Rajani el at. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 4, Issue 1, March 2017, pp. 78-82

Agent Based System for Managing Of Bullwhip Effect in Supply Chain Management Using CBR

Rajani

Assistant Professor, Computer Science Department, Kalindi College, University of Delhi

Abstract: **Soundness of store network is one of the real worries to make the organization pushing ahead and to accomplish the vivacious conduct that depicts changes of stock into requests after some time. The bullwhip impact uncovers the amplification of stock and requests contrasted with buyer request. The system of control has impacts on the security and bullwhip impact in supply chain framework. Overseeing Supply Chain is extremely perplexing as it is an arrangement of associations which includes numerous substances, for example, providers, fabricates, merchants, and retailers, incorporating their exercises of moving products and including an incentive from the crude material stage to the last conveyance organize. Each chain has its own exceptional arrangement of market requests and working difficulties. Retailing is one such administration space of Supply Chain helpless against bullwhip impacts. Request instability is one of the main drivers of Bullwhip impacts. At last an idea on new headings in bullwhip research is exhibited in this paper**

Key Words: **Supply Chain; Multi-Agent Systems; Bull Whip Effect, Case Base Reasoning (CBR), Supply chain management (SCM)**

I. INTRODUCTION

The bullwhip impact is a lively marvel in supply chains. It alludes to the inclination of the changeability of orders rates to increment as they go through the stratums of a store network towards makers and crude material providers. The bullwhip impact uncovers that there is a mellow tremor in the SCM . It might be a bungle between request also, request and in this manner stock moves toward becoming wild. In the event that moves are not made , it prompts a greater issue over the inventory network . There are different measures of the bullwhip impact proposed in the writing. The most well-known measure is the proportion of the fluctuation of the request rate to the change of the request rate, see condition. The measure centers and works best for stable, stochastic, disengaged time request forms. However there are different measures. Standard deviations could be utilized. To be sure, it is more normal when the financial aspects of the bullwhip are considered. Another measure is proportions of the co-proficient of variety of request what's more, request rates. This is a valuable measure when there are various items experiencing different courses to advertise what's more, some examination is required crosswise over various items, organizations or courses to advertise. Bullwhip makes lopsided generation plans. These unsteady preparations timetables are the reason for a scope of unnecessary expenses in supply chains. Organizations need to put resources into additional ability to meet the high variable request. This limit is then under-used when request drops. Unit work costs ascend in times of low request, after some time, organization and sub-contract costs ascend in times of appeal. The exceptionally factor request expands the prerequisites for security stock in the supply chain. Also, organizations may choose to deliver to stock in times of low request to expand profitability. On the off chance that this is not overseen appropriately this will prompt extreme out of date quality. Very factor request additionally increments lead times. These expanded lead-times prompt expanded stocks also, bullwhip impacts. In this way the bullwhip impact can be very maddening for organizations, they put resources into additional limit, additional stock, work after some time one week and stand sit without moving the following. There are different causes to the bullwhip impact. Their fundamental commitment was to examinations four distinctive reasons for the bullwhip impact; clumping, lack gaming, lead-times and request flag handling. In any case, there are different wellsprings of the bullwhip impact. Together request flag handling and the effect of lead-times have already been known as the Forrester Effect.

II. RELATED WORK

In production network administration, enhancing the proficiency of the general supply of items is of key intrigue. On account of showcase globalization and the headway of online business the significance of production network system is expanding. It is extremely troublesome for various organizations in supply chains to share data. A store network can create items for various markets. Additionally, an individual organization is probably going to have just restricted perceivability of the production network structure, which makes it hard to make future request estimations, on the grounds that the example of interest engendering through the production network relies on upon the abilities and procedures

of organizations along the way from the business sectors to the organization [4]. S. Yung et al. [13] states that exploration in coordination of supply chains can be arranged into the taking after four ranges:

1. Modeling of Supply Chains – the processes and functionality of supply chains must be organized and coordinated efficiently to achieve better performance. A constraint network model have been suggested and applied.
2. Modeling of Information Flows – which provides the communication among facilities within the supply chains, where real-time data are critical in supporting decision making. It enables quick response and accurate data transmission. Internet and intranet provide a channel to support communication for both the facilities within and outside the supply chains.
3. Human Computer Interface (HCI) – the amount of information generated from a supply chain is very strong. It is important to have a good interface for users to input and retrieve data or information. Recently, many researchers have focused on software agents to model the behavior of the users and use the captured behavior to support design of better graphical user interface (GUI).
4. Optimization Method – optimization is an important research area to search for better resources allocation in supply chain management. Some mathematical models including transportation model , allocation model , simples methods and other optimization techniques have been applied to increase the performance of supply chains.

But such research can be computational intensive if the number of facilities is large. S. Srinivasan et al. [1] proposed a multi-agent architecture for integrated dynamic scheduling of the steel pipe industry, each agent performs a specific function of the organization and share the information with other agents. X. Xu and J.Lin [5] suggested an advancing mechanism that integrates High Level Architecture with multi-agent distributed simulation to meet time management in supply chain simulation. V. Misra et al. [8] survey the Supply Chain Management Systems and states that, six characteristics define current supply chain management philosophy: 1) Shared Information, 2) Organizational Relationships, 3) Inventory Management, 4) Total Pipeline Coordination, 5) Readiness to adopt Flexibility and 6) Costing Issues. They regarded Agent Based SCM is the vision and states that: Agents can help transform closed trading partner networks into open markets and extend such applications as production, distribution, and inventory management functions across entire supply chains spanning diverse organizations. M. Paolucci et al. [12] proposes a multi-agent based system for small and medium-size manufacturing organizations to dynamically achieve cost-effective aggregate sales and operations plans in supply chain contexts. M. Uppin and S. Hebbal [19] outline in their survey that information sharing is most important requirement of efficient supply chain and multiagent modeling is most suitable for designing of supply chains. V. Kumar and S. Srinivasan [20] review SCM systems and their functionalities . M. Abdoli and B. Al-Salim [21] provide a conceptual framework for implementing a sales agent at Internet-based stores (estores). As the effectiveness of centralized command and control in SCM starts to be questioned, there is a critical need to organize supply chain systems in a decentralized and outsourced manner. Agent-based models can easily be distributed across a network due to their modular nature and therefore, the distribution of decision-making and execution capabilities to achieve system decentralization is possible.

III. SOLVING THE BULLWHIP PROBLEM USING AGENT TECHNOLOGY

The greatest choice one needs to make is whether to concentrate the bullwhip issue in discrete or persistent time. In discrete time, framework states (request rates, stock what's more, WIP levels) and recharging requests are made at the similarly separated snapshots of time. In the middle of these snapshots of time, nothing is thought about what is happening in the framework. In nonstop time the frameworks states are observed at all snapshots of time and the request rate is ceaselessly balanced. Operator innovation can deal with the Multiple Input, Multiple Output (MIMO) frameworks and handle to tame and control the bullwhip impact to make great estimates. Operator can register the incentive as indicated by definition of mean forecasts that minimize mean squared error (MMSE) between the figure of interest over the lead-time.

IV. INFORMATION TECHNOLOGY FOR SUPPLY CHAIN MANAGEMENT USING MAS

Data is the way to the achievement of a supply chain since it empowers administration to decide over a wide extension that crosses both capacities and organizations. The utilization of the operator/multi-specialist framework (MAS) worldview has expanded forcefully as a vital field of look into inside the Artificial Intelligence range. An Agent is characterized by its adaptability, which suggests that a specialist is:

Reactive: agents perceive the context in which they operate and react to it appropriately.

Proactive: an agent has to be able to try and fulfill his own plans or objectives.

Social: an agent has to be able to communicate with other agents by means of some kind of language.

Autonomy: agents have capabilities of task selection, prioritization, goal-directed behavior, decision-making without human intervention.

Persistence: code is not executed on demand but runs continuously and decides for itself when it should perform some activity

Cognition: agents perform information processing and reasoning, based on their internal knowledge base, in terms of rules;

Communication: agents participate in communication acts, interacting and sharing knowledge with other agents of the MAS.

Given their properties, the agent technologies seem the most appropriate choice to solve problem Bull whip effect over supply chain. This outcomes from the abilities of the operators to give arrangements in a space portrayed by the disseminated way of information, the multifaceted nature of the programming arrangement, the absence of concentrated control, the need to guarantee the freedom of the item elements, the need to impart and organize with a specific end goal to give particular administrations to people, and the need to get data and guidance proactively. Multi-agent innovation could be a most loved contrasting option to show and mimic the coordinated effort components and procedures. In this manner, the blend of store network handle definitions with an propelled foundation as far as multi-agent frameworks can possibly make conceivable a genuine vital upper hand for the whole inventory network and will empower new types of business and work. The objective is to make and assess sets of keen specialists that can agreeably bolster creation and coordination's organize choices. Each operator in the SCM bolster demonstrate claims its learning, premiums, status data, message handlers, prepare component agents and approaches.

V. MAS-SCM SYSTEM FOR CONTROLLING BULL WHIP EFFECT USING CASE BASE REASONING (CBR)

Our proposed system, MAS-SCM (Multi-Agent System Supply Chain Management) includes four main agents that are Wrapping Agent, Finished Goods Agent, Machine handling Agent, Supply Agent, Distributor Agent, Production Agent, Ware-House Agent, Managing Agent, Finance Agent, Inventory Agent, Demand Agent, Event Management Agent, Inventory Agent Control Agent, Retailer Agent,. A local database is used in each phase, and is related to the corresponding agent, a central database is used to be accessed by all the agents and provide complete information to this centralized data base information handler and provide the data according to the requirement having a backend support to the centralized data known as CBR agent. It is the key of controlling the bull whip effect in supply chain.

VI. AGENTS OPERATIONS SYSTEM WITH CBR

To control the bull whip effect the centralized system developed so that a agent can inform to all that any information get which indicate the process may be move in bull whip, to handle this information agent is working which is centralized powerhouse of information and it send a message to inventory and control agent for further action, and after getting the suitable response from these agent it pass the massage to production and supply and ware house and finance agent. And each agent is supported by the Case Base Reasoning Agent . The operation of agents to control bull whip effect the message passes on is like:-

1. **Wrapping Agent**

Verify the product value (quality and quantity) x, for (x=1, x=X) If Valid
then
Insert product x into local database
otherwise
Delete product x from local database
Send message (invalid_product) to Production agent
Verify product value y, for (y=1, y=Y) If Valid
then
Insert wrapping y into local database
otherwise
Delete package y from local database
Send message (invalid_wrapping_alarm) to **Wrapping agent**
Send message to (central database) Information Agent
Send message (product_information, wrapping information) to **FinishedGoods agent**
If Receive message (**Alarm_Delay**) from **FinishedGoods agent**
then
Send message (**Alarm_Delay**) to **Wrapping agent** If Receive message (Alarm_Counterfeit) from **FinishedGoods agent**
then
Send message (Alarm_Counterfeit) to **Wrapping agent**
Send message (Query_for_Supply_Information) to local database Send message (product_information, wrapping information) to **FinishedGoods agent**
If Receive message (Alarm_Delay) from **FinishedGoods agent**
then
Send message **(Alarm_Delay)** to **Wrapping agent** If Receive message (Alarm_Counterfeit) from **FinishedGoods agent**
Then Send message (Alarm_Counterfeit) to **Wrapping agent**
Send message (Query_for_Supply_Information) to local database

2. **FinishedGoods Agent** Receive message (product information, package information) from **Wrapping agent**
Send message (Query_for_Authentication) to (central database) **Information Agent**
Receive message (Authentication) from (central database**) Information Agent** If (true)
then
Insert products and wrapping into local database
otherwise
Delete products and wrapping from local **database and CBR Agent** Send message (**Alarm_Counterfeit**) to **Wrapping agent**
Send message (ePedigree) to (central database) **Information Agent** Receive message (Order) from **Distributor agent**
Send message (product_information, package_information, lot_information supply_information) to Distributor agent If Receive message (**Alarm_Delay**) from **Distributor agent**
then
Send message (**Alarm_Delay**) to **FinishedGoods agent**
Locate truck
Contact truck

If Receive message (**Alarm_Counterfeit**) from **Distributor agent**
then
Send message (**Alarm_Counterfeit**) to **FinishedGoods agent**
Send-message (Query_for_Shipping_Information) to local database
3. **Distributor Agent**
Receive message (product_information, package_information, lot_information, supply_information) from **FinishedGoods agent**
Send message (Query_for_Authentication) to (central database) **Information Agent**
Receive message (Authentication) from (central database) **Information Agent** If (true)
then
Insert products and packages and lots into local database
otherwise
Delete products and packages and lots from local database
Send message (Alarm_Counterfeit) to **FinishedGoods agent**
Send message (ePedigree) to central database
Receive message (Order) from Retailer agent
Send message (product_information, package_information, shipping_information) to Retailer agent If Receive message (**Alarm_Delay**) from Retailer agent
then
Send message (**Alarm_Delay**) to **Distributor agent**
Locate truck
Contact truck
If Receive message (**Alarm_Counterfeit**) from **Retailer agent**
then
Send message (**Alarm_Counterfeit**) to **Distributor agent**
Send message (Query_for_supply_Information) to local database
Like this message passing each agent will communicate each other.

VII. CONCLUSION

To configuration, fabricate and convey an item or benefit needs a system or casing work for data sharing. Agent based System having a support of CBR is another method for contemplating and applying data. With this thought an exertion is made to give a multi specialist framework display for the production network administration keeping in mind the end goal to lessen the bull whip effect. In the proposed demonstrate (bull whip effect show) every agent plays out a particular capacity of the association what's more, offer the data with data and CBR agent. There by the most imperative prerequisite of supply chain system i.e data sharing is accomplished other than controlling the request supply inconvenience in the proposed show. In the current work a piece of the model identified with control specialist is composed and it might be the primary ever such framework to lessen the bull whip effect issue in the supply chain system.

REFERENCES

[1] S. Srinivasan, D. Kumar, and V. Jaglan, "Multi-Agent SystemSupply Chain Management in Steel Pipe Manufacturing". IJCSI International Journal of Computer Science Issues, Vol.7, Issue 4, No 4, July 2010.

[2] Bellifemine, F., Caire, G., Poggi, A. and Rimassa, G. (2008). JADE: A software framework for developing multi-agent applications. Lessons learned. Information and Software Technology, 50, pp. 10–21.

[3] Castro, L. and Wamba, S. F. (2007). An inside look at RFID technology. Journal of Technology Management Innovation, 2 (1), pp. 128-141.

[4] W. Um, H. Lu, and T. Hall, "A Study of Multi-Agent Based Supply Chain Modeling and Management". iBusiness, 2, 333- 341, 2010.

[5] X. Xu, and J. Lin, "A Novel Time Advancing Mechanism for Agent-Oriented Supply Chain Simulation". Journal of Computers, Vol. 4, No. 12, December 2009. © Academy Publisher.

[6] C. Seitz , T. Scholler, and J. Neidig, "An Agent-based Sensor Middleware for generating and interpreting Digital Product Memories". Proc. Of 8th Int. Cof. On Autonomous Agents and Multiagent Systems (AAMAS 2009). © International Foundation for Autonomous Agents and Multiagent Systems.

[7] Frey, D., Stockheim, T., Woelk, P. O. andZimmermann, R. (2003). Integrated Multi-agent-based Supply Chain Management. In Proceedings of 1st International Workshop on Agent-based Computing for Enterprise Collaboration.

[8] V. Misra, M. Khan, and U. Singh, "Supply Chain Management Systems: Architecture, Design and Vision". Journal of Strategic Innovation and Sustainability vol. 6(4) 2010.

[9] R. Carvalho, and L. Custodio, "A Multiagent Systems Approach for Managing Supply-Chain Problems: new tools and results". Inteligencia Artificial V. 9, No 25, 2005.

[10] Huang, D., Verma, M., Ramachandran, A. and Zhou, Z. (2007). EPCA Distributed ePedigree Architecture. Accepted by the 11th International Workshop on Future Trends of Distributed Computing Systems (FTDCS 2007).

[11] Jung, E. H. and Cho, S. Y. (2006). A Robust Digital Watermarking System Adopting 2D Barcode against Digital Piracy on P2P Network. International Journal of Computer Science and Network Security, 6(10), pp. 263-268.

[12] Koh, R., Schuster, E. W., Chackrabarti, I. and Bellman, A. (2003). Securing the Pharmaceutical Supply Chain. White paper,

[13] Kovalchuk, Y. (2008). Multi-Agent Decision Support System for Supply Chain Management. 10th Int. Conference on Electronic Commerce (ICEC) '08 Innsbruck, Austria.

[14] Kwok, S.K., Tsang, A. H. C., Ting, J. S. L., Lee, W.B. and Cheung, B. C. F. (2008). An Intelligent RFID-based Electronic Anti-Counterfeit System (InRECS) for the Manufacturing Industry. In proceedings of the 17th World Congress The International Federation of Automatic Control Seoul, Korea, pp. 5482-5487.

[15] Lehtonen, M., Al-Kassab, J., Michahelles, F., Kasten, O. (2007). Anti-counterfeiting Business Case Report. Available at www.bridge-project.eu.

[16] S. Garg, S. Srnivasan, and V. Jaglan, "Multi-agent CollaborationEngine for Supply Chain Management", International Journal on Computer Science and Engineering, Vol.3, No. 7, 2011.

[17] Mitkas, P. A., Kehagias, D., Symeonidis, A. L. and Athanasiadis, I. N. (2003). A Framework for Constructing Multi-Agent Applications and Training Intelligent Agents. In Proceedings of the Fourth International Workshop on Agent-oriented Software Engineering (AOSE-2003), pp. 96- 109.

[18] Moyaux, T., Chaib-draa1, B. and D'Amours, S. (2006). Multi-agent based Supply Chain Management. Springer Berlin Heidelberg.

[19] M. Uppin, and S. Hebbal, "Multi Agent System Model of Supply Chain for Information Sharing". Contemporary Engineering Sciences, Vol. 3, 2010, No.1, pp 1-16.

[20] V. Kumar, and S. Srinivasan, "A Review of supply ChainManagement using Multi-Agent System". IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 5, September 2010.

[21M. Abdoli, and B. Al-Salim, "Intelligent Agent-based Approach to Sales Operations at E-stores". Proceedings of the Eleventh American Conference on Information Systems, Omaha, NE, USA Auguest 11th – 14th 2005.

[23] A. Goel, S. Gupta, S. Srinivasan, and B. Jha, "Integration of Supply Chain Management Using Multiagent System & Negotiation Model". International Journal of Computer and Electrical Engineering. Vol. 3, No. 3, 2011.

[24] Seilonen, I., Pirttioja, T. and Koskinen, K. (2009). Extending process automation systems with multi-agent techniques. Engineering Applications of Artificial Intelligence, 22 (7), pp.1056-1067.

[25] Shirazi, M. A. and Soroor, J. (2007). An intelligent agent-based architecture for strategic information system applications. Knowledge-Based Systems, 20, pp. 726-735.

[26] Angappa Gunasekaran and Bulent Kobu, (2006), Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995– 2004) for research and applications,International Journal of Production Research, Vol. pp 1–22. DOI: 10.1080/00207540600806513.

[27] Agostino Villa, (2002), Emerging trends in large-scale supply chain management, International. Journal of. Production Research, vol. 40, no. 15, 3487-3498. DOI:10.1080/00207540210131833.

[28] Sunil Chopra, Peter Meindl, (2008), Supply Chain management,3rd edition, PearsonEducation Asia, NewDelhi, ISBN : 81-7808-272-1

