Reverse logistics is the process of logistics management involved in planning, management and controlling the flow of resources for either reuse, recycle or final disposal of wastage (Hu, Shu, & 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 that 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 drug recycling laws of United States of America in drug recycling process.

![Image](image1.png)

**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.

**Introduction**

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.

**Methodology**

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 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:
2. Inspection Process: Includes validation and toxification of EOL medications by performing various stability chemical tests.

**IT Infrastructure**

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

Classification of EOL medications based on:
- Expiration date
- Toxification
- 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.

**Conclusion and Future Research**

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

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