

# A Dynamic Simulation of Service Quality, Customers Satisfaction and Cash Flow in a Pharmaceutical Distribution Company

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## Abstract

In the current competitive business environment many factors can influence on firms Survival, but the most important factors those senior managers focus are service quality, customer's satisfaction and cash flow, it is aimed to simulate these factors in a company. In most situation a company have good amount of potential customers who order for the first produce line, but inventory is not enough to answers all orders, hence back orders and lost orders comes up. Lost orders will effects on market and companies market share directly, back orders will gradually effect on companies market share and directly play a role on supply chain planning.

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*Index terms*— Customer's satisfaction, service quality, cash flow, orders quality.

## 1 I. Introduction

celerating economic, technological, social, and environmental change challenge managers and policy makers to learn at increasing rates, while at the same time the complexity of the systems in which we live is growing. Many of the problems we now face arise as unanticipated side effects of our own past actions. Over the past decade, many top companies, consulting firms, and governmental organizations have used system dynamics to address critical issues.

System dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems. System dynamics is also a rigorous modeling method that enables us to build formal computer simulations of complex systems and use them to design more effective policies and organizations.

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Author ? : BS in Electronics Engineering Islamic Azad University, Tehran, Iran. E-mail : azadeh\_sohrabinejad@irib.ir H.I.T.T. Pharmaceutical group is one of the biggest private pharmaceutical holding companies in Iran, with 50 years experience in develop, produce and distribute pharmaceutical products in Iran. These companies are as follows: ? Tehran Chemie Pharmaceutical Co. ? Afa Chemie Pharmaceutical Co. ? Tehran Darou Pharmaceutical Co. ? Darou Gostar Nokhbegan Co. This paper is organized as follows: First the literature reviews, Second propose the dynamic model of the company which includes Customers, order and cash flow as three different parts, and the third part is the conclusion.

## 2 II. Literature Review

Discrete event simulation (DES) and system dynamics (SD) are two modeling approaches widely used as decision support tools in logistics and supply chain management (LSCM). A widely held belief exists that SD is mostly used to model problems at a strategic level, whereas DES is used at an operational/tactical level. The outcome is a set of dominant loops that determine the dynamics of capacity growth. It is revealed that the delivery delay information has little effect while the loop that connects retail sales with production order affects the dynamics significantly.

Narasimha B. Kamath, Rahul Roy [1] proposes a method for identifying critical information flows using the system dynamics model of a two-echelon supply chain. The fundamental premise of system dynamics methodology

43 is that (system) structure determines (its) behavior. Using loop dominance analysis method, the feedback loop  
44 structure of the supply chain system is studied.

45 A research on "postponement" strategy in the context of a global production-distribution system is considered  
46 by Kanghwa Choi, Ram Narasimhan [2]. It proposes a model that integrates multiple considerations germane  
47 to global supply chains. Postponement is important in this context because it is In, Fredrik Persson [3] a work  
48 to develop a simulation tool for supply chain simulation based on the SCOR model is reported. The SCOR  
49 template is a set of predefined SCOR compliant building blocks in the Arena simulation software. In Persson  
50 and Araldi (inpress) the first version of the tool was described and two tests of the tool were reported on. The  
51 first version was incomplete since It lacked the SCOR predefined metrics and some of the predefined processes.  
52 This paper presents the second version of the SCOR template that Proposed model in Suresh S. Pitty et al [4]  
53 has been implemented as a dynamic simulator, called Integrated Refinery In-Silico (IRIS). IRIS allows the user  
54 the flexibility to modify not only parameters, but also replace different policies and decision-making algorithms  
55 in a plug-and-play manner. It thus allows the user to simulate and analyze different policies, configurations,  
56 uncertainties, etc., through an easy-to-use graphical interface. The capabilities of IRIS for strategic and tactical  
57 decision support are illustrated using several case studies.

58 Nina YAN [5] establishes model a reverse chain system with one manufacturer and one retailer under demand  
59 uncertainties. a two-stage dynamic model for reverse supply chain based on remanufacturing is proposed for  
60 distinguishing between the recycling process of the retailer and the remanufacturing process of the manufacturer,  
61 by Using buyback contract as coordination mechanism and applying dynamic programming the optimal decision  
62 problems for each stage are analyzed.

63 The development of efficient capacity planning policies for remanufacturing facilities in reverse supply chains  
64 is tackle in Dimitrios Vlachos et al [6], taking into account not only economic but also environmental issues,  
65 such as the take-back obligation imposed by legislation and the "green image" effect on customer demand. The  
66 behavior of the generic system under study is analyzed through a simulation model based on the principles of  
67 the system dynamics methodology.

68 Jose B. Cruz Jret et al [7] presents a novel multitime-stage input-output-based modeling framework for simulating.  
69 Control term enables the system to regulate the dynamics. Feature since the uncontrolled dynamic model  
70 exhibits oscillatory or unstable behavior under some conditions; this is an important which allows such undesirable  
71 characteristics to be suppressed.

72 A model of a generic supply-chain node is developed in Wing Yan Hung et al [8] to capture the features present  
73 in all supply-chain entities. The generic node models in detail activities such as inventory control, manufacturing  
74 processes and order handling. The supply-chain model is constructed by specifying the physical and business  
75 attributes of each supply-chain member. This model provides a fully dynamic simulation of the supply-chain and  
76 the effect of various uncertainties.

77 During the last half century many mathematical tools emerging from the control literature have been applied  
78 to the supply chain management problem. These tools vary from classical transfer function analysis to highly  
79 sophisticated control methodologies, such as model predictive control (MPC) and neuro-dynamic programming.  
80 The aim of Haralambos Sarimveis et al. [9] is to provide a review of this effort .The bottom line of this review is  
81 that a joint co-operation between control experts and supply chain managers has the potential to introduce more  
82 realism to the dynamical models and develop improved supply chain management policies.

83 Antuela A. Tako and Stewart Robinson [10] aims to explore the application of Discrete event simulation  
84 (DES) and system dynamics (SD) in logistics and supply chain management (LSCM) with a view to identifying  
85 differences and/or similarities in terms of the nature and level of their use. We define the nature of use in terms  
86 of the type of LSCM issues modeled using DES and SD.

87 Modifying these kind of loops yields appropriate capacity augmentation decisions resulting in higher  
88 performance. What-if analyses bring out effects of modifying other structural elements. In conclusion, it is  
89 claimed that the information feedback based methodology is general enough to be useful in designing decision  
90 support systems for capacity augmentation.

91 This is aimed to make a stimulated model in a distributing pharmaceutical company.

### 92 3 III. Research Methodology

93 To make the system dynamic model according to Customer receive products following steps are considered: 1.  
94 Divided the firm to different parts, in this case we can divide the sale flows to three parts which are: customers,  
95 orders, and cash flow. Requirement is the basis of product development, and it can vary with time. The variation  
96 of customer makes the variation of products and therefore market competition will happen.

97 In this part it is tried to model customer relationships in the company among this competitive market. First  
98 introducing related variables: According to Fig 1 competitive market effects directly on customer and their orders,  
99 so communicate with potential customers and sales relations play important roles in companies' market share.

100 In this part potential customers, in line customers and companies customers are stocks.

101 Received orders and answered orders are flows.

102 So the final model will illustrate as follows:

103 i. Orders ? Answered new order : the fraction of orders can be answered from new orders in period t, this  
104 factor makes new back order reduced and has a direct effect on inventory.

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105 ? In used products : fraction of sold products which are working and no replacement is needed. This variable  
106 affects in answered new orders directly and reorders inversely.

107 ? Re back order : back orders belong to period t-1 and answer in period t.

108 ? Answered re order : orders which is got by old customers, it has a direct effect on in used products.

109 A ? Back order : an order to purchase something that is not currently available but will be sent at a later  
110 date.

111 ? New order : orders in period t which there wasn't exist in period t-1, this variable effect on new back orders.  
112 This variable directly Effects on back order. ii. Cash flow The variables used for measuring accountingbased  
113 performance are cash flow. Cash flow is a comparable accounting-based measure across firms. Extant research  
114 in finance has long proposed that the value of a firm equals the net present value of all future cash flows  
115 .Moreover; existing research in marketing has also supported cash flows as an appropriate measure of firm value  
116 ??Srivastava et al. 1998). Marketing efficiency leads increasing cash flows by repurchases of satisfied customers  
117 and purchases of acquired customers.

118 ? Cost : the amount of money should pay in order to produce products. This factor has directly affects in  
119 price and annual expenses.

120 ? Annual expenses : average cost in a year, which directly effects on answered orders and cost and inverse  
121 affects in taxable income.

122 adjusting for the cost of doing business, depreciation, interest, taxes and other expenses. This factor is affected  
123 by gross income and tax.

124 ? Taxable income : The amount of income that is used to calculate an individual's or a company's income tax  
125 due.

126 ? Annual interest : the amount charge by a lender to a borrower for the use of assets during a year.

127 ? Tax rate : the burden ratio (usually expressed as a percentage) at which a business or person is taxed.

128 ? Tax : amount of money which should be paid to government according to taxable income.

129 ? Capital : amount of money which is used to start a business.

130 ? Loan : amount of money which is borrowed from a bank.

131 ? Loan payment period : the period of time in which the loan should be paid.

132 ? Debt : sum of money that organization owes. In Fig 5, it is appears that the cash balance is deal with debt  
133 and annual interest which they result effects on taxable income. There for stock would be debt as it is shown in  
134 Fig 6. ? Gross income : A company's revenue minus cost of sales price and has affect in taxable income and net  
135 income.

136 ? Net income : A company's total earnings (or profit).

137 Net income is calculated by taking revenues and goods sold, this is affected by answered order and

138 ? Interest rate : The amount charged, expressed as a percentage of principal, by a lender to a borrower for  
139 the use of assets. In which variable order effects new order, variable answered new order affect in answered order  
140 and answered order effects on gross income and annual expenses. iv.

## 141 4 Conclusion

142 As supply chains have moved from a cost focus to a customer focus and now currently to a strategic focus, the  
143 need to think strategically about the supply chain has never been more important. The success of a strategy is  
144 only as good as the company's ability to fully and properly execute it. A great supply chain strategy, linked with  
145 operational excellence, can provide success for not only the company but also its partners and customers. We  
146 believe that demand analysis Supply Chain management is an amazing challenge for companies to satisfy their  
147 customers in a better way. The three sections of the industrial supply chain need to interact to ensure goods  
148 or services reach consumers. In this paper we discussed the logistical view on LSCM. A three stage integration  
149 model seems to be realistic for the LSCM-industry. <sup>1</sup>

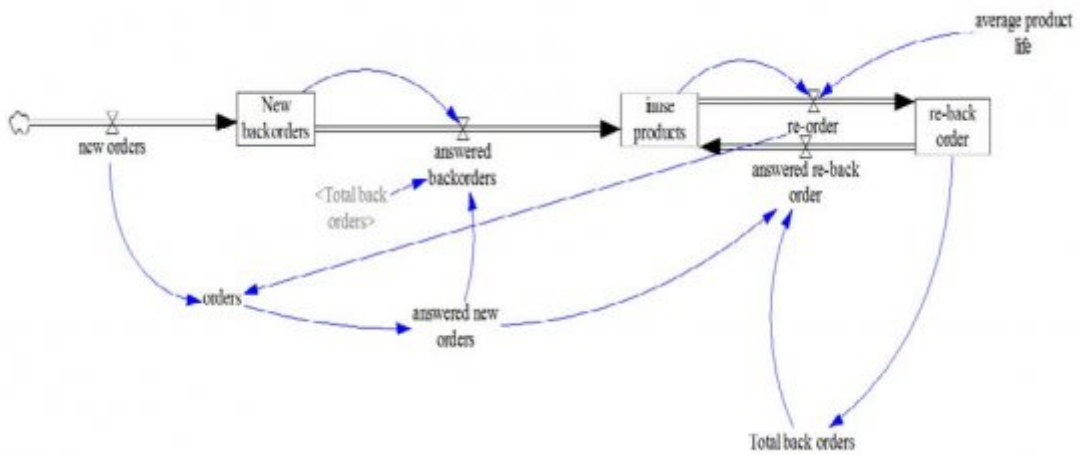
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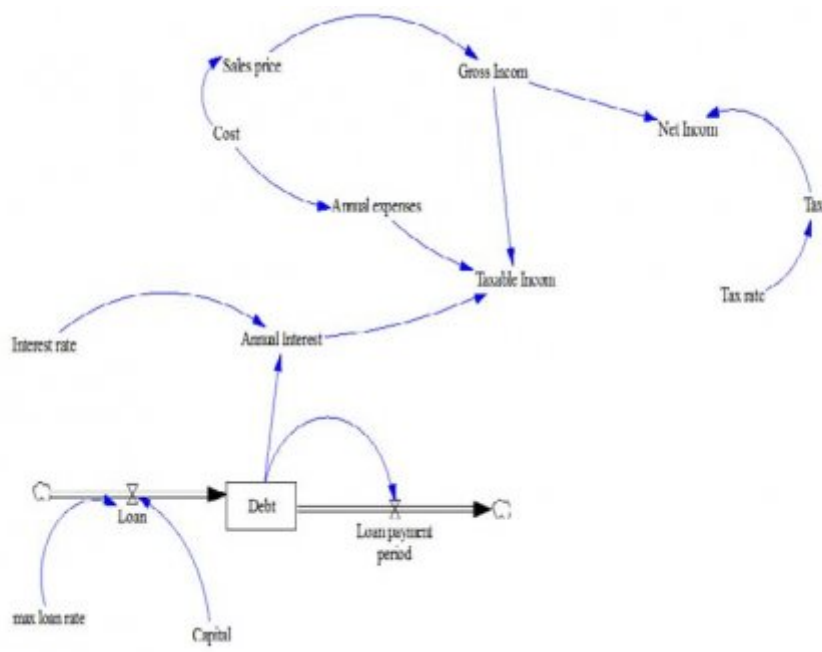
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Figure 1: 2 .



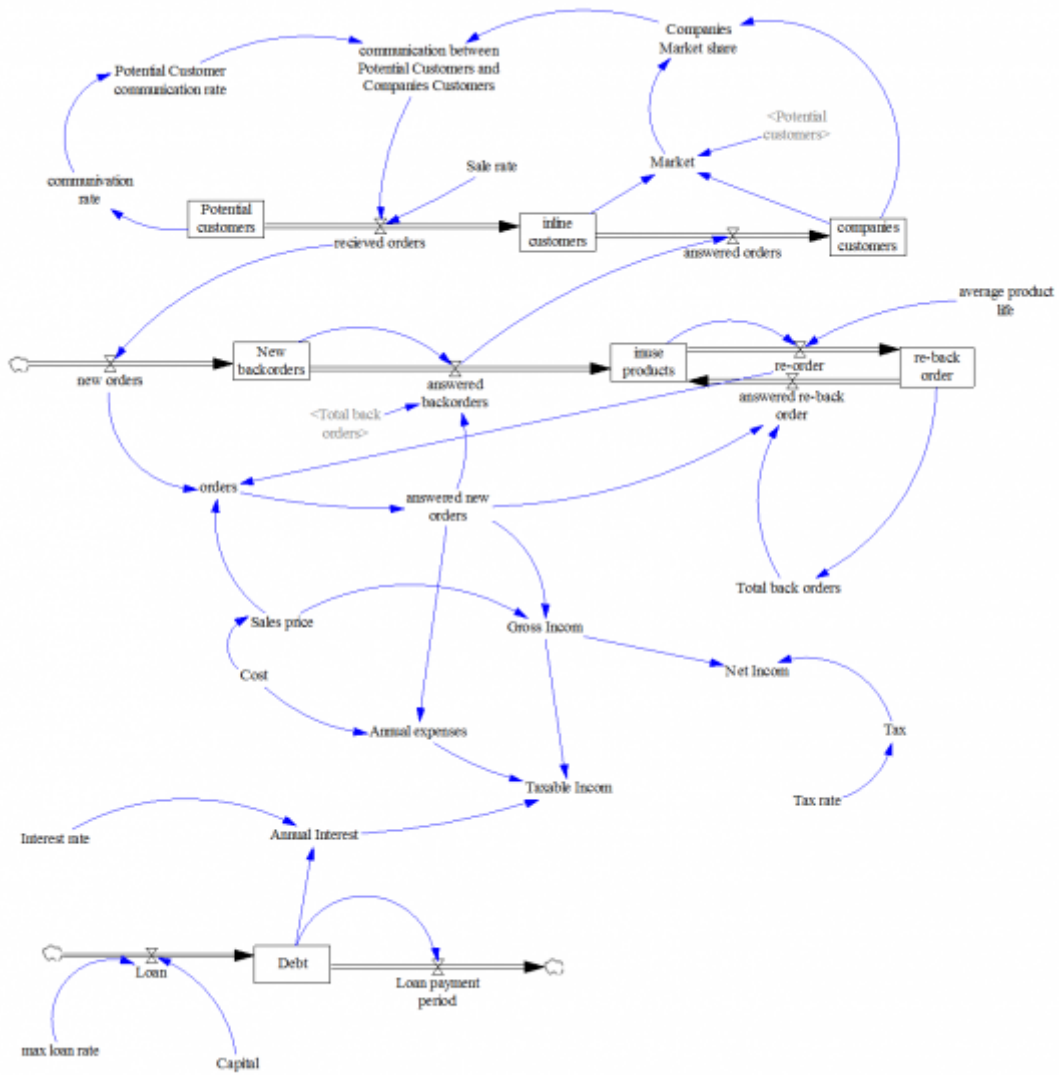
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Figure 2: Figure 2 :



3

Figure 3: Figure 3 :



3

Figure 4: According to fig 3 ,

$$\begin{aligned}
 & \text{New Orders} + \text{new back orders} - \text{answered back orders} + \text{in use products} + \text{re-back order} \\
 & + \text{orders} - \text{answered new orders} + \text{Total back orders} + \text{answered re-back order} \\
 & + \text{orders} - \text{answered new orders} + \text{Gross Income} - \text{Cost} - \text{Annual expenses} - \text{Tax} \\
 & + \text{Debt} - \text{Loan payment period} + \text{Annual Interest} - \text{Interest rate} + \text{Loan} - \text{max loan rate} + \text{Capital}
 \end{aligned}$$

Figure 5:

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