on supplying firm's performance. As pervious literature highlighted the effect of buyer-supplier close contact or partnership relationship and its positive impact on buying firms operational performance, the result of supplying firm's performance is a further addition to previous work. The result indicates that if there is a close dyadic relationship between the buyer/ manufacturer and supplier, the supplier's response to buying firms needs is improved.

7.2 Recommendations

The following recommendations can be drawn for the future work.

- Processes should be redesigned to take advantage of new capabilities made possible by the technology. The issue is one of sequence- understand the technologies capabilities, redesign the process, and then implement the change. Because when human and technology systems work together, higher levels of performance become possible.
- The information sharing should be performed in a standardized format which ultimately reduces uncertainty and allows the performance improvement. Without standardization, however, uncertainty reduction is less valuable.
- The right information should be shared in right manner in the right time. That is not to say that all information must be 100% correct, but rather that the data available paint a picture that is at least directionally correct.

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APPENDIX-A

Factor Analysis

Table A1: Communalities

	Initial	Extraction
SupInfo1	1.000	0.201
SupInfo2	1.000	0.551
SupInfo3	1.000	0.400
SupInfo4	1.000	0.582
SupInfo5	1.000	0.536
SupInfo6	1.000	0.189
SupInfo7	1.000	0.311
SupInfo8	1.000	0.139
SupInfo9	1.000	0.443

Extraction Method: Principal Component Analysis.

Table A2: Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.352	37.244	37.244	3.352	37.244	37.244
2	1.498	16.646	53.890			
3	1.046	11.624	65.514			
4	.886	9.841	75.355			
5	.813	9.036	84.391			
6	.568	6.315	90.706			
7	.473	5.255	95.960			
8	.238	2.640	98.601			
9	.126	1.399	100.000			

Extraction Method: Principal Component Analysis.

Table A3: Component Matrix

	Component
	1
SupInfo1	0.449
SupInfo2	0.742
SupInfo3	0.632
SupInfo4	0.763
SupInfo5	0.732
SupInfo6	0.435
SupInfo7	0.557
SupInfo8	0.373
SupInfo9	0.666

Extraction Method: Principal Component Analysis.

1 component extracted.

Table A4: Component Score Coefficient Matrix

	Component
	1
SupInfo1	0.134
SupInfo2	0.222
SupInfo3	0.189
SupInfo4	0.228
SupInfo5	0.218
SupInfo6	0.130
SupInfo7	0.166
SupInfo8	0.111
SupInfo9	0.199

Extraction Method: Principal Component Analysis.
Component Scores.

Table A5: Component Score Covariance Matrix

Component	1
1	1.000

Extraction Method: Principal Component Analysis.
Component Scores.

Table A6: Correlations

		REGR factor score 1 for analysis 1	Knowledge	Performance	Relationship
REGR factor score 1 for analysis 1	Pearson Correlation	1	0.404(*)	-0.138	0.063
	Sig. (2-tailed)		0.027	0.467	0.742
	N	30	30	30	30
Knowledge	Pearson Correlation	0.404(*)	1	0.217	0.166
	Sig. (2-tailed)	.027		0.250	0.382
	N	30	30	30	30
Performance	Pearson Correlation	-0.138	0.217	1	0.557(**)
	Sig. (2-tailed)	0.467	0.250		.001
	N	30	30	30	30
Relationship	Pearson Correlation	0.063	0.166	0.557(**)	1
	Sig. (2-tailed)	0.742	0.382	0.001	
	N	30	30	30	30

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

APPENDIX- B

Regression

Table B1: Descriptive Statistics

	Mean	Std. Deviation	N
Knowledge	0.0000000	1.00000000	30
Information	0.0000000	1.00000000	30

Table B2: Correlations

		Knowledge	Information
Pearson Correlation	Knowledge	1.000	0.424
	Information	0.424	1.000
Sig. (1-tailed)	Knowledge	.	0.010
	Information	0.010	.
N	Knowledge	30	30
	Information	30	30

Table B3: Variables Entered/ Removed (Dependent Variable Knowledge)

Model	Variables Entered	Variables Removed	Method
1	Information (a)	.	Enter

(a) All requested variables entered.
Dependent Variable: Knowledge

Table B4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.424 (a)	0.180	0.150	0.92176459	0.180	6.132	1	28	.020

(a) Predictors: (Constant), Information

Table B5: ANOVA (for Knowledge)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.210	1	5.210	6.132	0.020(a)
	Residual	23.790	28	0.850		
	Total	29.000	29			

(a) Predictors: (Constant), Information
Dependent Variable: Knowledge

Regression

Table B6: Descriptive Statistics

	Mean	Std. Deviation	N
Relationship	0.0000000	1.00000000	30
Knowledge	0.0000000	1.00000000	30
Information	0.0000000	1.00000000	30

Table B7: Correlations

		Relationship	Knowledge	Information
Pearson Correlation	Relationship	1.000	0.166	0.070
	Knowledge	0.166	1.000	0.424
	Information	0.070	0.424	1.000
Sig. (1-tailed)	Relationship	.	0.191	0.356
	Knowledge	0.191	.	0.010
	Information	0.356	0.010	.
N	Relationship	30	30	30
	Knowledge	30	30	30
	Information	30	30	30

Table B8: Variables Entered/Removed (for Dependent Variable Relationships)

Model	Variables Entered	Variables Removed	Method
1	Information, Knowledge(a)	.	Enter

(a) All requested variables entered.
Dependent Variable: Relationship

Table B9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.166 (a)	0.027	-0.045	1.02206518	0.027	0.381	2	27	0.687

(a) Predictors: (Constant), Information, Knowledge
Dependent Variable: Relationship

Table B10: ANOVA (for Relationship)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.795	2	0.398	0.381	0.687(a)
	Residual	28.205	27	1.045		
	Total	29.000	29			

(a) Predictors: (Constant), Information, Knowledge
Dependent Variable: Relationship

Regression

Table B11: Descriptive Statistics

	Mean	Std. Deviation	N
Performance	0.0000000	1.00000000	30
Knowledge	0.0000000	1.00000000	30
Information	0.0000000	1.00000000	30
Relationship	0.0000000	1.00000000	30

Table B12: Correlations

		Performance	Knowledge	Information	Relationship
Pearson Correlation	Performance	1.000	0.217	-0.165	0.557
	Knowledge	0.217	1.000	0.424	0.166
	Information	-0.165	0.424	1.000	0.070
	Relationship	0.557	0.166	0.070	1.000
Sig. (1-tailed)	Performance	.	0.125	0.192	0.001
	Knowledge	0.125	.	0.010	0.191
	Information	0.192	0.010	.	0.356
	Relationship	0.001	0.191	0.356	.
N	Performance	30	30	30	30
	Knowledge	30	30	30	30
	Information	30	30	30	30
	Relationship	30	30	30	30

Table B13: Variables Entered/Removed (for Performance)

Model	Variables Entered	Variables Removed	Method
1	Relationship, Information, Knowledge(a)	.	Enter

(a) All requested variables entered.

Dependent Variable: Performance

Table B14: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.637 (a)	0.406	0.338	0.81375299	0.406	5.931	3	26	0.003

(a) Predictors: (Constant), Relationship, Information, Knowledge

Table B15: ANOVA (for Dependent Variable Performance)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.783	3	3.928	5.931	0.003(a)
	Residual	17.217	26	0.662		
	Total	29.000	29			

(a) Predictors: (Constant), Relationship, Information, Knowledge
Dependent Variable: Performance

APPENDIX-C

Questionnaire for The effect of Information and Knowledge sharing on supply chain performance through supplier-buyer relationship from Bangladesh Perspective

(For the Buyer/ Manufacturer)

1. What is your primary business area? Tick all that apply.

☐ Apparel

☐ Apparel supplies

☐ Textile

☐ Other, please specify _____

2. The following questions relate to the relationship with your supplier firm. Please indicate your opinion on the following dimensions [1 = strongly disagree, 2 = disagree, 3= apparently disagree, 4= not completely disagree, 5= apparently agree, 6= agree, 7 = significantly agree]

	1	2	3	4	5	6	7
We enter into special agreements with supplier's relationships that have improved performance.							
We are loyal to key suppliers.							
We have very frequent face-to-face planning/communication with key suppliers.							
There is high corporate level communication on important issues with key suppliers.							
There are direct computer to computer links with key suppliers.							

3. The following questions relate to the performance of your supplier firm. Please indicate your opinion on the following dimensions [1 = significantly poor, 2 = poor, 3= apparently poor, 4= between poor and good, 5= apparently good, 6= good, 7 = significantly good]

	1	2	3	4	5	6	7
On-time delivery							
Perfect order fulfillment rate							
Delivery reliability/dependability							
Quality (e.g., ability to meet specifications)							
Speed of response							
Manufacturing capability (e.g., capacity)							

1. Name of the Organization:

2. Name of the employee interviewed:

3. Designation of the employee:

4. Employee Background

- Age:
- Educational Background:
- Duration of service in current organization:

Questionnaire for The effect of Information and Knowledge sharing on supply chain performance through supplier-buyer relationship from Bangladesh Perspective

(For the Supplier)

1. What is your primary business area? Tick all that apply.

☐ Apparel

☐ Apparel supplies

☐ Textile

☐ Other, please specify _____

2. How often does your major customer provide your firm with its information in the following dimensions [1 = never, 2 = annually, 3 = semi-annually, 4 = quarterly, 5 = monthly, 6 = weekly, 7 = daily]

	1	2	3	4	5	6	7
Price							
Quality							
Changes in purchase order information							
Planned order information							
Inventory level information							
Product specifications							
Design drafts and sketches							
Performance evaluation information							
Future demand forecasting information							
Production planning information							
Negotiation records, contracts							
Confirmation of orders							

3. How often does your major customer provide your firm with its (knowledge based) information in the following dimensions [1 = never, 2 = annually, 3 = semi-annually, 4 = quarterly, 5 = monthly, 6 = weekly, 7 = daily]

	1	2	3	4	5	6	7
Organizational philosophy							
Skills, suggestions, ideas, expertise							
Markets trend							
Problems (including personal issues)							
New business directions and new scenarios							
Changes in product and process designs							

4. **The following questions relate to the relationship with your customer firm. Please indicate your opinion on the following dimensions [1 = strongly disagree, 2 = disagree, 3= apparently disagree, 4= not completely disagree, 5= apparently agree, 6= agree, 7 = significantly agree]**

	1	2	3	4	5	6	7
We enter into special agreements with customer relationships who have judged our improved performance.							
We are loyal to key customers.							
We have very frequent face-to-face planning/communication with key customers.							
There is high corporate level communication on important issues with key customers.							
There are direct computer to computer links with key customers.							

1. Name of the Organization:

2. Name of the employee interviewed:

3. Designation of the employee:

4. Employee Background:

- Age:
- Educational Background:
- Duration of service in current organization :