# Human-Machine Interaction Design for Freight Planning Systems

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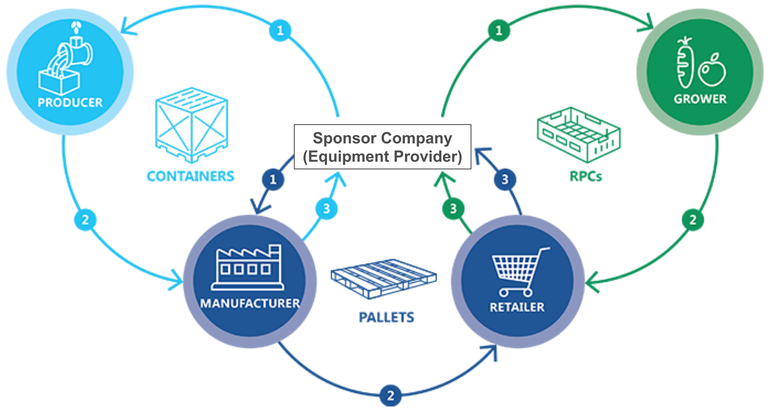
Sponsor: A Closed Loop Supply Chain Company

January 2019 Poster Session

## Motivation / Background




- Multi-Billion $$ Industry
- Closed Loop Supply Chain

1. Issue Containers, Pallets, & Crates
2. Customer use of Equipment
3. Recover and Rehab Equipment

## Key Question / Hypothesis

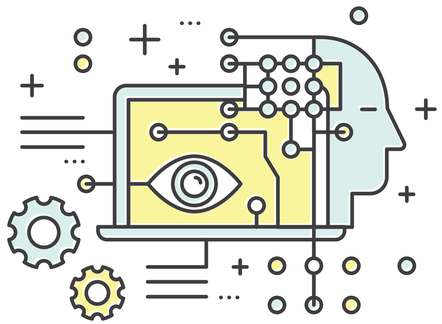
- Human-Machine Interaction (HMI) Principles can be applied to
  - Retrofit an existing Freight Planning System, and
  - Improve the Joint Cognitive System's cost and efficiency

## Relevant Literature

Badreddin, E., & Wagner, A. (2011). Real-Time Level of Autonomy Adaptation for Human-Machine-Interaction Based on the Reaction Time. *IFAC Proceedings Volume*s.

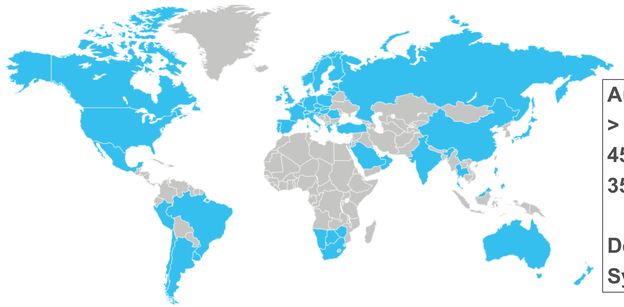
Miller, C. A. (2018). Displaced Interactions in Human-Automation Relationships: Transparency over Time. *Engineering Psychology and Cognitive Ergonomics*.

Poklukar, Š., Papa, G., & Novak, F. (2017). A formal framework of human-machine interaction in proactive maintenance - MANTIS experience. *Automatika: Journal for Control, Measurement, Electronics, Computing & Communications*.



What does Human-Machine Interaction (HMI) design have in common with a common pallet?

## The Problem

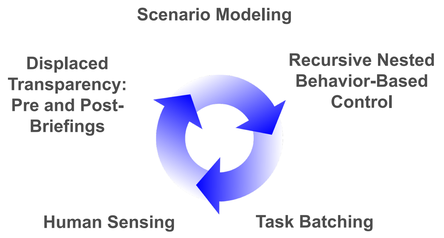


Automated Planning System
> 10,000 Loads Daily
45% Manual Interventions
35% More Costly
(Manual > Automated)
Decreased Strategic Focus
System Stagnation

## Methodology

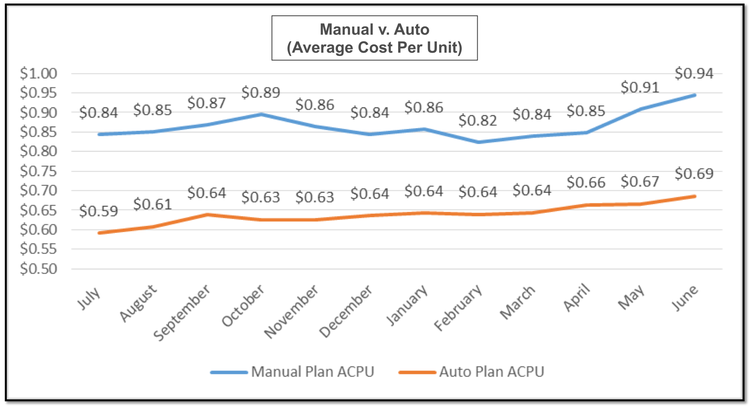
- Systems Evaluation
  - Map 3 Automated Systems
  - Map Manual System
  - ID Automated Drops
  - ID Human Interventions
- Data Collection
- Data Analysis
- HMI Iterative Design Process
- Retrofit Existing System

HMI Iterative Design Process




## Initial Conditions

Manual Planning Costs > Automated Planning Costs by 35%




## Expected Contributions

Practical Contributions to Company:
- Reduce Manual Interventions
- Reduce Overall Cost
- Increase Strategic Focus of Human Planners
- Retrofit System for Iterative Continual Improvement

Research Contributions:
- Apply HMI principles to a Novel Application
  - Freight Planning System
  - Loosely Coupled Joint Cognitive System
- Retrofit HMI Solution to Existing System
  - Existing High Volume Freight Planning System
  - Model for Other Joint Cognitive Systems

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