International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 3, Issue 3 (May-June 2015), PP. 220-224

A NOVEL APPROACH OF QUALITY CHAIN MANAGEMENT

Pooja Sharma, Nitin kumar waghmare
Manav Rachna International University
Pooja.bhagatymca@gmail.com, nitinwaghmare.fet@mriu.edu.in

Abstract- This Research deals with the supply chain management (SCM) provide us a high practical rapidity flow of high quality, significant information that will assist suppliers to provide a constant and specifically timed flow of resources to customers. However, unplanned demand oscillations, including those caused by stock outs, in the supply chain performance development produce distortions. There are numerous causes, often in combination that will cause these supply chain distortions to start what has become known as the "Bullwhip Effect".

While the devil is generally hidden in the details, as is the case here, the most common drivers of these demand distortions are: Customers, Promotions, Sales, Manufacturing Policies, Processes, Systems and Suppliers. The "Bullwhip Effect" has in the past been recognized as normal, and in fact, thought to be a predictable part of the order-to-delivery cycle. In this paper we propose a novel effective approach to find the MSE (Mean square error) with the help of MAMDANI Fuzzy logic.

Keywords: Supply chain management, Bullwhip Effect, Mamdani Fuzzy Logic, MSE.

I. INTRODUCTION

SUPPLY CHAIN MANAGEMENT (SCM)

The supply chain includes the activities that start from the raw materials & come to an end with transfer of the product to the end users. The Bullwhip effect is one of the main incidents that concept the worst significance on the reading of the supply chain management system. The contradiction in the product demand causes the bullwhip effect. It is the occurrence wherever there is enormous divergence among the supplier orders and the consumer sales. The modification between the supplier's order and the buyer's sale root the most terrible outcome on the concert of the supply chain system. When the supplier's order is much advanced than buyer's sale then this surroundings turn out the wastage of the inventory cost & minimizes the organization's profits.

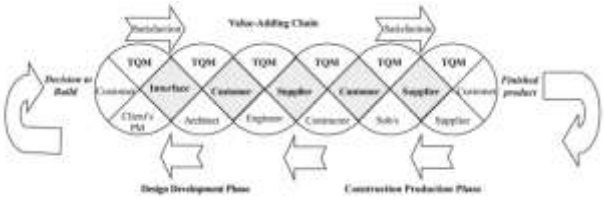

Fig 1: Customer-Supplier interface of SCM

In other condition, the supplier's direction is very low then buyer's sale then this position minimize the buyer fulfillments and powdered the absence of the favorite product to the customers at the moment. It leads to excellent disorganizations as specified below:

A. Extreme inventory asset

It causes more inventory resources unpaid to improper demand forecast. The producer movement about high product sell so that it collect supplementary uncooked resources to conform the client requirements to reservation the customer satisfactions.

B. Poor client service

Due to unavailability of preferred product, the customer tactics concerning the alternative. It causes deprived buyer services.

C. Lost revenues

In case of extra supply then companies put up for sale of the products at reduced price that's decreases the revenues.

These factors validate the most terrible effects of bullwhip effects [1]. Hence if company wishes for facing the global commercial opposition appropriately then the bullwhip effect should be tackled to exploit the organization profits with proper customer satisfactions.

II. IMPACT OF FORECASTING BULLWHIP EFFECT

Supply chain management (SCM) has develop a searing topic over the past few years, as advanced and valued SCM resolutions have emerged. The awareness of real and possible enhancements in SCM has extended the maximum heights of commercial and government. In SCM research, an occurrence known as the "bullwhip effect" has strained much kindness. The bullwhip effect signifies a market pathology in which material about request becomes progressively more distorted as it changes upstream in the supply-chain. Such an alteration can lead to extreme inventory through the supply-chain system, deficient or excessive capacities, product inaccessibility, and higher costs in general. The initial acknowledgment of the bullwhip effect can be traced back to Forrester [1]. The beer game [5] that has been used in instruction supply chain management exhibited the same phenomenon. Most of the previous research on the bullwhip effect has focused on demonstrating its existence, classifying its likely causes, and providing methods to decrease its impact. In particular, Lee et al. [6, 7] well-known five possible bases that may lead to bullwhip effect: the use of demand forecasting, non-zero lead time, batched order, limiting game below shortage and price oscillations and upgrades. Forecasting methods play an important role in supply chain management. This focus of this paper is the impact of different forecasting methods, such as moving average (MA), exponential smoothing (ES), and minimum mean square error (MMSE) method, on the bullwhip effect. [8, 9, 10, 11]

III. LITERATURE SURVEY

The resolve of the Literature Review is to analyze relevant journals, books, related researches, and then made improvements by applying Lean Six Sigma approach to improve supply chain management.

A recent survey done by Feller et. al. [13] of the main usages of the term "value" in the economics, marketing, strategy, and operations fields indicates that the notion of a value chain may actually be a misnomer, although a widely used one. According to this analysis, only resources move along the chain of linkages between firms supplies going one way and money going the other, while value is a metaphysical perceived quality associated with the benefits that occur at the various points of exchange along the resource chain. Therefore, value chains can be thought to operate in both directions, with suppliers accruing value from the financial resources, payment terms, stability, and future order cover that their customers provide, while customers derive value from the delivered products and services.

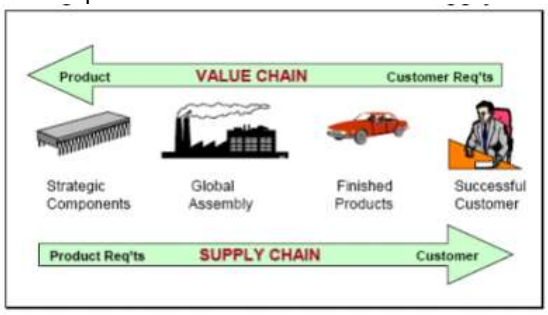

Fig 2: A Comparison of a Value Chain with a Supply Chain

Misnomer or not, the value chain concept has become a staple idea in the management and research literature, and is the focus for evolving strategies, enterprise models, and numerous efforts at improving business performance. Creating a profitable value chain therefore requires alignment between what the customer wants, i.e., the demand chain, and what is produced via the supply chain. And while supply chains focus primarily on reducing costs and attaining operational excellence, value chains focus more on innovation in product development and marketing.

Beside of it there is research in quality management which has been done by **Foster** [14] has focused on internal versus external views of quality, with the internal view focusing on process and the external view focusing on the customer. As firms adopt the systems approach implicit in supply chain management, they must merge these views as they internalize upstream and downstream processes with their own. To understand the field of supply chain quality management (SCQM), we must first define the term by deconstructing it.

Bowersox et al. [15] state that supply chain management consists of firms collaborating to leverage strategic position and to improve operating efficiency. This includes partnering with other firms in chains of relationships that result in downstream benefits to customers. Similarly, the quality management perspective has traditionally considered interacting aspects of systems such as processes, inputs, machines, people, procedures, plant, and equipment as means of creating excellence in products and services. This systems-based view of quality also applies to supply chains as well.

IV. PROBLEM DEFINITION

A supply chain includes all the actions, functions and services elaborate in creating and carrying a product and/or service, from suppliers (and their suppliers) to the customers. The supply chain management (SCM) model is geared towards improving each component of what used to be called (Production and) Operations management (production, warehousing, inventory, transportation and distribution etc.) These models focused on the numerous mechanisms of the supply chain in isolation, this infers that these models were concerned with towards the optimization of a sub-part of the system. For example, JIT would need a factory to keep records low and produce and distribute produces in a timely manner, however JIT ignores many other features which cannot be seen independently However, in an background where dissimilar functional units manage the various logistics activities autonomously, an organization is less likely to properly analyze such important trade-offs.

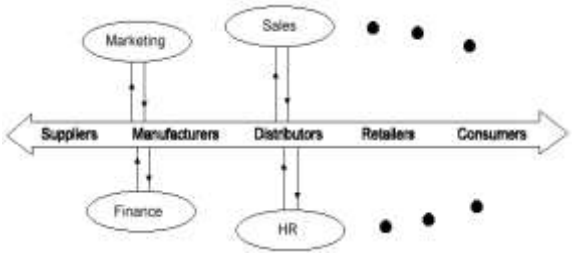

Fig. 3: supply chain with other functional domains in an enterprise.

Furthermore, these models also ignore the interdependency of production and operations purposes with other fields within an organization, such as marketing and finance. Marketing choices have serious impact on logistics function and vice-versa. For example, a marketing promotion cause should be synchronized with production planning; since a higher demand may be expected Fig.-3 shows a simple symbol of the interdependence of the supply chain and the other functional domains in the organization.

Currently, Mamdani Fuzzy Logic and SC Management are recognized as most widespread continuous improvement initiatives and companies are using them widely. The first objective is linkage such as Total Quality Management (TQM).

V. SYSTEM MODEL

Further recently, a Supply Chain Operations Reference (SCOR) model has been distinct as a generic development model [4]. The SCOR model can be used to define supply chains using a common context and terminology. It describes five process types: PLAN, SOURCE, MAKE, DELIVER, and RETURN, that can be used to designate a supply chain. Such e-marketplaces are presently used not only in consumers' buying but also for business-to-business (B2B) purchases among universal suppliers [5]. The key to realizing such business-process addition depends on well-organized apparatuses for 1sharing information among supply chain member companies. Powerful tools are needed to support

design and operation of such information systems. Replication is one such powerful tool that can be used to support choices at design and operative phases. This paper refers to modeling requirements and design issues for a generic simulation system that can support design, planning, and operation of supply chain systems. The primary determination of a supply chain is to arrange for an industrial product to the end-customer. This paper emphasis on business activities in supply chains in discrete products industries. Also, the argument here primarily highlights the simulation model functional capabilities without making it specific to a process model.

VI. METHODODOLOGY

A) Fuzzy Logic using Mamdani approach

1) Mamdani approach : first to calculate the degrees of association of the input values in the rule originator. Retaining the s-norm operator as a model for the "and", we compute the degree of match of rule r as:

$$\alpha_r = \min_{i=1,\dots,n}\{\mu_i^{ji}(x_i^{input})\} \quad \dots\dots\dots\dots\dots..1$$

The collection of all consequences is obtained by using the t-norm (max) operator:

$$\mu_r^{conseq}(u) = \alpha_r \wedge \mu^j(u) \quad \dots\dots\dots\dots\dots\dots\dots\dots..2$$

As a final point, we compute the fuzzy set of the control action:

$$\mu^{conseq}(u) = \alpha_r \vee \mu^j(u) \quad \dots\dots\dots\dots\dots..3$$

Complete method: the significance fuzzy sets are calculated by using t-norm operator as following:

$$\mu_r^{conseq}(u) = \alpha_r \vee \mu^j(u) \quad \dots\dots\dots\dots\dots\dots\dots4$$

And the outcome of this assessment process is got by using the s-norm(max) operator as:

$$\mu^{conseq}(u) = \alpha_r \wedge \mu^j(u) \quad \dots\dots\dots\dots\dots\dots..5$$

2) Grouping of Mamdani and Fuzzy logical methodologies: To control the final result of the system, we combine Mamdani and Logical approach by using following equation:

$$y = (1-\lambda)y_m + \lambda y_l \quad \dots\dots\dots\dots\dots..6$$

λ is the constraint of grouping and indicated that the system tend to be logical or Mamdani.

3) Defuzzification: Defuzzification is the control of a brittle mathematical value from a space of fuzzy control action. Defuzzification is frequently the most the consuming operation in fuzzy processing. For defuzzification of the result, first we reduce type-2 to type-1 sets. To achieve so, we apply type reduction for Gaussian type-2 fuzzy logic system.

A Gaussian type-2 set $\tilde{\tilde{A}}$ is such that for every $\in \tilde{\tilde{A}}$,$\mu_{\tilde{\tilde{A}}}(x)$ is a Gaussian type-1 set; and, a Gaussian type-2 FLS is a type-2 FLS in which all the originator and resultant sets are Gaussian type-2 sets. Consider the weighted average as following:

$$y(z_1,\dots,z_M,w_1,\dots,w_M) = \frac{\sum_{l=1}^{M} w_l z_l}{\sum_{l=1}^{M} w_l} \quad \dots\dots..7$$

Where $z_l \in R$ and $w_l \in [0,1]$ for $l = 1,\dots,M$. If each z_l is replaced by type-1 fuzzy set $\tilde{W}_l \in [0,1]$, then the extension of weighted average gives:

$$\tilde{Y}(\tilde{Z}_1,\dots,\tilde{Z}_M,\tilde{W}_1,\dots,\tilde{W}_M) = \int_{z_1}\dots\int_{z_M}\int_{w_1}\dots\int_{w_M} \tau_{l=1}^{M}\mu_{\tilde{Z}_l}(z_1) \star \tau_{l=1}^{M}\mu_{\tilde{W}_l}(w_1) \Big/ \frac{\sum_{l=1}^{M} w_l z_l}{\sum_{l=1}^{M} w_l}$$

Where τ and $\star$ both indicate the t-norm used (in this study Yegar), $w_l \in \tilde{W}_l$ and $z_l \in \tilde{Z}_l$ for $l = 1,\dots,M$.

Then the Basic Defuzzification Distribution (BADD) is used for defuzzification of the result.

$$y^* = \frac{\int y[\mu_F(y)]^{\alpha} d_y}{\int [\mu_F(y)]^{\alpha} d_y} \quad \dots\dots\dots\dots\dots8$$

In this paper, we use Mamdani for tuning the limit of membership, t-norm, s-norm, negation of Mamdani and logical approaches, combination of both methods and defuzzification of the system.

B) Proposed Model in Export Value Forecasting

To validate the performance of the proposed rule based fuzzy scheme to predict spread possible in target market, the study uses the Persian carpet export data of the quantified 9 years period ending 2010. Allowing to recovered information from trade databases, Iran exports carpet to the total 146 countries and free zones. We present a type-2 fuzzy model for data analysis of international market of Persian carpet. To detect the behavior of export trade, first of all five variables including Recency, Frequency, Monetary, Continuously and Trend are determined from time series of export Persian carpet for each country as effort variables of system and export value which is calculated by equation (8) is considered as output variable.

VII. RESULT

The differ types in the way output is determined. In the Mamdani-type, after the aggregation process the output membership function of the output variable is a fuzzy set.

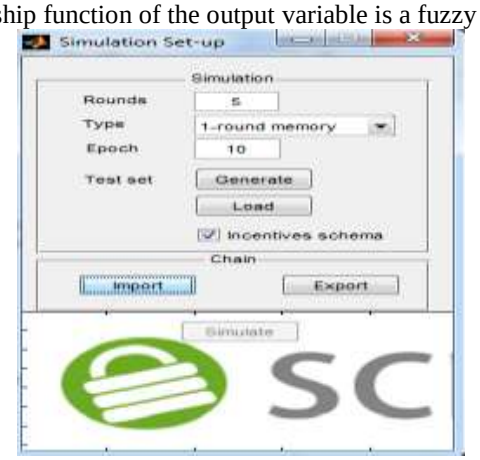

Fig 4: Load RDF Quality Data for Supply Chain

Fig 5: Generate Test Case for Quality

Fig 6: Simulate Parameter for Market demand Forecasting using Bullwhip effect

Shapley Computation Shapley Delta computation Payoff computation internal context: Replace ability
Probability Computation Conditional Probability Computation Risk Landscape Computation Incentives lot evaluated Shapley Delta after incentives Conditional Probability Computation after Incentives Impact after incentives Simulate scenarios

Attacker:
ans =Avio Parameter variation
ans = 40 40

Attacker:
ans =Ext_man Parameter variation
ans =126 136

Attacker:
ans = Pin_D Parameter variation
ans = 100 100

Attacker:
ans = Boro_B Parameter variation
ans = 76 77 Next round

rounds = 3
Shapley Computation Shapley Delta computation PayOff computation Internal context: Replaceability
Probability Computation Conditional Probability Computation Risk Landscape Computation Incentives incentives lot evaluated Shapley Delta after incentives Conditional Probability Computation after Incentives Impact after incentives Simulate scenarios
Attacker:
ans =Pin_D Parameter variation
ans = 100 100

Attacker:
ans = Pin_E

Parameter variation
ans =150 150

Next round
rounds = 4
Shapley Computation Shapley Delta computation Payoff computation internal context: Replaceability Probability Computation Conditional Probability Computation Risk Landscape Computation Incentives incentives lot evaluated Shapley Delta after incentives Conditional Probability Computation after Incentives Impact after incentives Simulate scenarios
Attacker:
ans =Bushing_C

Parameter variation
ans = 120 61

Attacker:
ans =Pin_E

Parameter variation
ans = 150 150

Next round
rounds = 5

Next Test
epoch = 10

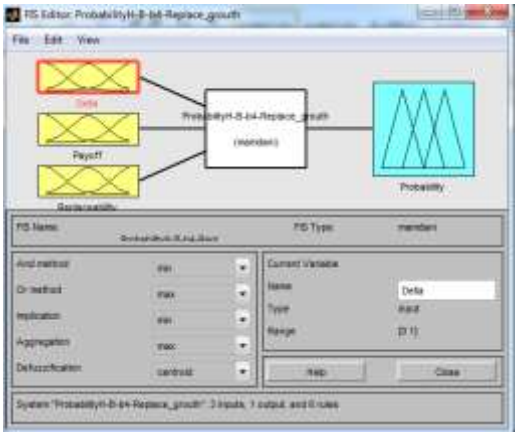

Fig 4: Reliability, Payoff, Delta forecasting using Mamdani

In fig 4 shows that Forecasting of Reliability, payoff using Mamdani method to calculate Delta current variable.

Fig 5 presents the Risk response surface with quality and round time as input variables. There lativel smooth surface depicts the order score to be diminished significantly with round time.

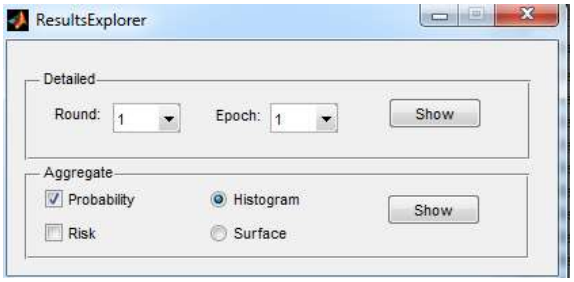

Fig 5: Show Probability and Risk Level interface

	Delta %	Payoff %	Context	Probability	Impact %	Risk %
Ext_man	100	29	50	0.49	24.89	12.19
Shroud_A	77.29	28	0	0.41	5.98	2.45
Boro_B	81.83	16	0	0.41	4.27	1.75
Bushing_C	95.45	3	0	0.41	0.17	0.07
Avio Prod	0	0	50	0.12	0	0
Pin_D	100	0	50	0.49	0	0
Pin_E	49.6	0	50	0.25	0	0

Fig 6: Round Table Parameter details

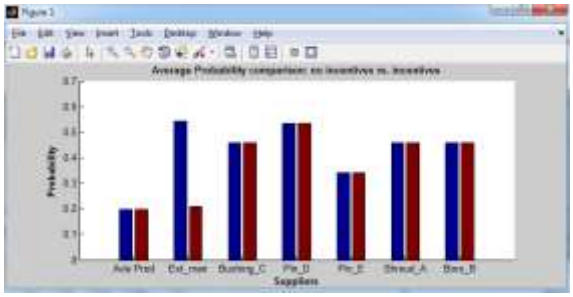

Fig 7: Average Probability comparison: Probability & Suppliers

Better demand forecasts allow reliable operations at low inventory costs throughout the entire supply chain. Mamdani technology gives us the best performance (Min Price) after the conciliation between the customer(Probability) and suppliers.

VIII. CONCLUSION

Supply chain management has become not just a query of effectual logistic process, but is related to the growth and survival of organization(s). With customers becoming more challenging in their requirement of facilities from the suppliers, the construction of an efficient and combined supply-chain has assumed paramount importance. Information technology shows a major role in the formation of the supply chain. The decision sustenance provided by IT products (ERPs, Network construction tools etc.) can help the decision makers in the growth of the supply chain procedure and in operation. The broadcasting of the demand (forecast) information through the chain can lead to avoidance of the "Bullwhip" effect. The measurable models embedded in supply chain organization are still at a very basic stage (in comparison to the theoretical developments), for decision support in the structure of an integrated demand-supply chain, use must be made of these progressive techniques.

REFERENCES

[1] J.W. Forrester, "Industrial dynamics—a major breakthrough for decision making," Harvard Business Review, vol. 36, no. 4, pp. 37– 66, 1958.

[2] O.J. Blanchard, "The production and inventory behavior of the American automobile industry," Journal of Political Economy, vol. 91, pp. 365–400, 1983.

[3] A.S. Blinder, "Inventories and sticky prices," Am Econ Rev, vol. 72, pp. 334–349, 1982.

[4] J. Kahn, "Inventories and the volatility of production", Am Econ Rev, vol. 77, pp. 667-679, 1987.

[5] J. D. Sterman, "Modeling managerial behavior: misperceptions of feedback in a dynamic decision making experiment," Management Science, vol. 35, pp. 321–339, 1989.

[6] H.L. Lee, P. Padmanabhan, S. Whang, "Information distortion in a supply chain: the bullwhip effect," Management Science, vol. 43, pp. 546–558, 1997.

[7] H.L. Lee, P. Padmanabhan, S. Whang, "Bullwhip effect in a supply chain," Sloan Management Review, vol. 38, pp. 93-102, Spring, 1997.

[8] S.C. Graves, "A single-item inventory model for a non-stationary demand process," Manufacturing & Services Operations Management, vol. 1, no. 1, pp. 50–61, 1999.

[9] F. Chen, Z. Drezner, J.K. Ryan, D. Simchi-Levi, "Quantifying the bullwhip effect in a simple supply chain," Management Science, vol. 46, no. 3, pp. 436–443, 2000.

[10] F. Chen, Z. Drezner, J.K. Ryan, D. Simchi-Levi, "The impact of exponential smoothing forecasts on the bullwhip effect," Naval Research Logistics, vol. 47, pp. 269–286, 2000.

[11] X Zhang, "The impact of forecasting methods on the bullwhip effect," International Journal of Production Economics, vol. 88, pp. 15-27, 2004.

[12] (Khan, Z, 2010) Alsmadi, M.; Khan, Z.; , "Lean sigma: The new wave of business excellence, literature review and a framework," Engineering Systems Management and Its Applications (ICESMA), 2010 Second International Conference on , vol., no., pp.1-8, March 30 2010- April 1 2010
URL:http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5542688&isnumber=55 42651 y (Iron Systems,

[13] Feller A., Shunk D., and Callarman T., Value chains versus supply chains (BPT Trends, March, 2006)

[14] Foster Jr. S. T. Towards an understanding of supply chain quality management, Journal of Operations Management (26), pp. 461– 467, 2008.

[15] Bowersox, D., Closs, D., Cooper, M.B., Supply chain logistics management (McGraw Hill, New York, NY, 2007)