Reverse Logistics of Pharmaceutical Products

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Abstract

As an attempt to minimize the environmental damage, the number of counterfeit medications, the potential hazard to human health, this study presents a framework for managing end-of-life pharmaceutical products. Establishing such an infrastructure capable of conducting proper EOL processing options would have numerous advantages when the environment, public health, and financial benefits are considered. Furthermore, a framework that includes environmental, economical and physical concerns for the reverse logistics operations of pharmaceutical products is proposed. Required Information Technology (IT) infrastructure is also provided.

Introduction

Reverse logistics is the process of logistics management involved in planning, management and controlling the flow of wastes for either reuse, recycle or final disposal of wastage (Hu, Sheu, & Huang, 2002).

End-of-life (EOL) pharmaceutical products are also subject to reuse, recycling, storage and/or proper disposal. Majority of such EOL products are toxic to plants and animals.

Healthcare Distribution Management Association (HDMA) estimates three to four percent of product going out from pharmaceutical warehouses ultimately comes back and redistributed, recycled and return for disposition.

Firms those invest in information technology to increase the capabilities may end up with high performance efficiency.

This study considers the *Food and Drug Administration* (FDA) rules and regulations released regarding EOL and counterfeit medications all over United States with the intention of implementing reverse logistics.

National Review

Figure 1 depicts FDA laws contribution of United States of America in drug recycling process.

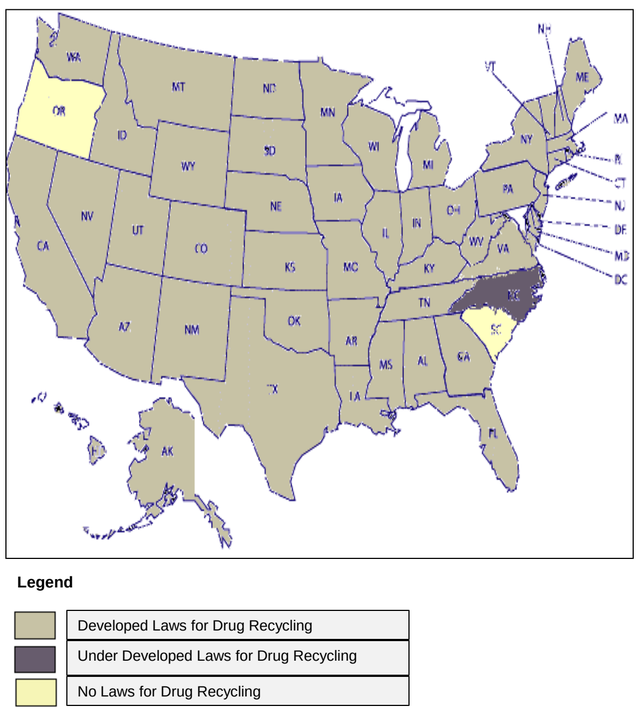

Figure 1. FDA drug recycling laws in the US

All states in the US have developed rules and regulations for drug recycling except the states of North Carolina, South Carolina and Oregon.

Methodology

The study portrays a composite model of various phases such as of forward supply chain, decision input to reverse logistics and reverse logistic of EOL medications as shown in Figure 2.

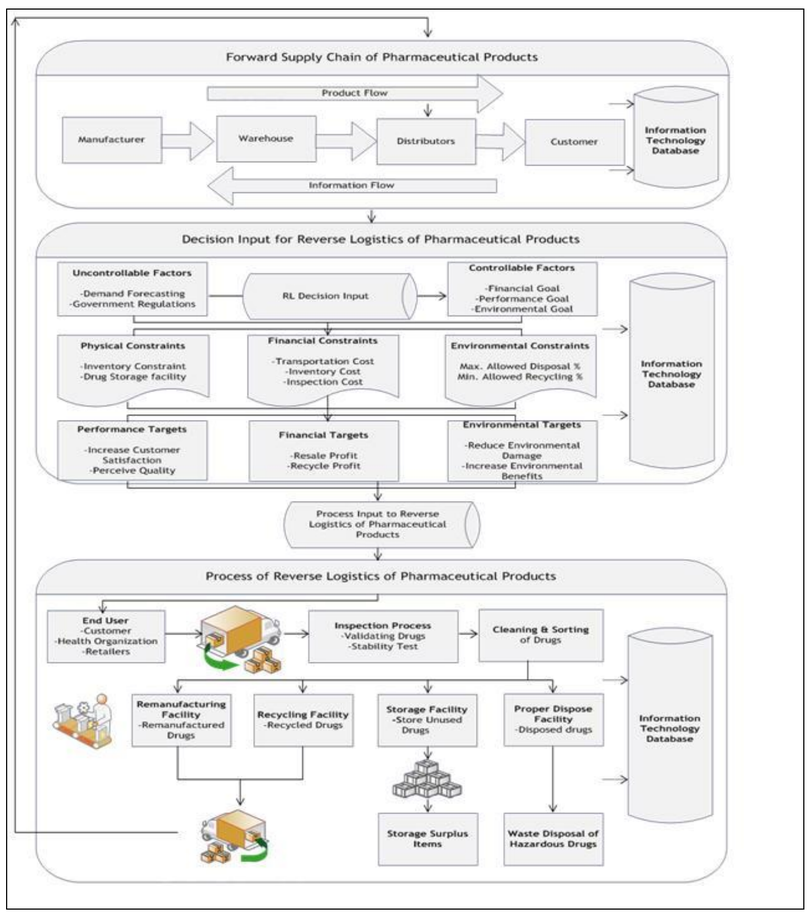

Figure 2. Work Flow Diagram presents forward and reverse logistics of Pharmaceutical Products.
Adopted from: (Kongar & Gupta, 2009)

Decision input phase emphasizes on:
Uncontrollable factors:
- Demand forecasting
- Government regulations

Controllable factors :
- Financial goals : Study cost benefit analysis
- Performance goals : Reduce significant amount of time delay, poor information flow and more number of handlers in entire logistics process of medications
- Environmental goals : Study various existing methods (both proper and improper) to dispose EOL pharmaceutical products.

Constraints :
- Physical Constraints: Inventory Capacity
- Environmental Constraints: Restriction on amount of disposal and recycling allowed
- Financial Constraints: Cost involved in overall reverse logistics

Targets:
- Performance: increase the level of customer satisfaction
- Environmental: increase environmental benefits.
- Financial: Revenue and profit generated from reselling and recycling of the expired drugs

The proposed system mainly partitioned into two main processes:
1) Collection process : Includes 'Drug Take Back' program.
2) Inspection Process : Includes validation and toxication of EOL medications by performing various stability chemical tests.

IT Infrastructure

The paper put forward the solution using information technology software. The use of information technology enables companies to improve the profitability by eliminating poor information flow and manual mistakes, increasing labor productivity and resource utilization in supply chain.

Role of Information Technology

The software keeps the track of medications using :
- Barcode Technology
- Information Database

Classification of EOL medications based on :
- Expiration date
- Toxication

Test Cases:
- Unexpired Drugs
- Expired and Nontoxic Drugs
- Expired and Toxic Drugs
- Damaged Drugs

Result:
- Redistribution
- Recycle
- Dispose

Figure 3 illustrate dataflow diagram of inspection process in detail.

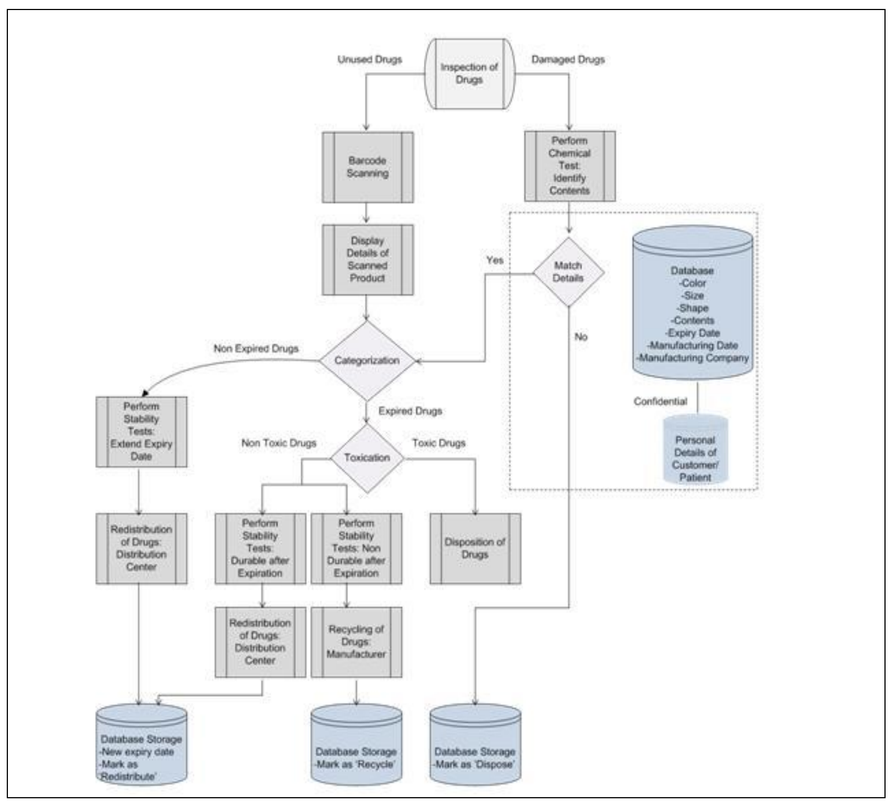

Figure 3. Dataflow Diagram of Inspection Process

Cost Benefit Analysis:

- Cost Benefit in Credit System
- Cost Benefit in Redistribution
- Effective Process Management lower operation cost

Conclusion and Future Research

Conclusion:
- Implement reverse logistics of pharmaceutical products.
- The effective use of technology, government programs facilitate companies to decrease the overall cost or even to create financially profitable system.

Future Research:
- Putting barcodes on interior packaging of the pharmaceutical products
- Government of United States of America needs work on drug recycling laws.

Acknowledgement and In Memoriam: This poster is dedicated to the memory of Katherine (Kay) Larobina Macari. This work has been inspired by her courage and strength of character. The authors would like to acknowledge the contribution of Dr. Jani Macari Pallis, who posed the initial problem.

References:

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