Tracking Goods Not for Resale Consumption and Replenishment

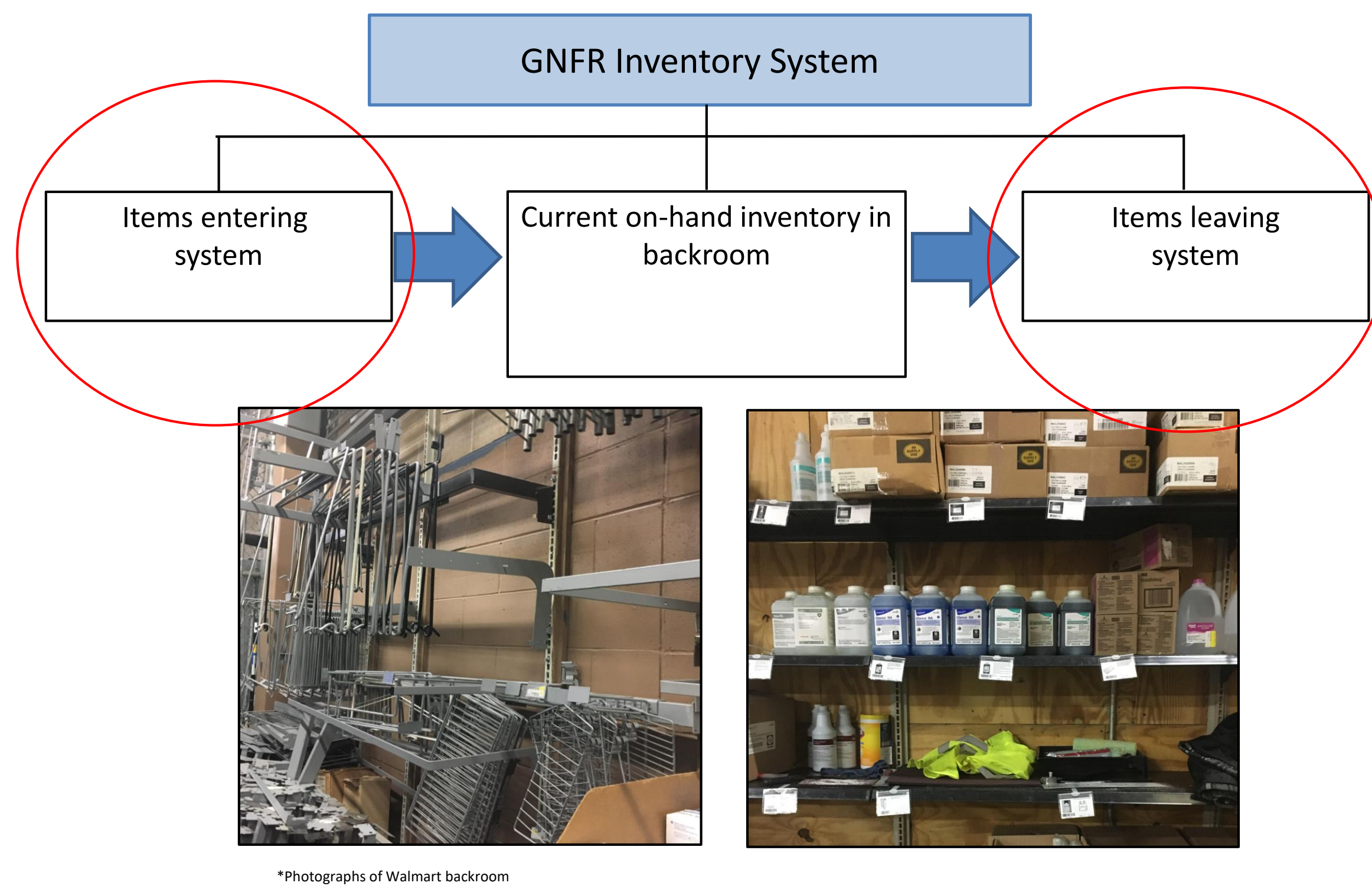Team: Peter Scheele, Savanna Kis, Nour Abu-Safe, Timothy O' Toole

Project Objective

Measure Walmart's GNFR inventory by measuring the system's inputs and outputs. Approaches to accomplish this were:
1. Evaluate different alternatives to track inventory.
2. Develop an EOQ model to determine current system accuracy and prevent over and understocking.

GNFR Inventory System

Items entering system → Current on-hand inventory in backroom → Items leaving system

*Photographs of Walmart backroom

Current Process

The current inventory process requires an associate to manually check the inventory levels of individual GNFR items. An associate then orders the necessary inventory based on estimated need. A claims manager approves the order and sends it to the appropriate supplier. Individual GNFR items all have different reorder points and consumption rates which increases the ordering difficulty within the process.

Alternative Evaluation

RFID	Video	Manual
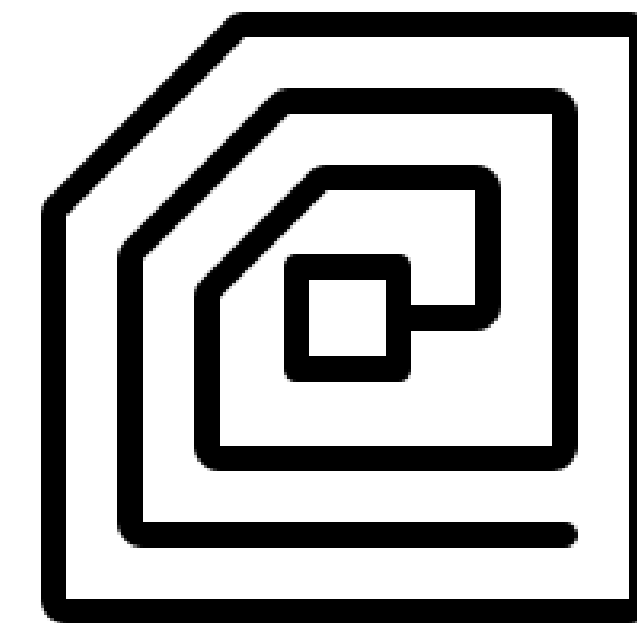
Radio Frequency Identification uses RFID chips that communicate with readers via electromagnetic waves.

Video analytics/recognition uses camera and coding to detect certain items within the inventory system.

Manual streamline processing uses the current process they have but under a more strict, efficient protocol.

EOQ and Accuracy Comparison

EOQ Amount:	
Annual Demand (D):	641
Unit Cost (c):	$25.00
Inventory Holding Cost (H): 37% of unit cost	$9.25
Ordering Cost (S):	$0.64
EOQ =	10

(Q, R) Model Original:	
Q:	12
Average Weekly Demand:	12.33333333
StDev of Weekly Demand:	2.081665999
Expected Demand during LT:	10.57142857
StDev of Demand during LT:	1.927248223
Average Annual Demand (D):	641
Inventory Holding Cost (H):	$9.25
Stockout Cost (p):	$15.00
Probability of Stocking Out During LT:	1.15%
Z-Table Value:	2.271960047
Reorder Level (R.):	14
Safety Stock (SS):	3

(Q, R) Model Recommended:	
Q:	10
Average Weekly Demand:	12.333333
StDev of Weekly Demand:	2.081666
Expected Demand during LT:	10.571429
StDev of Demand during LT:	1.9272482
Average Annual Demand (D):	641
Inventory Holding Cost (H):	$9.25
Stockout Cost (p):	$15.00
Probability of Stocking Out During LT:	0.96%
Z-Table Value:	2.340833
Reorder Level (R.):	15
Safety Stock (SS):	4

Inventory	Q:	R:	Safety Stock:	Probability of Stocking Out During LT:	Total Annual Order Cost:	Total Annual Holding Cost:	Final Annual Cost:	Accuracy:	Cost Difference:
Paper Towel (Original):	12	14	3	1.15%	$33.66	$83.25	$116.91	75%	-$6.99
Paper Towel (Recommended):	10	15	4	0.96%	$40.65	$83.25	$123.90		
Toilet Paper (Original):	5	18	15	2.26%	$24.13	$226.63	$250.76	219%	$142.45
Toilet Paper (Recommended):	5	7	4	2.26%	$24.13	$84.18	$108.31		
Plastic Sack (Original):	64	80	11	1.14%	$41.28	$477.30	$518.58	83%	-$478.35
Plastic Sack (Recommended):	22	137	68	0.39%	$120.03	$876.90	$996.93		
Waste Liners (L) (Original):	2	7	6	1.42%	$27.94	$64.75	$92.69	260%	$32.47
Waste Liners (L) (Recommended):	4	4	3	2.84%	$13.97	$46.25	$60.22		
Stretch Film (Original):	2	6	5	3.32%	$16.51	$64.75	$81.26	735%	-$46.08
Stretch Film (Recommended):	3	7	6	4.98%	$10.80	$116.55	$127.35		
Total Cost Difference (Original - Recommended):									-$356.50

Inventory Clustering

The data was clustered using K-means algorithm in Python. This algorithm grouped items based on quantity, frequency, and price of each item.

Cluster	Number of items	Average Quantity	Average Frequency	Average Price
Paper Towels	1	18181	286	$ 35.00
A	56	19	11	$ 259.33
B	30	928	218	$ 27.62
C	1997	27	12	$ 21.12

Cluster A: High priced items
Cluster B: High Quantity and frequent items
Cluster C: Low cost and infrequent items
Paper Towels: Most similar to cluster B, but separate due to abnormally high volume

Final Analysis

System Costs

Alternatives	Implementation Costs	Reoccuring Cost	Reoccurring Basis (Years)	Reoccurring Cost Over 9 Years	Total System Cost Over 9 Years
RFID	$10,500.00	$7,320.00	9	$7,320.00	$17,820.00
Video Analytics	$2,669.99	$750.00	4	$1,687.50	$4,357.49
Manual	$1,778.00	$2,780.00	3	$8,340.00	$10,118.00

Annual Ordering and Holding Cost Savings For 'B' Cluster Items

Alternatives	Annual Inventory Cost	9 Year Projected Cost
RFID	-$176.62	-$1,589.56
Video Analytics	-$176.62	-$1,589.56
Manual	-$356.50	-$3,208.50

Cost of Alternatives Implemented on Cluster B Items After 9 Years

Alternatives	"B" Cluster Cost	Total System Cost	Final Cost
RFID	-$1,589.56	$17,820.00	-$19,409.56
Video Analytics	-$1,589.56	$4,357.49	-$5,947.05
Manual	-$3,208.50	$10,118.00	-$13,326.50

The alternatives were evaluated by computing system cost, inventory holding cost, and order costs. While these 3 alternatives resulted in a profit loss after 9 years, switching to one of these inventory tracking methods can still be beneficial because it will allow Walmart to have a more accurate inventory supply across their entire portfolio of products. Also, the scope of this project only focused on 'B' cluster items. However, implementing more 'C' items onto one of these proposed systems could save more time and money.