Implementation of Model for Handling the Problems in Supply Chain Management

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Abstract- **Information technology based solution frameworks offer a way to more effectively integrate decision-making by enabling better knowledge sharing and facilitating more transparent economic transactions. The multi-agent system paradigm promises to be a valuable software engineering abstraction for the development of computer systems. In this work, a prototype model is design to handle the various issues and problem in supply chain management on the basics of Agent technology in Java Agent Development Framework.**

Keywords— Multi-agent system (MAS), Model Management System (MMS), Case Based reasoning System (CBRS), Supply Chain Management (SCM)

I. INTRODUCTION

In supply chain is not a stable production concept by itself. The increase and decrease of the demand fluctuates along the **supply chain because poor information flow and lack of communication among various components in the supply chain.** Large variations in orders placed upstream are often triggered by small changes in consumer demand. Eventually the network can oscillate in very large swings as each organization in the supply chain seeks to solve the problem to meet their own ends. This phenomenon is known as the **bullwhip effect** and has been observed across most industries resulting in increased cost and poorer service. The following are the main reason for the bull whip effect:

- Lack of communication up and down the supply chain
- Lack of co-ordination up and down the supply chain
- Delayed information flow and material flow

In order to overcoming the bullwhip effect, knowing the exact causes helps us analyze the problem and design our approach to solving it in a better fashion. The implantation of following would greatly reduce the bull whip effect in supply chain:

1. Improve communication along the supply chain.
2. Improve sources of forecast data
3. Work with firms upstream and downstream in the supply chain
4. Work with suppliers

Multi-agent system (MAS) technology will ensure proper communication, coordination and information flow among various functions in the supply chain. It is proposed that a Supply chain based on MAS will be the right choice and this MAS-SCM is integrated with a model management system (MMS) which includes Case Based reasoning System (CBRS), Data Mining Systems and several mathematical models. This system will minimize the cause bull whip effect to a great extent.

II. APPROACH OF AGENT TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT SYSTEM

Multi-agent systems (MAS) offer new perspectives compared to conventional, centrally organized architectures in the scope of supply chain management (SCM). Their structure inherently meets the requirements of decentralized supply chains, whereas conventional SCM systems are often restricted in terms of dynamic behavior, handling severe disturbances at supplier sites as well as dealing with highly customized or complex products. Since necessary data are not available within the whole supply chain, an integrated approach for production planning and control taking into account all the partners involved is not feasible. In this work a MAS architecture integrating various intelligent agent systems is presented to address the problem.The goal of this work is the introduction of a new supply chain planning and execution approach on the basis of multi-agent systems. Compared to existing SCM systems, the successful integration of numerous MAS that perform both inter- and intra-organizational planning and execution tasks is an important innovation. Companies face a global market characterized by numerous competitors, a steadily increasing complexity of business processes and a highly turbulent production environment. The business processes have to be highly efficient and need to provide the necessary flexibility to be able to react to short-term changes of the customer demand and unforeseen events during fulfilment. The global optimization of the corresponding business processes offers a vast optimization potential. On the other hand, various problems arise. For example, fluctuating demands multiply and create the so-called bullwhip effect. In addition, the global planning process is hampered by the fact that the companies are not willing to reveal their production data to competitors, unless they are forced to do so by powerful OEMs (as it is common in the automotive industry). MAS perfectly suit these demands for global flexibility, co-operation and, at the same time, local autonomy. The

individual projects that are involved in the research activities presented in this work address these problems and offer services in the range of SCM scheduling, shop floor production planning and control and proactive tracking and tracing services to guarantee the reliability of supply chain processes in the case of unforeseen disruptions. In this chapter, a reference model integrating the mentioned MAS is introduced including interfaces and gateways between the systems.

III. IMPLEMENTATION OF SCM CONTROL MODEL IN JADE

Multi-agent technology has many beneficial features for autonomous, collaborative and intelligent system in distributed environment, which make it one of the best candidates for complex supply chain management. Agent send and receive messages concerning their current situation to agent in other related or same system and display evolutionary behavior in response to change[1]. Within MAS, different types of agents have different degree of problem solving capabilities with in different problem domains. The proposed model is given below. The agents are goal oriented. In the proposed models, Goals are defiled for each agent with their roles [2].

Manager Agent:- Goal of this agent is Maximum profit providing to the company and its function is Import game parameters, BOM and Component Catalogue, Get supplier offers, Customer RFQs and orders, Send and register, Customer offers, suppliers' RFQs etc.

Performatives interpreted by Manager Agent	
INFORM :from <Agent Identity>	Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates that the Scheduling agent, Supply Agent and Demand Agent: from send its requirements, scheduling and supply.
CONFIRM :from <Agent Identity> :content <Final offer>	Indicates that the Inventory Agent & Demand and Supply Agent in: from want to obtain the final confirmation : content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Inventory Agent & Demand and Supply Agent in: from send the request of concession on certain quality term in : content
PROPOSE :from <Agent Identity> :content <counteroffer>	Indicates that the Inventory Agent & Demand and Supply Agent in:from send counteroffer requirement in :content
FAILURE :from <Agent Identity> :content < Final offer >	Indicates that the Inventory Agent & Demand and Supply Agent in: from didn't update the information and select his requirement in: content.

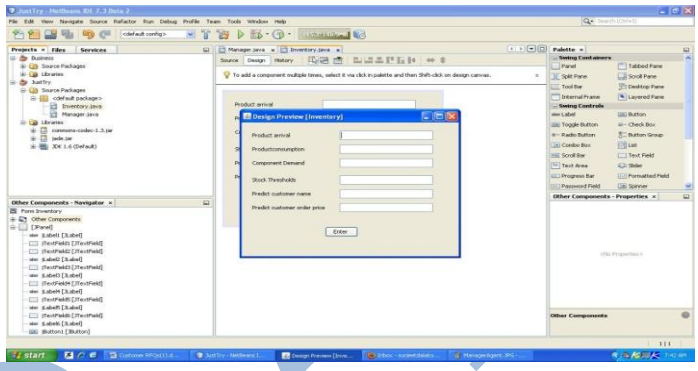

Fig 1:- Manger Agent

Demand Agent:- Goal of this agent is Revenues(Decision times) and Max Production utility (Production capacity)(Component stock) function is Generate future demands, Process new customer Orders, Predict customer order prices, Process new customer RFQs, Product Production, Manage Late Production, Generate production Schedule[3]

Performatives interpreted by Demand Agent 1 and Agent 2	
INFORM :from <Agent Identity>	Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates that the Scheduling agent, Supply Agent and Demand Agent: from send its requirements, scheduling and supply.
CONFIRM :from <Agent Identity> :content <Final offer>	Indicates that the Inventory Agent & Demand and Supply Agent in: from want to obtain the final confirmation : content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Inventory Agent & Demand and Supply Agent in: from send the request of concession on certain quality term in : content
PROPOSE :from <Agent Identity> :content <counteroffer>	Indicates that the Inventory Agent & Demand and Supply Agent in:from send counteroffer requirement in :content
FAILURE :from <Agent Identity>	Indicates that the Inventory Agent & Demand and Supply Agent in: from didn't update the information and

:content < Final offer >	select his requirement in: content.

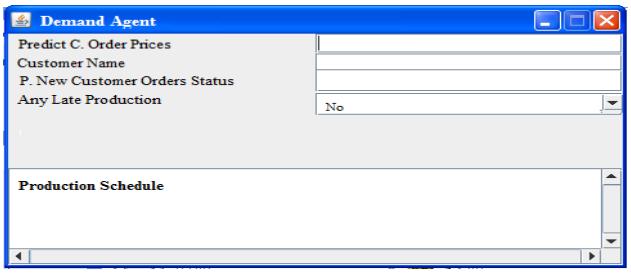

Fig 2:- Demand Agent

Inventory Agent:- GOAL of this agent is Min component holding cost and function is Manage component, Product arrival & consumption, Manage Component Demand, Tune Component Stock Thresholds, Tune Component Critical levels, Predict customer order prices[4].

Performatives interpreted by Inventory Agent	
INFORM :from <Agent Identity>	Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates that Demand Agent and scheduling Agent: from send its requirements, scheduling..
CONFIRM :from <Agent Identity> :content <Final offer>	Indicates that the Demand and Supply Agent in: from want to obtain the final confirmation : content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Demand and Supply Agent in: from send the request of concession on certain quality term in : content
PROPOSE :from <Agent Identity> :content <counteroffer>	Indicates that the Demand and Supply Agent in: from send requirement in :content
FAILURE :from <Agent Identity> :content < Final offer >	Indicates that the Inventory Agent in: from didn't maintain the inventory: content.

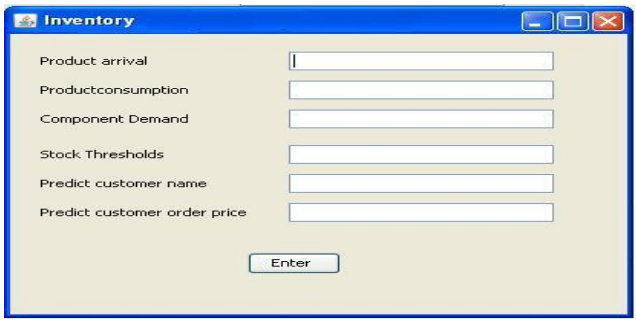

Fig 3:- Inventory Agent

Supply Agent :- GOAL of this agent is Min component Cost and function of this agent is Generate Supplier RFQs, Decide on quantity And future date for supplier, Track Supplier Prices and Deliveries, Generate Supplier Orders, Process Supplier Offers.

Performatives interpreted by Supply Agent	
INFORM :from <Agent Identity>	Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates that the Inventory Agent in & Manager Agent :from send its requirements and price
CONFIRM :from <Agent Identity> :content <Final confirmation>	Indicates that the Inventory Agent & Manager Agent in: from want to obtain the final confirmation on his offer in: content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Inventory Agent in :from send the request of concession on certain quality term in : content
PROPOSE :from <Agent Identity> :content <requirements>	Indicates that Inventory Agent in :from send requirement in :content
FAILURE :from <Agent Identity> :content < Final requirements >	Indicates that the Inventory Agent: from didn't select his requirement in: content.

Table :- Agents Performative

Fig 4:- Supply Agent

Delivery Agent:- GOAL of this agent is Min Component Holding Cost and Function of this agent is Generate Deliver Schedule, Manage Late Customer Orders[5].

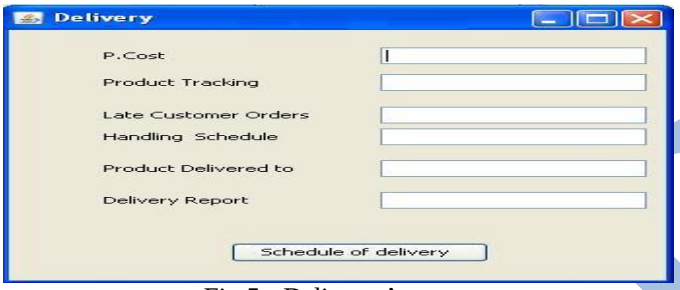

Fig 5:- Delivery Agent

Scheduling Agent:- GOAL of this agent is Each process is completed within a reasonable time framework and Function of this agent is Customer service management process, Procurement process, Manufacturing flow management process etc.

Performatives interpreted by Scheduling Agent	
INFORM :from <Agent Identity>	Indicates that the Manager Agent Production agent, Inventory Agent and Demand Agent in :from has Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates Production agent, Inventory Agent and Demand Agent in :from send requirements
CONFIRM :from <Agent Identity> :content <Final offer>	Indicates that the Manager Agent in: from want to obtain the final confirmation on his final schedule : content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Manager Agent in :from send the request of his final schedule : content
PROPOSE :from <Agent Identity> :content <Schedule>	Indicates that Delivery and Production Agent in :from schedule of each delivery and production :content
FAILURE :from <Agent Identity> :content < Final offer >	Indicates that the Schedule in: from didn't Perform Scheduling: content.

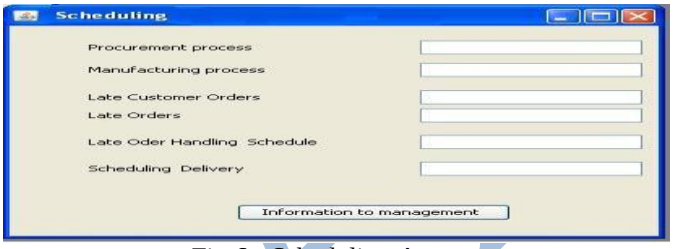

Fig 6:- Scheduling Agent

Order processing Agent:- GOAL of this agent is Each process is complete process from point of sales inquiry to delivery and Function of this agent is The nature of the orders, Availability and cost and productivity of workforce, The nature of the orders, Predictability of future volume, product and order profiles, Seasonality variations in outbound volume

Performatives interpreted by Order processing Agent	
INFORM :from <Agent Identity>	Register in the company data base
CFP :from <Agent Identity> :content <Requirements>	Indicates that the Manager Agent: from send its requirements and order.
CONFIRM :from <Agent Identity> :content <Final order>	Indicates that the Manager Agent in: from final order confirmation : content
REQUEST :from <Agent Identity> :content <Suggestion>	Indicates that the Manager Agent in: from send the request of concession on certain quality term in : content
PROPOSE :from <Agent Identity> :content <order>	Indicates that the Manager Agent in: from send requirement in :content

FAILURE :from <Agent Identity> :content < Final order >	Indicates that the Manager Agent in: from didn't update the information related to order: content.

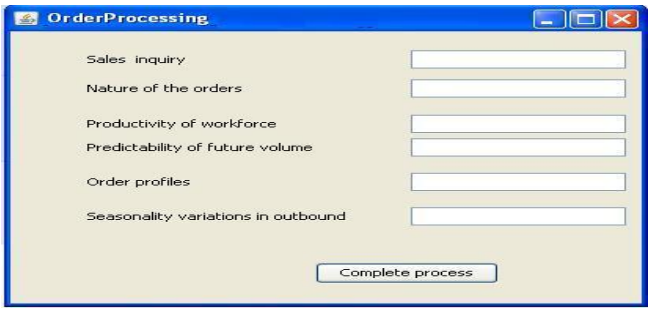

Fig 7:- Oder Processing Agent

Relation between agent and the information and controlling of processes in particular order in this system which is purposed

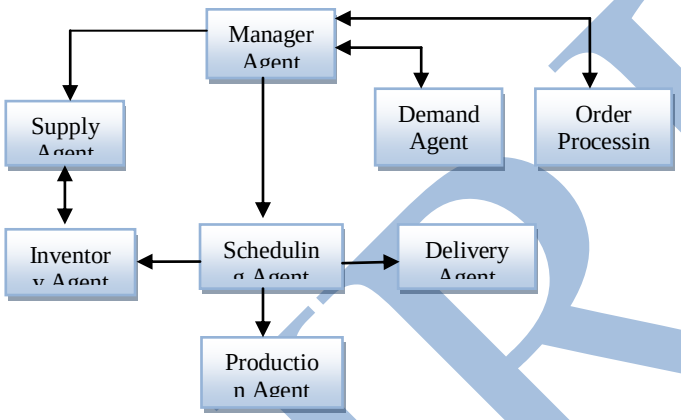

Figure 8:- Flow of information and control

II. Frame Work

In this Frame work the original case is check out by the RDQL (Retrieval Data Query Language) if this case exist then directly reach the result of previous case other wise move on adapted case and Check out by RDQL again if it's find then show result directly other wise move on similar Assessment

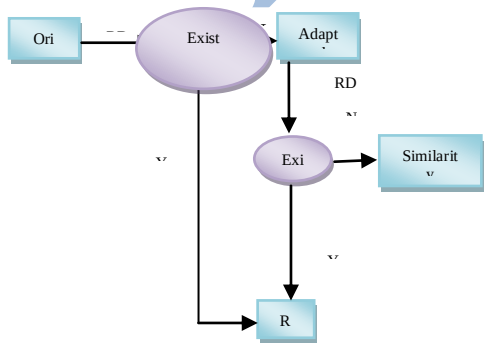

Figure 9:- Framework.

Supply Chain Management (SCM) has become a vital issue for manufacturers, professionals and researchers [6]. It is felt that to manage the supply chain effectively entire structure of supply chain must be understood properly. It presents a state of art on SCM by systematically arranging main activities in supply chain. supply chain management is to integrate. SCM needs integration of all activities like sourcing, procurement, production scheduling, order processing, inventory management, transportation, manufacturing, warehousing, and customer services. Research suggests that integration of several functions at different organizational levels could give above average financial and performance results. There is a continuous need to interact with supply chain partners to achieve the basic objective of organization. MACE-SCM provides more flexible and extensible solutions to help address emerging uncertainties in Supply Chain Management. The importance of collaboration in the supply chain has led researchers to suggest diverse approaches for problems in the collaboration process [7]. Questions still remain about which technology is best when coordinating and sharing information in the presence of various supply and demand uncertainties. Given a complexities of supply chains we propose a frame work based on case based reasoning approach to build a complete comprehensive multi agent system to understand, manage and make informed decision to minimize disruption in SCM. This work will enable Next-Gen computing especially in the software field which requires much attention in the computer field [8]. Building Autonomous Agents is a challenging task which is essential for our main project MACE-SCM. The main problem in the industry is to reduce the cost of production and increase the revenue. This aim of the project is to provide a solution to the industry so that the industry will grow on at faster speed.

IV. Conclusion

Supply Chain Management (SCM) has become a vital issue for manufacturers, professionals and researchers. It is felt that to manage the supply chain effectively entire structure of supply chain must be understood properly. This paper attempts to provide the reader a complete picture of supply chain management through a systematic literature review. It presents a state of art on SCM by systematically arranging main activities in supply chain. supply chain management is to integrate. SCM needs integration of all activities like sourcing, procurement, production scheduling, order processing, inventory management, transportation, manufacturing, warehousing, and customer services. This Research suggests that integration of several functions at different organizational levels could give above average financial and performance results. In this work, concept of supply chain management along with the need of SCM from organization point of view.In order to explore the domain of supply chain management we have argued that one must examine the nature, interrelations and dependency among MACE-SCM provides more flexible and extensible solutions to help address emerging uncertainties in Supply Chain Management .This work propose a frame work based on case based reasoning approach to build a complete comprehensive multi agent system to understand, manage

and make informed decision to minimize disruption to business sand resulting impacts. CBR emphasizes problem solving and learning as two sides of the coin: problem solving uses the result of past learning episodes while problem solving provides backbone of experience from which learning advances. The development trends of CBR methods can be grouped around four main topics: Integration with other learning methods, integration with other reasoning components, incorporation into massive processing and method advanced by focusing on new cognitive aspects. Hence, this research aims to propose an integrated framework based on multi-agent collaboration and case-based reasoning that can resolve various collaboration issues in the supply chain. This paper will enable Next-Gen computing especially in the software field which requires much attention in the computer field. Building Autonomous Agents is a challenging task which is essential for our main project MACE-SCM. The main problem in the industry is to reduce the cost of production and increase the revenue. This aim of the project is to provide a solution to the industry so that the industry will grow on at faster speed.

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