Title: Improving sustainability in the Indian pharmaceuticals industry through reverse logistics: a conceptual study

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Abstract

Wide-spread income disparities, poor government medical insurance coverage and the dangerous impact of pharmaceuticals disposal/ incineration have motivated the present study which attempts at improving sustainability in the Indian Pharmaceuticals Industry. In this regard, structural changes to the current distribution systems are proposed via the novel management of reverse logistics activities. Modifications are presented to an existing causal loop model developed previously by the authors. This conceptual model is expected to improve the dynamic sustainable performance of the industry through properly managed product relocation and pricing initiatives, collaborative stakeholder involvement, revamped regulations, etc.

Keywords: Sustainability, Reverse Logistics, Indian Pharmaceuticals Industry

Introduction

Sustainable development in healthcare is the need of the hour and has been recognized on a global level such as in the 2002 World Health Summit on Sustainable Development. The pharmaceuticals industry is continuously faced with challenges related to product quality, affordability and efficacy, which have implications for the environment, consumers, healthcare providers and financial intermediaries in healthcare. As a result, these challenges also impact the profitability of the industry. Thus, the management of pharmaceuticals is crucial to providing sustainable solutions in healthcare. In India, almost 86% of the population depends on out-of-
pocket expenditures to satisfy healthcare needs (World Health Statistics 2013), while availability of essential medicines in public healthcare system can be as low as 25% (Kotwani et al. 2007). Additionally, product returns due to expiry and damages range between as low as 1.5% to 10% of sales (Narayana et al. in press). Such waste has the potential of being harmful to the environment as disposal procedures and regulations are under development. This makes it imperative for the private-dominated pharmaceuticals industry to adopt sustainable solutions which can help in providing access to medicines to all sections of society in an affordable and eco-friendly manner.

This study focuses on the role of Reverse Logistics (RL) in the development of sustainable solutions in the Indian pharmaceuticals industry. Reverse logistics refers to “the process of planning, implementation, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal” (Rogers and Tibben-Lembke 1999). While research efforts in reverse logistics have tried to address economic and environmental performance of an industry, the focus on the social dimension of sustainability has been low (Sarkis et al. 2010). Furthermore, although reverse logistics is an important process in the supply chain, few studies have focused on its role in the pharmaceuticals industry (Narayana et al. 2014, Narayana et al. in press).

In order to study the role of reverse logistics in providing sustainable solutions in the Indian pharmaceuticals industry, Narayana et al. (in press) presented a causal loop model (Figure 1) which was developed to represent the current practices in the industry. Through a group-model building session, the causal loop model was developed using systems thinking methodology and helped in explaining the Behaviour-Over-Time (BOT) chart for variables relevant to sustainability (sales, product returns, quality issues, effective returns, etc.). Figure 1 depicted that while there is a great focus on driving sales through a process of flooding the market with products, there is low focus on socially sustainable practices of redistributing excess stock before expiry (effective returns). As a result, product returns and disposal due to expiry persist, while there is still demand for medicines in needier markets. Following the development of the initial causal loop model, dynamic modelling was carried out to simulate the base-case behaviour. An initial sensitivity analysis of various control factors within the dynamic model revealed the need to study the impact of certain factors related to the market attractiveness, product shelf life, market flooding and various delays with respect to the RL process. Given that effective returns are not carried out in the Indian pharmaceuticals industry, they were not incorporated in this model. Nevertheless, using systems thinking, we explore the utility of the same in this study and provide directions for application oriented research in this regard.

Following a description of systems thinking and dynamic modelling methodology, the suggested structural changes are presented. Discussions and scope for future research are presented in the concluding section.
Figure 1 - Causal Loop Diagram that Represents the Complexities in the Indian Pharmaceuticals Industry (source: Narayana et al. in press)
Systems Thinking and Modelling Methodology

Systems thinking and modelling is a methodology that gained increasing attention in the 1960s through the pioneering efforts of Jay Forrester. It focuses on causal linkages between variables and feedback between elements in order to explain, understand and change system behaviour. Research efforts in reverse logistics have recently begun applying systems thinking and dynamic model building approaches (e.g. Georgiadis and Besiou 2010, Georgiadis and Vlachos 2004, Kumar and Yamaoka 2007). The model building methodology is essentially based on synthesising qualitative and quantitative approaches to understanding the system under consideration. Causal loop model development is an important part of the process and helps in providing a conceptual understanding of linkages within the system. Following the initial model observed in Figure 1, changes are made in the causal loop model in this study. This causal loop model provides a basis for dynamic model development.

Suggested Changes for the Indian Pharmaceuticals Industry

Figure 2 highlights the changes envisaged for the new system in the Indian pharmaceuticals industry. The main changes to be made to the model include provision for effective returns to an alternative market, incorporation of the impact of effective returns on brand image, and incorporation of environmental costs along with other costs in the process. Similar to the original causal loop model, the new model comprises of additional causal loops. Due to revisions in the causal linkages, the causal loops in the new system have been renumbered. The system consists of reinforcing and balancing loops. In reinforcing loops (loops R1 to R8), when the value of a variable increases, the impact of this on other variables in the loop again results in an increase in the value of variable under consideration. In balancing loops (loops B1 to B19), an increase in the value of the variable finally results in a decrease in its value after its impact is transmitted through the loop. The four new causal loops (loops B2, B17, B18 and B19) are balancing loops.

Effective Returns to an Alternative Market

The original causal loop model (Figure 1) explored why effective returns do not occur in the Indian pharmaceuticals industry. It was observed that there is no perceived use for recovered medicines although there is a need for medicines in markets that have poorer populations. Hence, there is no provision for product recovery before deterioration. Further, as it is an added cost, there is no incentive for redistributing drugs within the same market. Thus, the first step in enhancing social sustainability for the Indian pharmaceuticals industry is to identify alternative markets. Products that have been retrieved from the primary market before sale can be sold in an alternative market and hence reduce the overall level of product deterioration. This is especially relevant in the Indian healthcare system, where medicine availability is low in rural and public healthcare settings.
Figure 2 - Revised Causal Loop Model with Suggested Structural Changes
(Key: New Variables - Green Highlight; New Causal Linkages – Blue Arrows)
In Figure 2, loops B2 and B17 depict the new system for utilising effective returns in the Indian pharmaceuticals industry. The demand for products in the alternative market triggers the sale of effective returns which is dependent on the availability of a stock of effective returns (loop B17). When compared to the original market, the sale of products is not affected by marketing efforts because of the high need for such medicines (irrespective of brand-name) in the alternative markets. Hence, the final sales value of the products in alternative markets is only dependent on the product price and the sales volume. Loop B2 depicts the replenishment process for the stock of effective returns. As the stock of products in the alternative markets decreases, the incentive for the industry to retrieve and redistribute products increases and hence, effective returns are “pulled” from the stock of unsold products that have not expired in the original market. This way, medicines that have not been sold/used in the original market can be used to satisfy the immediate needs in a needier market.

Impact of Effective Returns on Brand Image

While environmentally sound practices in logistics have been linked to improving the image of the companies (Georgiadis and Besiou 2010, Georgiadis and Vlachos 2004), research efforts on the impact of socially sustainable practices and its linkage with the brand image is relatively new. Recent studies suggest that involvement in corporate social responsibility is linked with improvement in brand image and better financial performance. In a brand-conscious environment such as the pharmaceuticals industry, there is potential for the companies to improve their brand image by involving themselves in socially sustainable practices. The impact on the brand image is observed in the original market as the population here is more aware of brands than in a needier market.

The impact of the socially sustainable activity of effective returns is captured through the effect of the Brand Image Index on sales in the original market. This is depicted through the balancing loop B18. The Brand Image Index reflects the degree to which the companies are able to satisfy demand in a needier market. Hence, this index increases with the sales volume of effective returns and decreases when the prices charged in the alternative market are on the higher side. When the sale of effective returns increases, the brand image index increases and increases the sale of products in the original market. As a result, the quantum of products in the original market reduces and the incentive to make effective returns reduces. When there is lower availability of a stock of effective returns, the sale of effective returns is reduced. Thus, this balancing loop serves the purpose of providing incentives to carry out effective returns to an alternative market, but within limits.

Environmental Costs

Apart from the economic costs captured in the original causal model, pharmaceutical companies in India also need to consider the environmental impact of their logistics activities. The incineration of pharmaceuticals is an expensive process which needs government regulation. In
this study, environmental costs are indicated in terms of the costs associated with investment in cleaner technologies for processing the disposal of the expired/damaged medicines.

In Figure 2, B19 is a balancing loop which depicts that when the return for disposal increases, the environmental costs to be borne with respect to disposal are increased and hence, reduce the incentive for return. Effectively, this mechanism is similar to that of economic costs and helps in balancing the excess return of products for disposal.

Economic Costs

In Figure 2, the costs associated with material handling and transportation has been highlighted as well. Although it was a part of the original causal model, they have been highlighted again in order to stress on the need to address the three dimensions of sustainability (economic, environmental and social). It is only through the analysis of these dimensions can the model be studied further for the sustainable performance of the system.

Conclusion and Future Research Scope

The conceptual model presented in this study depicts avenues to develop a dynamic model that is capable of improving the sustainability in the Indian pharmaceuticals industry. Building on the existing model, using systems thinking principles, this study provides intervention strategies that can be incorporated in the Indian pharmaceuticals industry. These strategies are in the form of structural changes that need to be created within the existing Indian pharmaceuticals industry. The structural changes highlighted in this study are the incorporation of effective returns to an alternative market, the impact of effective returns on the brand image and environmental costs associated with reverse logistics. This conceptual model is aimed at

The future research scope lies across two avenues. Firstly, the new model can be dynamically simulated by adding new stock and flow structures that depict the alternative market. In this study, the economic and environmental costs are depicted as impacting the decisions in a dynamic fashion. However, it is also possible to consider them as outputs of the model such that decisions can be made by stakeholders after viewing the simulation results. This would help in making the model more interactive. Additionally, this provides scope for utilising decision-making tools for ensuring better performance across the three dimensions of sustainability (economic, social and environmental). Such decision making would also include the identification of new factors in the system (e.g. pricing strategies for the alternative market, delays in the process, etc.) that would need to be controlled to achieve the desired system performance.

The second avenue for research lies in developing network designs that incorporate the various strategic alternatives suggested through the dynamic model. This would enable in finally creating a link between the research and practical efforts. As is with systems thinking and
dynamic modelling, such a linkage can only be created through continuous interaction between the stakeholders and the researchers.

In order to improve the ease of representation, the conceptual model here has depicted only the major causal linkages and loops. Further refinements in the model can be incorporated within the dynamic model (e.g. expiry and disposal of the stock of effective returns, non-linear relationships, etc.). This would help in making the model more realistic and user-friendly.

The conceptual model presented in this study is an important move towards incorporating the three dimensions of sustainability within the supply chain activities. This is relevant in an era where sustainability reporting and accounting have picked up pace in recent times across the world (e.g. Global Reporting Initiative (GRI) Guidelines and SA8000 guidelines). Hence, it is hoped that the efforts in this study are not only helpful for sustainable development in the Indian healthcare system but also provide insights to researchers and practitioners in other industries and countries.

**Bibliography**


