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

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

Razieh Lotfalian Saremi [α] & Azadeh Sohrabi Nejad [σ]

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On the other hand products price will cause a big change on orders which effects on income. And presumably the annual expenses and tax will change. This illustrates the Company cash flow and the credit which it can invest on getting loans.

In this paper, it is tried to simulate all this parts, therefore the model is formed of three parts: customers satisfactory, orders and service quality and cash flow.

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I. Introduction

Accelerating 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.

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.

In most cases the distribution companies face to back orders and lost customers which make them not earn good income, there for they cannot answer orders on time.

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.

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

A research on “postponement” strategy in the context of a global production–distribution system is considered by Kanghwa Choi, Ram Narasimhan [2]. It proposes a model that integrates multiple considerations germane to global supply chains. Postponement is important in this context because it is necessary to consider international transfers and tariffs, and it is important to appropriately account for the impact of postponement on total costs.

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In, Fredrik Persson[3] a work to develop a simulation tool for supply chain simulation based on the SCOR model is reported. The SCOR template is a set of predefined SCOR compliant building blocks in the Arena simulation software. In Persson and Araldi (inpress) the first version of the tool was described and two tests of the tool were reported on. The first version was incomplete since It lacked the SCOR predefined metrics and some of the predefined processes. This paper presents the second version of the SCOR template that contains all major processes and also a metric building block used to extracts emulation outputs during and after assimilation run, the Metric module.

Proposed model in Suresh S. Pittyet el [4] has been implemented as a dynamic simulator, called Integrated Refinery In-Silico (IRIS). IRIS allows the user the flexibility to modify not only parameters, but also replace different policies and decision-making algorithms in a plug-and-play manner. It thus allows the user to simulate and analyze different policies, configurations, uncertainties, etc., through an easy-to-use graphical interface. The capabilities of IRIS for strategic and tactical decision support are illustrated using several case studies.

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

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

Jose B. Cruz Jret el [7] presents a novel multi-time-stage input–output-based modeling framework for simulating.

The dynamics of bio energy supply chains. Extending the model further by introducing a feedback.

Control term enables the system to regulate the dynamics. Feature since the uncontrolled dynamic model exhibits oscillatory or unstable behavior under some conditions; this is an important which allows such undesirable characteristics to be suppressed.

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

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

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

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

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

III. Research Methodology

To make the system dynamic model according to Customer receive products following steps are considered:

1. Divided the firm to different parts, in this case we can divide the sale flows to three parts which are: customers, orders, and cash flow.
2. Is determining different variables then define relationships between them in the issue .All variables divided to two groups, Stocks and flows.

Stocks represent accumulations. They accumulate the difference between their inflows and outflows. They typically have units like dollars, defects, widgets, etc..

Flows change the level of stocks and are usually measured in units per time (dollars/month, widgets/yr.)

This model is stimulated in a distributing pharmaceutical company which is makes 3 different parts.

In this part of the research the model will be illustrated by Vensim.

a) Customer

Requirement is the basis of product development, and it can vary with time. The variation of customer makes the variation of products and therefore market competition will happen.

In this part it is tried to model customer relationships in the company among this competitive market.

First introducing related variables:

- *Potential customers :* any person or business that may be interested, seeking, could be convinced, sold, advertised to, walk by your shop, read your ad, view your video, Hear your radio ads, or your story about a product. Anyone having a need, which you may be able to fulfill. This variable directly effects on communication of potential customers, rate of orders, and market.
- *Received orders :* orders of potential customers, it directly effects on in line customers and has a reverse effect on potential customers. Also sales rate and communication between potential customers and companies customers directly effects on it.
- *Communication rate :* rate of communicate between potential customers and company customers.
- *Potential customer communication rate:* total communication between potential customers.
- *Communication between potential customers and companies customer :* number of potential customers who works with company. This variable effects on rate of order and be affected by potential communication rate.
- *Sales rate:* fraction of potential customers who buy our products.
- *In line customers:* the orders of potential customers which are not answered back yet.
- *Answered orders :* received orders which be answered.
- *Companies' customer :* total customers who order companies products.
- *Market :* total demand, this variable has direct effect on in line customers, companies' customers and potential customers and inverse effect on companies' market share.
- *Companies market share :* fraction of companies' customers to whole customers in the market.

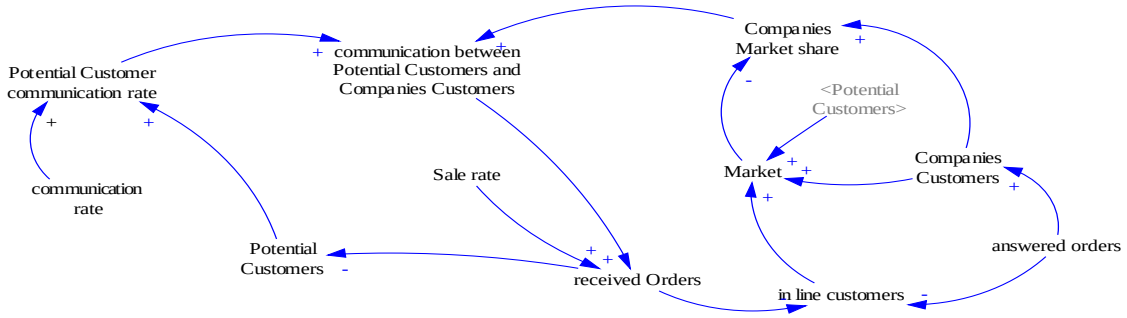

Figure 1 : Positive and negative feedback loops of customer's model.

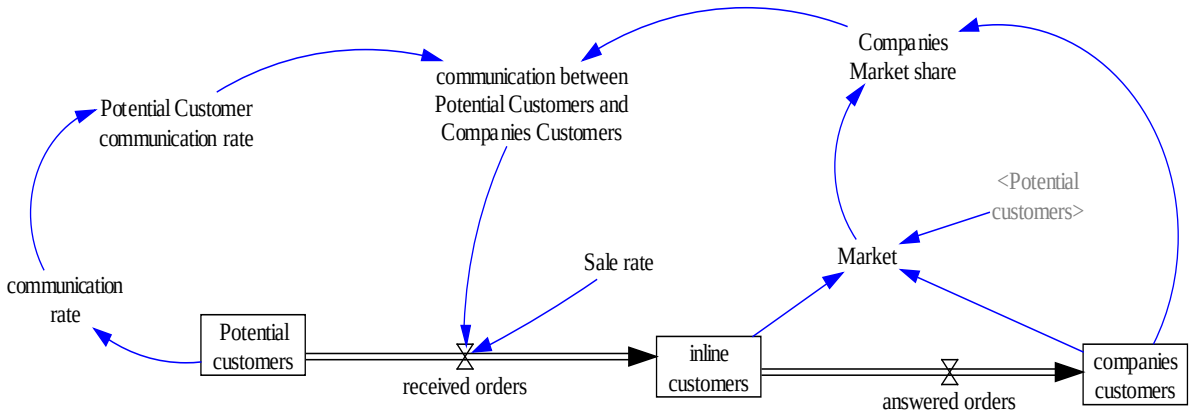

Figure 2 : Model of companies' customers.

According to Fig 1 competitive market effects directly on customer and their orders, so communicate with potential customers and sales relations play important roles in companies' market share.

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

Received orders and answered orders are flows.

So the final model will illustrate as follows:

i. *Orders*

- *Back order :* an order to purchase something that is not currently available but will be sent at a later date.
- *New order :* orders in period t which there wasn't exist in period t-1, this variable effect on new back orders. This variable directly Effects on back order.

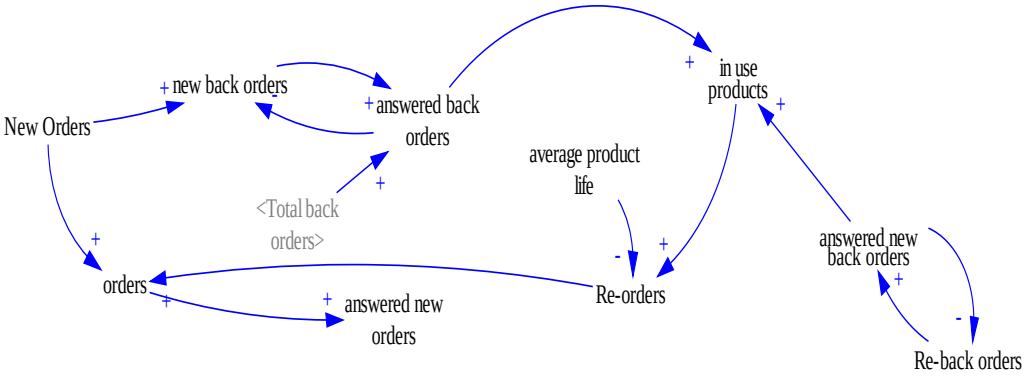

Figure 3 : Positive and negative feedback loops of orders' model.

- *Answered new order :* the fraction of orders can be answered from new orders in period t, this factor makes new back order reduced and has a direct effect on inventory.
- *In used products :* fraction of sold products which are working and no replacement is needed. This variable affects in answered new orders directly and reorders inversely.
- *Re order :* orders in period t which exists in period t-1. (Old customers: customers who reorder products in different periods)
- *Re back order :* back orders belong to period t-1 and answer in period t.
- *Answered re order :* orders which is got by old customers, it has a direct effect on in used products.

According to fig 3, it is crystal clear that back order is the most effective item in answering orders and new production planning.

Hence the stocks should be new back orders, in use product and re-back order, which are shown in Fig 4.

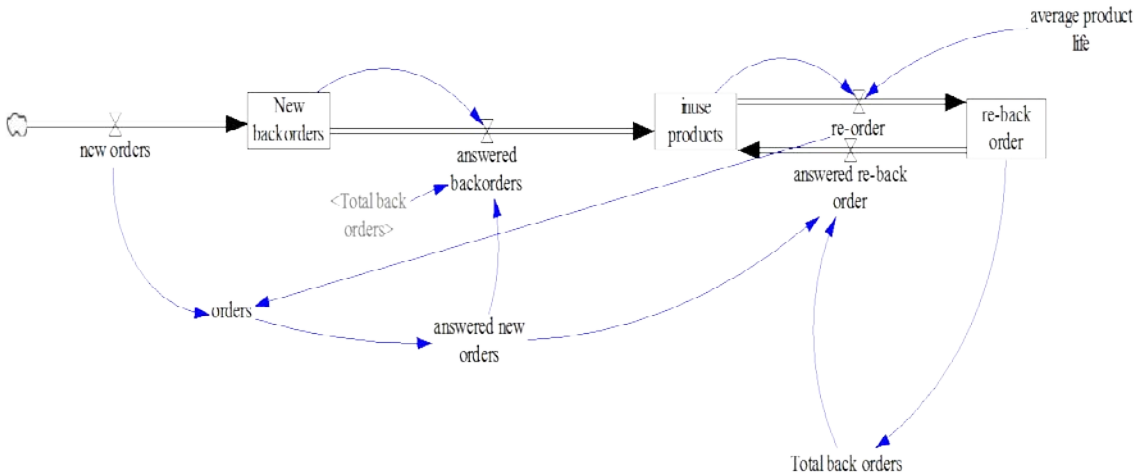

Figure 4 : Model of companies' order.

ii. *Cash flow*

The variables used for measuring accounting-based performance are cash flow. Cash flow is a comparable accounting-based measure across firms. Extant research in finance has long proposed that the value of a firm equals the net present value of all future cash flows .Moreover; existing research in marketing has also supported cash flows as an appropriate measure of firm value (Srivastavaet al. 1998). Marketing efficiency leads increasing cash flows by repurchases of satisfied customers and purchases of acquired customers.

- *Cost :* the amount of money should pay in order to produce products. This factor has directly affects in price and annual expenses.
- *Annual expenses :* average cost in a year, which directly effects on answered orders and cost and inverse affects in taxable income.
- *Gross income :* A company's revenue minus cost of goods sold, this is affected by answered order and sales price and has affect in taxable income and net income.
- *Net income :* A company's total earnings (or profit). Net income is calculated by taking revenues and adjusting for the cost of doing business, depreciation, interest, taxes and other expenses. This factor is affected by gross income and tax.
- *Taxable income :* The amount of income that is used to calculate an individual's or a company's income tax due.
- *Interest rate :* The amount charged, expressed as a percentage of principal, by a lender to a borrower for the use of assets.
- *Annual interest :* the amount charge by a lender to a borrower for the use of assets during a year.
- *Tax rate :* the burden ratio (usually expressed as a percentage) at which a business or person is taxed.
- *Tax :* amount of money which should be paid to government according to taxable income.
- *Capital :* amount of money which is used to start a business.
- *Loan :* amount of money which is borrowed from a bank.
- *Loan payment period :* the period of time in which the loan should be paid.
- *Debt :* sum of money that organization owes.

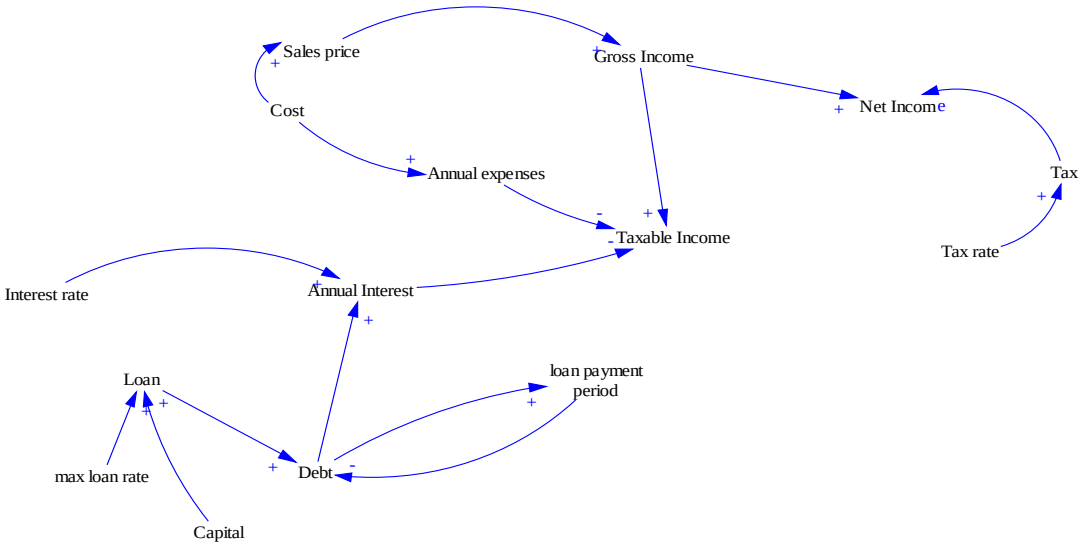

Figure 5 : Positive and negative feedback loops of cash flow's model.

In Fig 5, it is appears that the cash balance is deal with debt and annual interest which they result effects on taxable income. There for stock would be debt as it is shown in Fig 6.

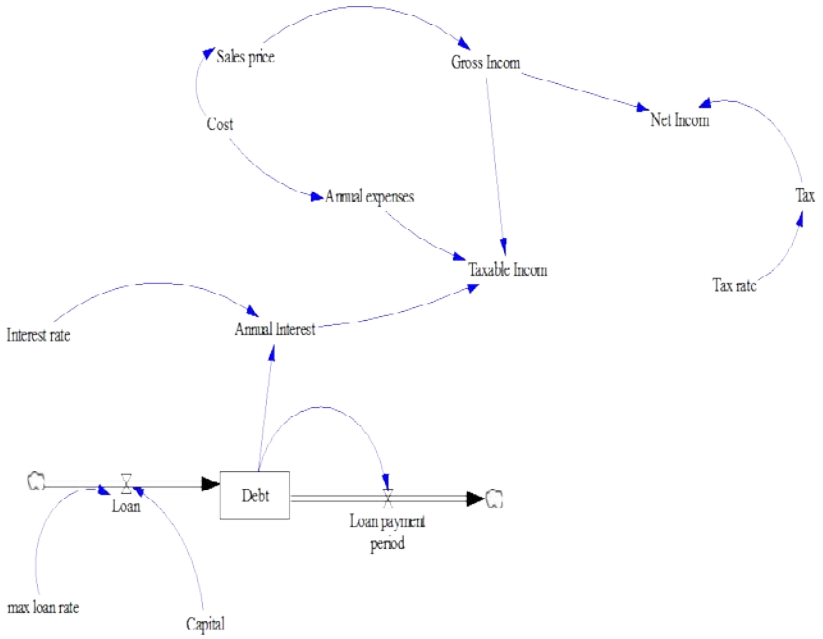

Figure 6 : Dynamic model of cash flow.

iii. *Whole companies' model*

By combining the 3 above model, whole companies' dynamic model creates.

In which variable order effects new order, variable answered new order affect in answered order and answered order effects on gross income and annual expenses.

Figure 7 : Positive and negative feedback loops of budget and demand.

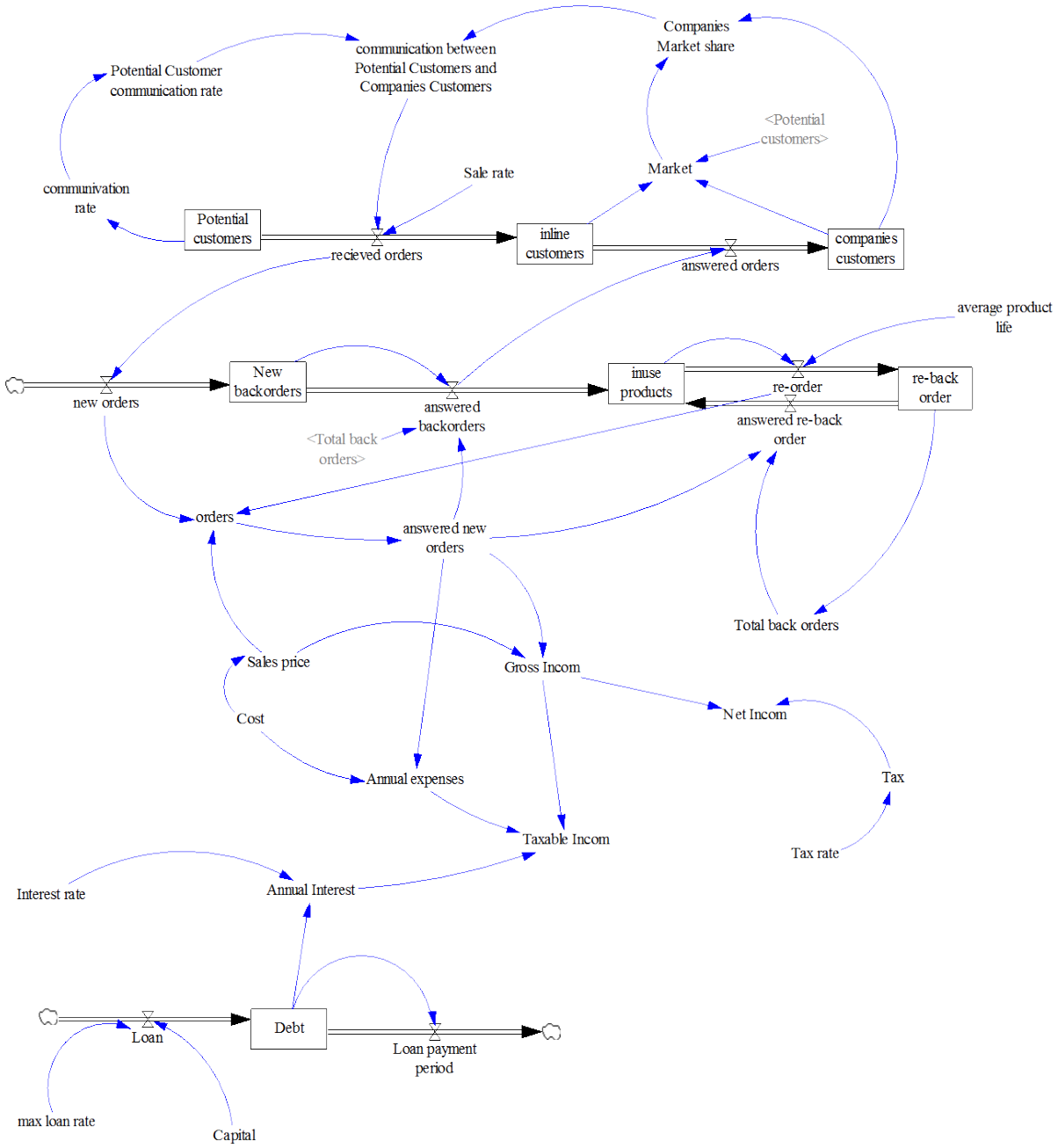

Figure 8 : Dynamic model of budget and demand.

IV. Conclusion

As supply chains have moved from a cost focus to a customer focus and now currently to a strategic focus, the need to think strategically about the supply chain has never been more important. The success of a strategy is only as good as the company's ability to fully and properly execute it. A great supply chain strategy, linked with operational excellence, can provide success for not only the company but also its partners and customers.

We believe that demand analysis Supply Chain management is an amazing challenge for companies to satisfy their customers in a better way. The three sections of the industrial supply chain need to interact to ensure goods or services reach consumers. In this paper we discussed the logistical view on LSCM. A three stage integration model seems to be realistic for the LSCM-industry.

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