Department of Industrial Systems Engineering and Management

Improving the Reconciliation of Found Shipments in Logistic Companies

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Introduction

Project Objectives

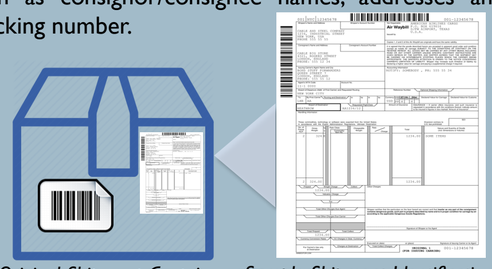
To improve the current Found Shipment reconciliation process, supporting our partner company's existing efforts to eliminate this process exception by providing new solutions

Company Overview and Problem Background

Our partner company is a logistics firm with a strong presence worldwide. It differentiates itself through superior performance excellence and a customer-centric approach to running its business. In recent years, the company has been increasing focus on Customer touch-points including customer satisfaction related to the Found Shipment opportunity.

What is a Found Shipment?

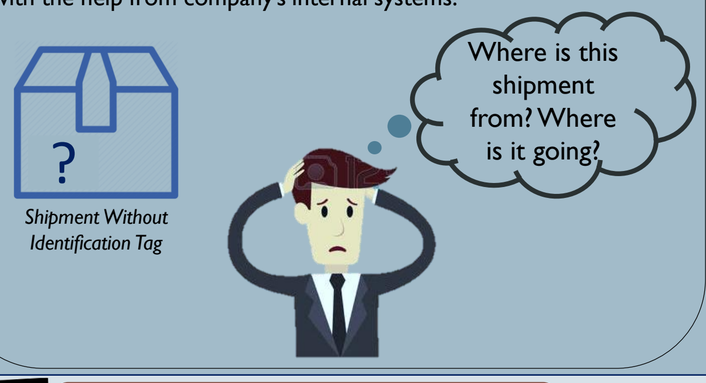
Every shipment that is given to the company is tagged with a unique shipment identifier which is referred to as shipment identification tag. The shipment identification tag contains important information about the shipment such as consignor/consignee names, addresses and a unique identifying tracking number.



Original Shipment Container *Sample Shipment Identification Tag*

In the unlikely event that an identification tag becomes disconnected from a shipment and the normal flow is interrupted due to lack of supporting on-shipment information, the shipment in question becomes a Found Shipment.

As there is no information about these unidentified shipments, the challenge lies in reconciling them with their identification information and sending them to their intended location. Current reconciliation process includes guided reconciliation procedures with the help from company's internal systems.



Shipment Without Identification Tag

Problem Analysis

Shipments that have parted from their identification tag are logged into the **Found Shipment database** (Company's internal system).

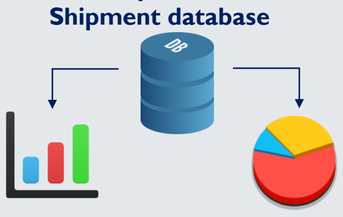
Identification tag that is parted from shipment

Found Shipment without identification tag

Found Shipment database

Our Investigation

Data analysis on Found Shipment database



Insights with regard to found shipments are drawn from in-depth analysis to the Found Shipment database.

Reconciliation trial using company's internal systems

An understanding of current processes, tools and associated internal systems to propose useful improvement.

Investigation Findings

From our study of the Found Shipment database and reconciliation trial using the internal systems, we have found out that the data entry can be further improved in order to reduce the effort of reconciliation by:

- Improving the shipment classification
- Providing a guided and better description for shipment content

Solution Approach

Taxonomy Development Process

STEP 1 Determination of requirements

- ***Scope:*** The found shipments within all the hubs covered by our partner company's service
- ***Purpose:*** Help the company better manage and organize found shipments items' information in the Found Shipment database
- ***Target User:*** The company employees

STEP 2 Analysis of relevant contents for taxonomy

- Understand current categorization → **SINGLE-LEVEL**
- Examine top 30% main categories using **text analysis** on content descriptions
- Determine **existing taxonomies** to be learnt from online shopping platforms
- Identify categories that cannot be found on existing taxonomies like confidential documents

STEP 3 Build taxonomy

- Start broad with major categories:
- ***Electronics, Medical Industrial & Scientific, Apparel & Accessories, Paper Material, Arts & Crafts***
- Supplement with all other possible categories
- Check against samples from the database

Taxonomy Solution

Combining data mining results from the records in the database with researches on the E-commerce established categorization, a comprehensive taxonomy consisting of 15 main categories is produced, which covers a wide range of items found in the database.

Database Records (Data Mining) + E-commerce categorization (Industry Practices) = **Solution Taxonomy**

Main category	Level 2 category	Level 3 category	Level 4 category
Electronics	Electrical equipment	Switches	Flow Switches
Electronics	Electrical equipment	Switches	DIP Switches
Electronics	Electrical equipment	Transformers	
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Power Cables
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Electrical Wires
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Wiring Harness
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Cable Manufacturing Equipment
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Power Cords & Extension Cords
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Other Wires, Cables & Cable Assemblies
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Control Cables
Electronics	Electrical equipment	Wires, Cables & Cable Assemblies	Instrumentation Cables
Electronics	Electrical equipment	Wiring Accessories	Cable Ties
Electronics	Electrical equipment	Wiring Accessories	Cable Trays
Electronics	Electrical equipment	Wiring Accessories	Cable Conduits
Electronics	Electrical equipment	Wiring Accessories	Cable Glands
Electronics	Electrical equipment	Wiring Accessories	Cable Clips
Electronics	Electrical equipment	Wiring Accessories	Wiring Ducts
Electronics	Electrical equipment	Wiring Accessories	Cable Sleeves
Electronics	Electrical equipment	Wiring Accessories	Cable End Caps
Electronics	Electrical equipment	Wiring Accessories	Other Wiring Accessories

Snapshot of our taxonomy

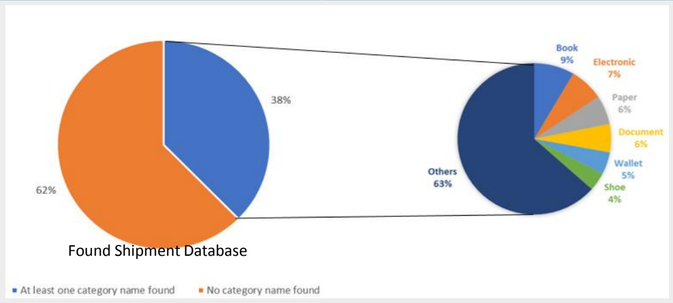
Taxonomy Validation

Purpose: To determine the similarity between the phrasing of the proposed taxonomy and the keywords used by the staffs to describe the contents of shipments

Validation Approach: Searching for categorical names of the proposed taxonomy within the content description logged in the database

Results

Our search result shows that **37.56%** of all entries contained at least one categorical name from level 2 of the proposed taxonomy. This value is significant as the ability to recognise the level 2 categories is necessary, for the staffs to categorise items in subsequent levels.



The proposed taxonomy is **similar** to the command of vocabulary used by FSC staff, at least for the categorical names in the second level.

Text Input Enhancement

Current State: Staff log information related to the item based on visible clues and their experiences.

Improved State: Prescribed fields that best describe the item category

Shipment from:	Printed on label:	Order No.:
Shipment to:	Telephone:	…

Improvement Process

STEP 1 Populate resultant taxonomy

Excel VBA populates each second-level category in the taxonomy with the records from the main Hubs, based on taxonomical keywords

Items from main hubs

Apparel & Accessories > Clothing	Industrial & Scientific > Fasteners	Paper Material > Advertising Material	…
Extracted Text Fields: Color, Size, …	Extracted Text Fields: Part no., Dimension …	Extracted Text Fields: Written:, Company:, …	…

STEP 2 Assign suitable text fields

Based on Literature Research

- Excel VBA extracts the more popular keywords from the records in each subcategory.
- Supplement with best descriptors for every first level categories based on literature research

Performance Measures

Step 1: Categorical Keyword Population

Categories are reconstituted and a set of cognitive keywords is assigned to each group. These 200+ keywords, are those humans tend to associate with a specific category, and hence likely to be used by the operational staff. E.g.: *Screw* is found to be a cognitive keyword for *Machinery Parts*.

Initial Categories that we defined	Row Labels	Sum of Quantity
Machinery	Material	29.89%
	Unknown	18.16%
Advertising Brochures	Document	15.40%
Clothes	Personal / Wearables / Applicables	13.14%
Electronics	Electronics	12.31%
Machinery	Parts	5.27%
Medical	Medical / Consumables	3.36%
Household	Supplies / Samples	1.58%
	Household	0.90%
	(blank)	0.00%
	Grand Total	100.00%

Original categories

Electronic
Machinery Parts
Medical Consumables
Personal Wearables Applicable
Household
Paper

Reconstituted categories

mechanical
twisted
textile
deformation
screw
processing
rubber
socket
staple
efficiency
foodstuff
fitted
ltd
elastic
hull
locomotive
system
snap
typewriter
electrical
manufacturer
tape
turbine
factory

Cognitive keywords from a reconstituted category

Step 2: R Validation

Batches of cognitive keywords and our taxonomy are fed into an R program produced by our group. The output matrix from the program indicates the effectiveness of our taxonomy.

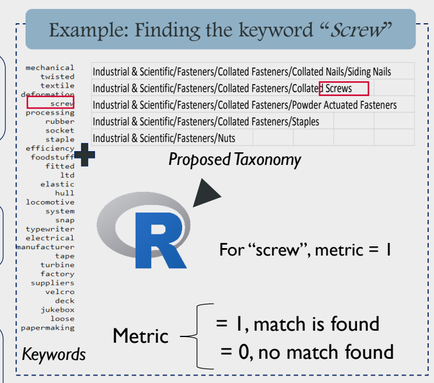
Logic of R code

100 samples are randomly selected from keywords list for each iteration

If a keyword match is found, metric = 1, otherwise, metric = 0

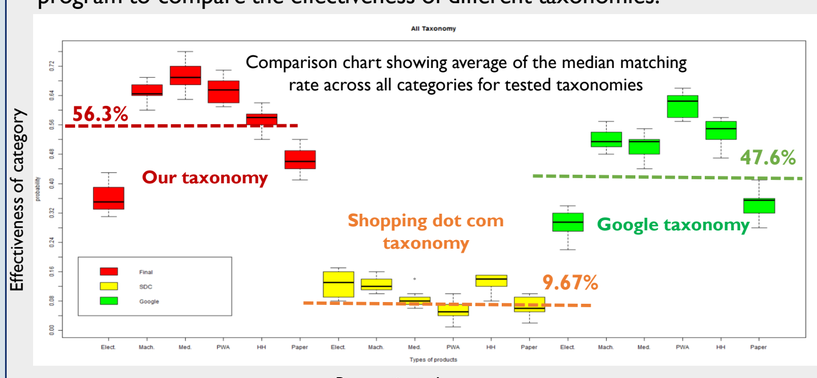
Effectiveness of category = $\frac{Metric\ for\ keyword}{Sample\ size\ of\ 100\ keywords}$

Example: Finding the keyword "*Screw*"



Step 3: Visualization of Results

Our taxonomy is compared against other taxonomies to prove its effectiveness by feeding two other E-commerce taxonomies into the R program to compare the effectiveness of different taxonomies.



Reconstituted category

Results & Discussion: Our taxonomy outperforms other taxonomies with an average **56.3%**. This implies that using the taxonomy, the success rate for each database query by customer service staff is around 56%.

Future Steps

Further refinements are to be made to the proposed taxonomy using the feedback gathered from usability testing

Our taxonomy used as a foundation for shipment content categorization + ***Picture recognition*** and ***machine learning*** technology

Goal

A system whereby a Found Shipment can be automatically categorized into the Found Shipment database. A quality description of the found shipment should also be generated with minimal human input.