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IMPROVED C4.5 : AN AGENT-BASED SUPPLY CHAIN MANAGEMENT SYSTEM

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ABSTRACT

The supply chain management is an interesting and focused process at present. It has a lot of scope in the literature on SCM and there are a wide of models describing the Supply chain from different approach. The Supply Chain management system is the lowest possible cost and also meets the customer's expectations on services like delivery precision and lead-time. In this paper, efficient decision based technique C4.5 is improved for the classification. The correlation coefficient of Kendall is used to improve supply chain management system. The accuracy of system is calculated by the sensitivity and specificity for the proposed and existing technique for the lowest textile dataset here. The result of system was proved by the proposed technique's efficiency.

Keywords:S*upply chain management, C4.5 Algorithm,* Mascot, *Agent Based Modelling*.

1. INTRODUCTION

Supply Chain Management (SCM) contains the oversight of materials, information, and finances. System process is supplier - manufacturer - wholesaler - retailer to consumer.

Supply chain virtually and universally encompass the following three functions:

i. Materials supply to the manufacturer

ii. The process of manufacturing and,

iii. The finished goods distribution through a network of distributors and retailers to a final customer. Companies followed in various methods of the process are met to each other through a supply chain.

To make possible the flow of products, information is shared up and down in the supply chain, i.e. with suppliers and clients. This sharing of information links all the parties to plan appropriately to meet the present and future needs. Several goals can be achieved through a successful supply chain management:

- To minimize inventory
- To reduce cost
- To improve the product time to market
- To enhance the flexibility

The number of companies supply chain are able to join together and coordinate their activities, the more likely they will optimize the flow of goods from the supplier to customer and to react efficiently to the changes in demand.

Figure1.Supply Chain Structure

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A simple supply chain is made up of several elements that are linked along with the movement of the products.

Contending effectively in any business condition currently expects organizations to finally end up plainly well a lot of related to however their suppliers and purchasers work along. As worldwide contention is attending to be perceptibly serious, organizations area unit giving careful thought to wherever materials originate from, however their provider's things and administrations area unit printed and picked up, however completed things area unit transported and place away and what conclusion shopper area unit actually searching for hassle. within the course of recent years, various Brobdingnagian mechanical corporations area unit concentrating a lot of on center skills whereas endeavoring to create unification or important association with suppliers, transporters, storage organizations, United Nations agency-lesalers and totally different purchasers who area unit nice at what they are doing. Such a gaggle thanks to take care of creating and appropriating things and administrations to purchasers is popping into the foremost enhance path for organizations to stay effective and is significant to the act of production network administration.

In SCM method custom many options need at the present corporations to figure along a lot of improvement than ever before. Use of communication and knowledge exchange through internets exploitation Enterprise Resource designing (ERP) systems, growing net selling, dynamical client preferences & life designs attributable to promotional drive, have created all common cluster support and cooperation a lot of easier than ever before and gap up unknown domain areas of purchase operations, supply method and SCM to make a stronger competitive communications half. Thus, Supply Chain Management (SCM) describe a emerged the most powerful business improvement tools available today. The real time application with suppliers, product manufactures, product distributors, product retailers and a host of Service Company or selling to any alter their operations and tactics by competitors with more innovative and aggregative supply networks. By bringing the product supplier, the product distributor and the user into one interrelated process through the constant flow of data, products item & funds, SCM strives for better quality and higher user satisfaction. SCM process will be described the supply network or the supply web because marketing intermediaries are now becoming partners by interacting with the others. The supply chain starts and ends with the customer.

CUSTOMER

The system contains customer's details like name, address and contact number. The customers are decided to purchase a product that has been offered for sale by a company. The customer links the sales department of the company, which enters the sales order for a specific quantity to be delivered on a specific date. If the product has to be manufactured, the sales order will include a requirement that needs to be fulfilled by the production facility.

Figure2.Supply Chain

PLANNING

The planning department first go through the customer needs after plan and produce the product. The company is manufacturing the customer needs and orders. To manufacture the products the company will then have to purchase the raw materials needed.

PURCHASING

The purchasing department receives a raw materials and services required by the production department to complete the customer's orders. The purchasing department sends purchase orders to the selected suppliers to deliver the necessary raw materials to the manufacturing site on the required date.

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INVENTORY

The raw materials are received from the suppliers, checked for quality and accuracy and then moved into the warehouse. The supplier will send an invoice to the company for the items they delivered. The raw materials are stored until they are required by the production department.

PRODUCTION

Based on a production plan, the raw materials list are moved inventory to the production area. The finished products ordered by the customer. The manufacturing company was using the raw materials purchased from suppliers. After the items have been completed and each item tested, they are stored back in the warehouse priory to deliver the corresponding customer.

TRANSPORTATION

When the finished product arrives in the warehouse, the shipping department determines the most efficient method to ship the products so that they are delivered on or before the date specified by the customer. When the goods are received by the customer, the company will send an invoice for the delivered products.

SUPPLY CHAIN MANAGEMENT PROCESS

A SCM process is not novel but it has become ever more important for the last few years. With the shifting of business focus from manufacturing to user value, group are not much concerned about modern costs or producing high-quality products rather the major challenge is to carry out the correct product, at the exact location, at the time the users need, in the suitable size, and at the lowest possible cost and meeting this problem entails the need of supply chain management process.

SCM process is a trade regulation that refers to the user of coordinating the behaviour involved in model of a product item. It used data to create a cross functional involving more than one organization system called SCM in sequence systems and these it model integrate the business modelling progression of seller, get firms, distributors, and user logistics in order to improve the efficiency and effectiveness of manufacturing and distribution. They automate the flow of data between a group and its supply chain partners to optimize the sourcing and procurement, manufacturing, and delivery of services.

Basically, SCM process blends with supply and correct administration inside and crosswise over organizations . It is the life cycle process containing physical, data, money related and learning streams whose reason for existing is to fulfil end-client necessities with items and administrations from different connected providers . It is the oversight of materials, data, and funds as they move in a procedure from provider to producer to distributer to retailer to shopper. SCM process has been includes planning and incorporating these streams both inside and amidst business.

SCM processes include entire things to do associated with the flow or variation regarding stuff beside the uncooked data tribune through in conformity with the quit consumer as much nicely as like the related facts data flows. It is the integration over these activities throughout improved furnish chain relationships to gain a Invasive advantage. The SC extends out of the consumer according to supplier yet the co-ordination concerning skilful yet long-term co-operation amongst co-makers within the aggregate sequences network for the development and production about products, each in manufacturing or product. Each co-maker is active inside their personal location over interior competence longevity.

The preference of co-makers is instituted along primary honour position because of in accordance in imitation of recognition concerning short lead epoch Lead epoch is a trouble aspect because fabric works data, namely fashion modifications entirely fast inside no time; the enterprise also desires according to lie equipped to exchange accordingly. Permanency permanency stability toughness toughness permanency durability durability toughness longevity toughness as fashion adjustments at whirlwind speed, the manufacture life ring is very brief for garments. Durability toughness durability permanency longevity longevity Thus, cloth cause agencies are greater difficult in nature and have their accomplishment performance area in imitation of be extra bendy than evermore after grant the production at the insignificant epoch as like possible durability.

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SCM method represents a model shift that extends one's approval for the conception of cooperation. it's not seen as a method between one set of commerce partners Effective SCM permits to create sophisticated selections on the whole offer chain, from deed raw materials to producing merchandise to distributing finished product to the patron SCM customers for higher performance and differentiated services have forced companies to switch SC methods.

SCM is over all entire organization network process. The SCM links with many company such that distribution customer require items. SCM managing is an different company model which consists of many entity that depicts the affiliation of each entity in the supply chain subsidizes on the mission of spanning the users. The SC has driven by different input namely data, source tools and outlay which flows under the SC cluster members. The unprocessed SC product material sources from suppliers are traded in-between products and finished provisions through developed services. The complete finished item product would be distribute centers and vendor and consumer. Henceforth, the SCs, especially of large firm can have primary, secondary, and tertiary suppliers in additional. The significant aim of SCM Model is to improved handle the stream of data, resources, and cost across the overall SCM process, there by decline the cost of chain while promoting a firm's goods from concept to market

IMPORTANCE OF SCM MODEL

SCM Model to receiving merchandise and delivery to users quicker than the struggle are going to be improving a company competitive position. To stay competitive, firms should ask for new solutions to big I-SCM problems like modal analysis, SCM, load designing, and route designing and distribution network style. In most firms, should face company many issues that impact I-SCM like reengineering common development and outsourcing knowledge. In Effective-Supply-Chain-Management (ES-CM) systems offer the subsequent advantages to optimize the organization's performance.

- To improve SCM method and also the user creating service and customary delivering services them the proper product at the proper time and at the proper location.
- The increase and change to the operating company to bring the merchandise to the market at a faster rate and acquire their payment.
- In lower the full SC_cost, together with procuring materials SC_cost, SC_transportation price, SC_inventor, carrying SCR_cost,etc. The reduction in SCM price facilitates to extend the firm's prosperity.

SUPPLY CHAIN PRINCIPLES

If supply-chain management has become top management's new "religion," then it needs a doctrine. Andersen Consulting has stepped forward to provide the needed guidance, espousing what it calls the "Seven Principles" of supply-chain management. When consistently and comprehensively followed, the consulting firm says, these seven principles bring a host of competitive advantages.

The seven principles as articulated by Andersen Consulting are as follows:

1. **Segment customers based on service needs.** Companies traditionally have grouped customers by industry, product, or trade channel and then provided the same level of service to everyone within a segment. Effective supply-chain management, by contrast, groups customers by distinct service needs--regardless of industry--and then tailors services to those particular segments.

2. **Customize the Supply Chain Management network.** In designing their Supply Chain Management network, companies need to focus intensely on the service requirements and profitability of the customer segments identified. The conventional approach of creating a "monolithic" Supply Chain Management network runs counter to successful supply-chain management.

3. **Listen to signals of market demand and plan accordingly.** Sales and operations planning must span the entire chain to detect early warning signals of changing demand in ordering patterns, customer promotions, and so forth. This demand-intensive approach leads to more consistent forecasts and optimal resource allocation.

4. **Differentiate product closer to the customer.** Companies today no longer can afford to stockpile inventory to compensate for possible forecasting

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errors. Instead, they need to postpone product differentiation in the manufacturing process closer to actual consumer demand.

5. **Strategically manage the sources of supply.** By working closely with their key suppliers to reduce the overall costs of owning materials and services, supply-chain management leaders enhance margins both for themselves and for their suppliers. Beating multiple suppliers over the head for the lowest price is out, Andersen advises. "Gain sharing" is in.

6. **Develop a supply-chain-wide technology strategy.** As one of the cornerstones of successful supply-chain management, information technology must support multiple levels of decision making. It also should afford a clear view of the flow of products, services, and information.

7. **Adopt channel-spanning performance measures**. Excellent supply-chain measurement systems do more than just monitor internal functions. They adopt measures that apply to every link in the supply chain. Importantly, these measurement systems embrace both service and financial metrics, such as each account's true profitability.

The principles are not easy to implement, the Andersen consultants say, because they run counter to ingrained functionally oriented thinking about how companies organize, operate, and serve customers. The organizations that do persevere and build a successful supply chain have proved convincingly that you can please customers and enjoy growth by doing so.

Dimensions of Supply Chain Management

By streamlining various dimensions of supply chain, organizations can maximize revenue, reduce cost and expand their business. The major SC dimensions identified by Levy et al., 1995; Rene et al., 2003; Caputo, et al., 2003; Bollapragada, Rao & Zhang, 2004 and Chen, Yeha& Yang, 2004 are as under:

a. Inventory management
b. Transportation management
c. Warehouse and storage management
d. Information technology management
e. Quality management, and
f. Customer satisfaction

A brief description of aforesaid dimensions is as follows:

a. **Inventory management:** Inventory decisions are one of the core issues of the SCM research and play an important role in the effective management of the supply chain (Cachon& Fisher, 2000 and Chen, 2000). The objectives of the inventory decision are to meet the outside demand and minimize the total inventory cost by controlling the order point and the order quantity (Erdema & Ozekici, 2002) thereby keep items at the right time, at the right amount and at the right place (Within, 1955). Apart from Radio Frequency Identification Technology (RFID) for maintaining inventory in unreachable regions, firms today operate with Stock Keeping Unit (SKU) level data for optimizing inventory (Graves, 1985).

b. **Transportation management:** Transportation is the movement of products from one node in the distribution channel to another (Laporte, 1992). By providing for the swift and uninterrupted flow of products back and forth through the distribution channel, transportation permits wider & deeper penetration of new markets far from the point of production. In addition, by maximizing vehicle & material handling capacities and cargo requirements, effective transportation permits distributors to leverage economies of scale by lowering the per unit cost of transporting the product (Okelly, 1986).

c. **Warehouse and storage management:** Warehousing can be defined asthe segment of an enterprise logistics function for the storage & handling of inventories beginning with supplier receipt and ending at the point of consumption(Randall, 1999). The management of this process includes the maintenance of accurate & timely information relating to the inventory status, location and disbursement (Ballou &Burnetas, 2003). Factors that influence warehouse decisions include the type of distribution industry, the firm's value, quantity & potential for obsolescence, strength of the competition and state of the economy (Faizul et al., 2006).

d. **Information technology management:** Information is the key to the success of a supply chain as it provides the foundation on

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which supply chain processes execute transactions and managers make decisions (Leek et al., 2003). Information technology by including hardware and software serves as the eyes & ears of management in a supply chain, capturing and analyzing the information necessary to make a good decision (Tippins&Sohi, 2003).

e. **Quality management:** The popularity of the supply chain concept has been stimulated from many directions including the quality revolution (Dale et al., 1994). It has been found that quality management practices contribute to quality offerings, overall firm performance, reducing costs (Forker et al., 1997) and ultimately to gaining a competitive advantage (Garvin, 1984). Quality is an important factor in the value-adding process involved in the production and delivery of products along the supply chain. In addition, by making quality management an integral element of the supply chain, companies can avoid being simply reactive to the requirements of their supply chain customers and can strive to meet their demands more proactively (Love et al., 2003).

f. **Customer satisfaction:** With the fast developing world economy and global marketplace, there has been a drastic increase in the pressure on organizations to find new ways to deliver superior value to customers and improvements in profitability, serviceability and reduced costs in the supply chain (Niraj et al., 2001). Effective SCM enables higher profit margins for designers & manufacturers, better & improved customer satisfaction, as well as high-value added business opportunities (Tseng & Jiao, 1998 and Jiao & Tseng, 2004).

Supply Chain Management

To ensure that the supply chain is operating as efficient as possible and generating the highest level of customer satisfaction at the lowest cost, companies have adopted Supply Chain Management Processes and Associated Technology. Supply Chain Management has three levels of activities which hat different parts of the company will focus on: strategic, tactical, and operational.

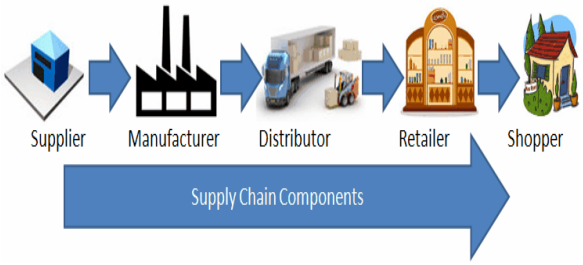

Figure3.Supply Chain Process

STRATEGIC

At this point, company management is looking for high level strategic decisions concerning the whole organization like as the size and location of manufacturing sites, partnerships with suppliers, products to be manufactured and sales markets.

TACTICAL

Tactical decisions mainly focus on adopting measures of the production cost benefits such as using industry's best practices, developing a purchasing strategy with favoured suppliers, working with logistics companies to develop cost effect transportation and e warehouse strategies to reduce the cost of storing inventory.

OPERATIONAL

Decisions at this level are made each day in businesses that affect how the products move along the supply chain. Operational decisions involve making schedule changes in production, purchasing agreements with suppliers, taking orders from customers and moving products in the warehouse.

PRINCIPLES OF SCM MODEL

The SCM contains seven principles as expressed by are as follows:

- Effective SCM method, against this, teams users by distinct service desires despite industry--and then tailors services to those explicit segments method.
- SCM may be a usual model to making a "monolithic" SCM relationship network runs counter to victorious SCM method.
- SCM method is heard signals of market demand and set up consequently approach results in a lot of consistent forecasts and optimum resource allocation.
- In SCM method may be a differentiate product nearer to the client and not will

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afford to stockpile arouse balance for potential foretelling errors

- SCM method may be a closely with their key suppliers to cut back the prices of owning materials and services, supply-chain management leaders enhance margins each for themselves and for his or her suppliers.
- SCM model may be a one amongst the idea of victorious provide link data technology should support multiple levels of deciding information.
- SCM is adopting channel-spanning performance measures with wonderful SCM designing systems do over simply monitor internal functions.
- The organizations that do continue and build victorious SC processes has been proven forcefully and luxuriate in user item group action growth by doing so.

DIMENSIONS OF SCM FUNCTION

By streamlining various dimensions of supply chain, organizations can maximize revenue, reduce cost and expand their business. The major SC dimensions known are as under:

- Inventory Control Process
- Transportation Control Process
- Warehouse and storage Maintenance Process
- Information technology Process
- Quality Process and
- Customer satisfaction Process

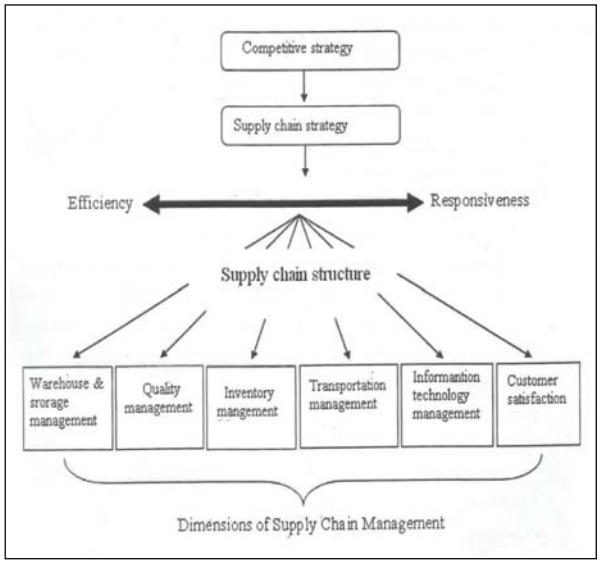

Figure 4: SC framework

A brief description of abovementioned dimensions is as follows:

g. **Inventory Control process:** Inventory decisions making are one of the core issues of the SCM research and play an important role in the effective management of the SC process

h. **Transportation Control process:** Transportation is the movement of products from one node in the distribution channel to another .

i. **Warehouse and storage Maintenance Process:** Warehousing can be defined as the segment of a scheme typically functions for the storage & handling of give beginning with supplier receipt and ending at the point of consumption .

j. **Information technology Process:** Information technology process by including hardware and software serves as the eyes & ears of management in a supply chain, capturing and analyzing the information necessary to make a good decision

k. **Quality Process:** Quality is an central facet of the value-adding process involved in the production and delivery of products along the SC process.

l. **Customer satisfaction:** Effective SCM enables higher profit margins for designers & manufacturers, better & improved customer satisfaction, as well as high-value added business opportunities .

AGENTS IN SCM

In SCM is an act of the agent pattern is a usual simile for network domain, while most of working company prefers increases their own cost

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profit than the cost profit of the SC process. In fact, the distributed SCM process units have the same characteristics as agents:

- Autonomy
- Social ability
- Reactivity
- Pro-activeness

Each SCM agent would like represent a part of the decision-making process, hence creating a tight network of decision makers process, who react in real-time to user requirements, in opposition to the flood of current processes, which is decided before customers place an order.

AGENT-BASED SYSTEM APPLIED IN SCM

The agent-based architecture for SCM process uses a multi-agent model in order to build a flexible and common design for a dynamic SCM. Each agent can be implemented with a different AI technique and decide the best combination of these models. The agents also use a distributed knowledge base as a key component for collaboration. Agents store results and information in the knowledge base so that other agents can use it to solve their problems. Figure 1.2 presents the architecture of the multi-agent system. The main focus of the proposed implementation is to tackle separately important sub-problems of a SC process:

- Procurement of components Analysis
- Production and delivery of finished goods Analysis
- Direct sales of finished goods to customers Analysis

The User agents typically represent real customers and firms that are willing to buy finished goods. The supplier agents are responsible for selling materials/components to the manufacturers, and it directly influences the procurement sub-problem. This agent is normally a manufacturer and could also use the implementation of the proposed in Figure 1.2. The product of finished product, also called organization, is composed of the following agents:

- **Sales Representative agent** – is to responsible for fulfilling customer orders.
- **Marketing manager agent** –To select the best customers and market segments in order to maximize the manufacturer's profitability.

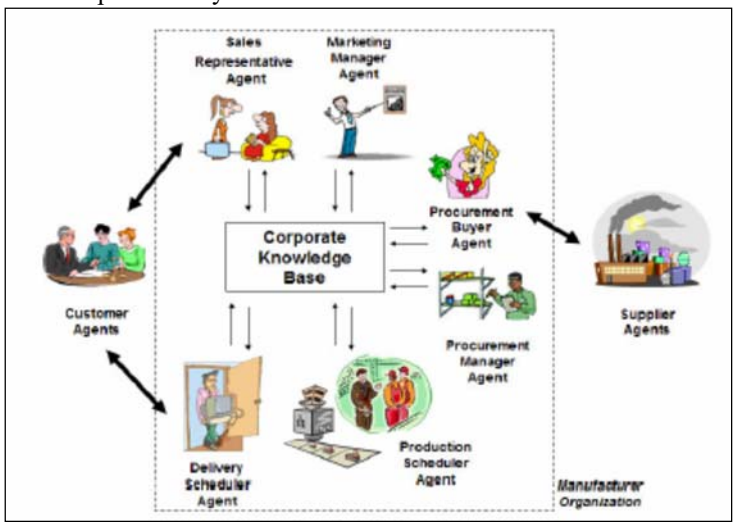

Figure 5: SCM Multi-Agent Architecture

- **Production scheduler agent and Delivery scheduler agent** – To optimize the schedule of the production and delivery of finished goods respectively.
- **Procurement buyer agent** – Negotiates components with supplier based on attributes such as price and delivery time.
- **Procurement manager agent** – Decides when to buy components based on the current inventory and component demand.

The SCM design of the maker tackles the sub-problems mentioned above with the following agents:

- Procurement of components
- Production and delivery of finished goods
- Direct sales of finished goods to customers

These SCM agents use the corporate knowledge base to exchange important information for decision making purpose. This collaboration has the ultimate goal of achieving the maximum profitability for the manufacturer organization.

APPLICATION OF SCM PROCESS

In SCM application following several domain used such that,

- Inventory Application Process
- Transportation service Application
- Materials handling Application
- Inbound transportation Application
- Warehousing Storage Application
- User service performance Rating observance

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- Custom Order processing/customer service
- SCM budget foretelling

In SCM model square measure definite functions that most complicated to urge underneath the sunshade of SCM model designing method are:

- Third party invoice payment/audit
- Sales foretelling
- Master production designing

2. LITERATURE REVIEW

In generally the performance measures can be divided as either qualitative or quantitative in nature (Felix and Chan, 2004) [14]. In the qualitative performance measures there are no direct numerical measurement, although some aspects may be quantified like customer satisfaction, flexibility, information and material flow integration, effective risk management, supplier performance, etc. Quantitative performance measures can be described numerically. Quantitative supply chain performance measures may be categorized by the objectives based on cost or profit (cost and inventory minimization, sales, profit maximization, return on investment, etc.) and, measures of customer responsiveness (occupancy rate maximization, product delay minimization, lead time minimization, etc.), and productivity (capacity maximization, resources maximization, etc.).

The premise of the supply chain management (SCM) is the performance of a single company which depends more and more on its ability to maintain effective and efficient relationships with its suppliers and customers [18,19]. Therefore, managerial tasks are moving from an organizational scale to a supply chain scale [20] and thus encompass the inter-organizational integration and coordination of the dispersed supply chain activities. Empirical research suggests that knowledge sharing and reuse between the supply chain participants are important determinants of the supply chain performance both the strategic and operational level [21, 22]. The role of information systems to support this task is subject of much research [23-25].

Knowledge sharing and reuse between the supply chain participants face many organizational obstacles such as confidentiality, trust, and norms. However, fundamental prerequisites for knowledge sharing are the means for exchanging, processing, and interpreting the relevant domain knowledge by using one or more representations of this knowledge. Since such representations may be diverse and serve different objectives, formal ontology has been proposed to represent domain knowledge, enhance communication between participants, and support interoperability of the systems [26]. A formal ontology formally captures knowledge through concepts, relationships and axioms, and can be regarded as the conceptual model of a knowledge base [27]. The application of the ontology in SCM has led to a large number of the ontologies for various SCM tasks, e.g., planning as well as more generally representing arbitrary supply chains [28][29].

The modelling approach used in this paper can be classified into the first category. Anderson et al. (1989) state that in measuring logistics performance, a comprehensive strategy of measurement is necessary for the successful planning, implementation and control of the different activities comprising the business of logistics function. Stainer (1997) [15] [16] advocated that a set of performance measures is needed in order to determine the efficiency and/or the effectiveness of an existing system, or to compare competing alternative systems.

Murthy (1998)[17] provides an overview of the work in the decision of trees and a sample of their usefulness to the newcomers as well as practitioners in the field of machine learning. Thus, in this work, apart from a brief description of decision trees, details are referred from some more recent works than those in Murthy's article as well as from few very important articles that were published earlier. Decision trees are trees that classify instances by sorting them based on the feature values. Each node in a decision tree represents a feature in an instance to be classified, and each branch represents a value that the node can assume. Instances are classified starting at the root node and sorted based on their feature values.

3.C4.5 ALGORITHM

Here describes about the most well-know algorithm in the literature for building decision trees is the C4.5 (Quinlan, 1993) [31]. C4.5 is an extension of Quinlan's earlier ID3 algorithm (Quinlan, 1979) [30]. C4.5 has a very good combination of error rate and speed.

C4.5 builds the decision trees from a set of training data in the same way as ID3, using the

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concept of information entropy. The training data is a set $S = S_1, S_2, ...$of already classified samples. Each sample S_i consists of a p-dimensional vector, $(x_{1,i}, x_{2,i}, ... x_{p,i})$where the x_j represents the attributes or features of the sample, as well as the class in which S_i falls.

At each node of the tree, C4.5 chooses the attribute of the data that most effectively splits its set of samples into subsets enriched in one class or the other. The splitting criterion is the normalized information gain (difference in entropy). The attribute with the highest and normalized information gain is chosen to make the decision. The C4.5 algorithm then recurs on the smaller sub lists.

This algorithm has a few base cases

- All the samples come into the same class. When this happens, it simply creates simply a leaf node for the decision tree on choosing that class.
- None of the features provide any information gain. In this method, C4.5 developed a decision node higher up than the tree using the expected value class.
- Instance of previously-unseen class encountered. Again, C4.5 creates a decision node higher up than the tree using the expected value.
- Counting Gain: The entropy is implemented and it is defined by the measuring or calculating the disorder of the data. It is defined as

$$Entropy(\bar{y}) = -\sum_{j=1}^{n} \frac{|y_j|}{|\bar{y}|} \, log \frac{|y_j|}{|\bar{y}|} \quad (1)$$

Iterating over all the possible values of $|\bar{y}|$. The conditional Entropy is

$$Entropy(j|\bar{y}) = \frac{|y_j|}{|y|} log \frac{|y_j|}{|\bar{y}|} \quad (2)$$

Al last defined the gain

$$Gain(\bar{y}, j) = Entropy\big(\bar{y} - Entropy(j|\bar{y})\big) \quad (3)$$

The goal is to maximize the gain, classified by over all entropy due to split argument $\bar{y}$ by value j.

Kendall's rank correlation coefficients

Kendall correlation coefficient [32] is also uses nonparametric method for correlation measure. It is also regarded as Spearman rank correlation coefficient. Spearman correlation is calculated from the variables' rank rather Kendall correlation is associated with the probability calculation. Kendal Correlation coefficient is denoted with the Greek letter τ (tau). Kendall-tau uses concordant or discordant values. The range of value of Kendall correlation coefficient is -1 to +1. Let X and Y are the pair of the measured and estimated inhibitory activity. Kendall tau coefficient is defined as in equation (4)

$$\tau = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} sgn(x_{i-} x_j) sgn(y_{i-} y_j)}{n(n-1)} \quad (4)$$

Where,

$$sgn(x_{i-} x_j) = \begin{cases} 1 \ if \ (x_{i-} x_j) > 0 \\ 0 \ if \ (x_{i-} x_j) = 0 \\ -1 \ if \ (x_{i-} x_j) < 0 \end{cases}$$

$$sgn(y_{i-} y_j) = \begin{cases} 1 \ if \ (y_{i-} y_j) > 0 \\ 0 \ if \ (y_{i-} y_j) = 0 \\ -1 \ if \ (y_{i-} y_j) < 0 \end{cases}$$

This coefficient quantifies the discrepancy between the number of concordant and discordant pairs. Any two pairs of ranks $(x_i, x_j)$and $(x_i, x_j)$are said to be concordant when xi < xj and yi < yj, or when $x_{i,} > x_{j,}$and $y_{i,} > y_{j,}$ or when $(x_{i-} x_j)(y_{i-} y_j) > 0$. Correspondingly, any two pairs of ranks $(x_i, y_i)$and (x_j, y_j) are said to be discordant when xi <xj and$y_{i,} > y_{j,}$, or when xi > xj and yi < yj, or when$(x_{i-} x_j)(y_{i-} y_j) < 0$. Similar to the two previous correlation coefficients, Kendall's tau ranges from -1 to +1, with the absolute value of τ indicating the strength of the monotonic relationship between the two variables. However, Kendall's tau can be 1 for even a wider range of scenarios than Spearman's correlation coefficient.

4. EXPERIMENTAL RESULTS

To calculate the performance of the proposed system for SCM, the textile dataset are collected from the open source. The dataset contains labels, supplier id, quantity, cost, item id, material, size, quantity, product cost and dealer cost values. These are given for the proposed improved C4.5 algorithm. The obtained results and its performance are measured and compared with existing technique for the input textile dataset.

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The classification method of this algorithm is viewed in the structure of tree where the decision tree is classified as

if x5<24 then node 2 ,else if x5>=24 then node 3 else 4

if x1<3.5 then node 4, else if x1>=3.5 then node 5 else 4

if x1<3.5 then node 6, else if x1>=3.5 then node 7 else 6

class = 4

class = 5

if x2<2750 then node 8, else if x2>=2750 then node 9 else 1

class = 6

if x2<1100 then node 10, else if x2>=1100 then node 11 else 1

class = 3

class = 1

if x9<6925 then node 12, else if x9>=6925 then node 13 else 2

class = 3

class = 2

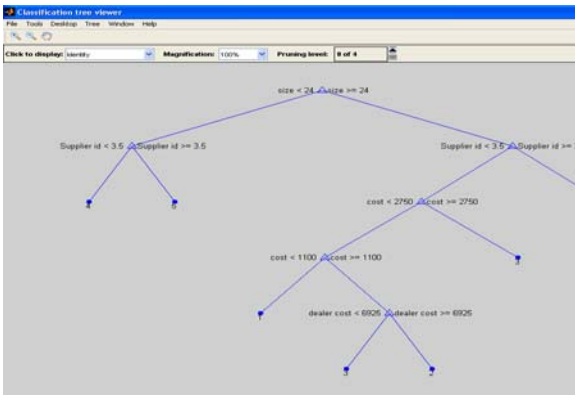

Figure 4: Classification of Proposed Technique Viewed In the Tree Structure

Performance Measures	Improved C4.5 for SCM (%)	Fuzzy Classification For SCM (%)
Accuracy	93.9	90.1

Table 2: Comparison Table for Accuracy

The table 2 gives the accuracy comparison for the proposed technique C4.5 and existing technique fuzzy based classification for SCM. The accuracy of system is measured by sensitivity and specificity.

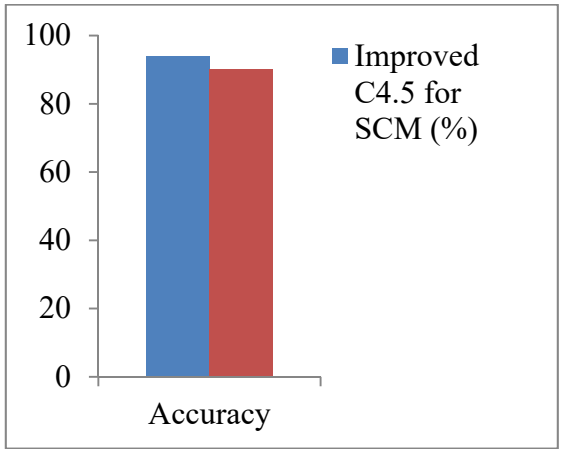

Figure 5: Comparison Graph for the Accuracy

The comparison graph for accuracy is calculated by the sensitivity and specificity, is shown in the graph. From the figure it proves that accuracy of the proposed improved c4.5 with Kendall correlation coefficient gives maximum while comparing with the existing fuzzy based technique for SCM.

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5. CONCLUSION

The SCM environment is very important, complex, highly dynamic, planning oriented and with many constraints. An improved C4.5 technique is proposed in the study for SCM using Kendall correlation coefficients. Here the performance of this technique is measured by the textile dataset. The processing time and accuracy is so good than compared to the traditional C4.5 technique. And from the experimental analysis, the accuracy from the sensitivity and specificity produces good result than the existing fuzzy classification compared. Further this can be extended for a large dataset and for a few more agents in SCM

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