Operational Analysis of the Steel Knife Manufacturing Industry

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OM4600 – Operations & Supply Chain Management

Steel

- **Steel industry is one of the largest manufacturing industries in the world**
  - contributes to 8% of global emissions
  - recycling rate over 60% globally
- **Iron & Steel Production**
  - made from iron ore, oxygen and other minerals that naturally occur
  - The raw materials for steelmaking are mined and then transformed into steel
  - largest producers - China, the European Union, Japan, United States, India, Russia and South Korea
- **Steel prices down almost 20% since the beginning of 2022**
  - back-to-back Q2's, 3rd most sourced product due to companies attempting to rebuild supply channels

Steel Supply Chain/ Industry Overview

3 issues faced in the steel industry	3 similar trends in manufacturing	3 challenges in distribution & retail
• Material shortages • Struggle to meet demand • Increased prices	• Stalled supply chains • Rising costs • Labor shortages	• labor shortages (specifically for truckers) • lack of warehouse space • growing online consumer demand

Typical Process flow

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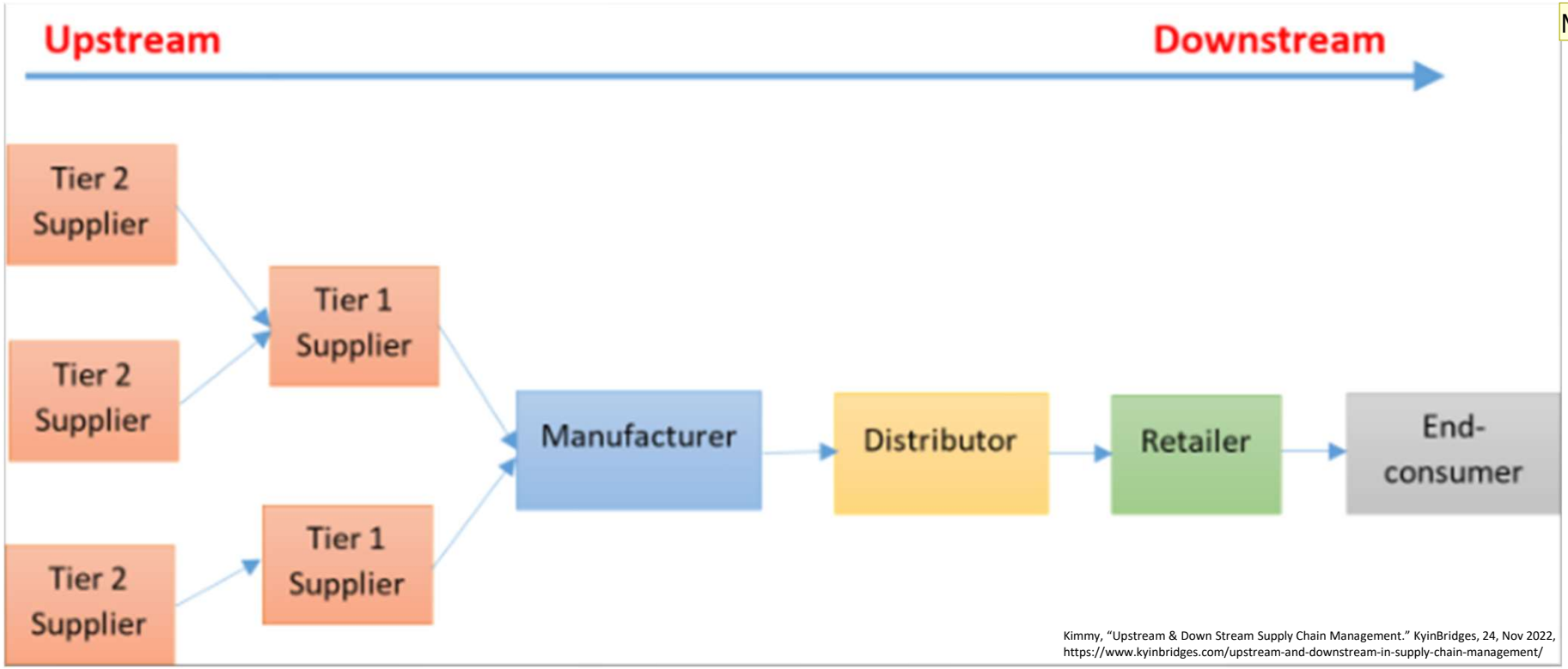


Kimmy, "Upstream & Down Stream Supply Chain Management." KyinBridges, 24, Nov 2022, https://www.kyinbridges.com/upstream-and-downstream-in-supply-chain-management/

Slide 4

MN0 Here's the standard structure for a digital image citation found on a website. It follows guidance found in the MLA Style Center. Image Creator's Last Name, First Name. “Image Title.” Website Name, Day Month Year Published, URL.

Minkwitz, Nathan, 2022-12-06T01:28:10.816

Hypothetical Situation

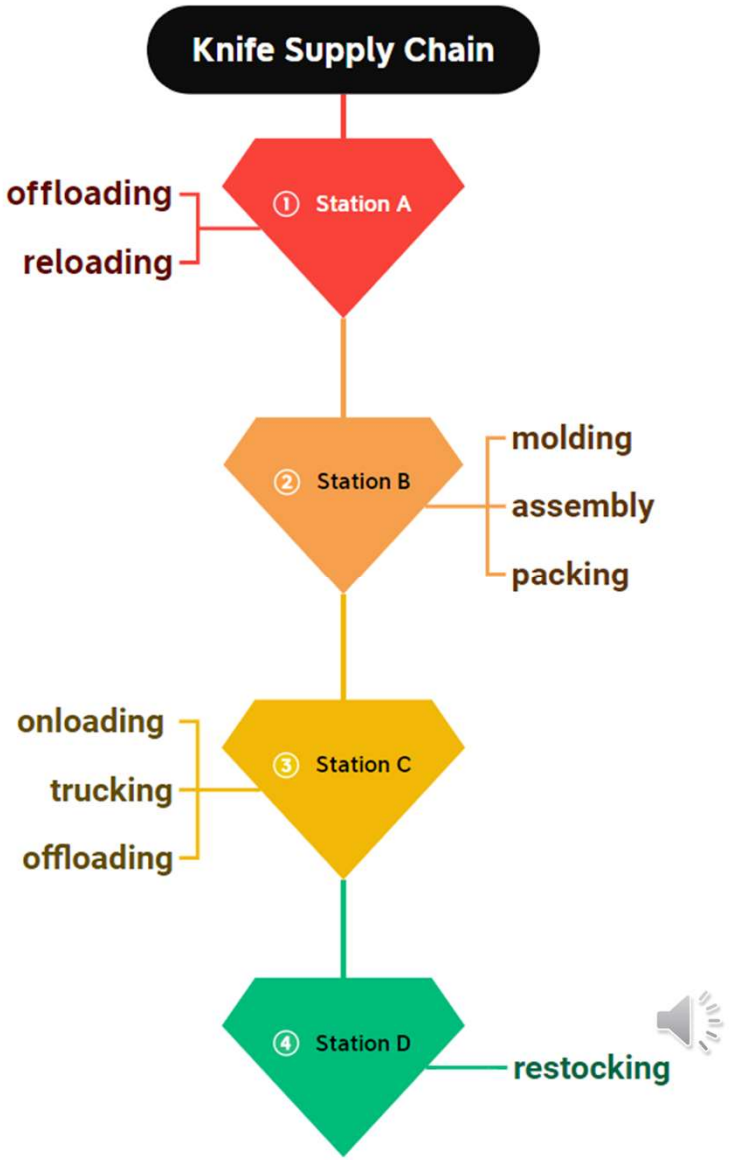
knife manufacturing supply description:

- Tier 1 & 2 suppliers – supply manufacturing plant with resources (plastic, steel, packaging materials)
- Manufacturing & Distribution plant - with 10 assembly lines, each yield a different style knife
  - kitchen
  - utility or hunting
  - collectible
- Retailer – all-purpose home goods chain with 5 physical wholesale locations, equally dispersed around the manufacturing plant
- The manufacturer has recently partnered with AI robot manufacturer conducting pilot programs for supply chains operating under the Just-in-Time (JIT) inventory management method

Goal

- Alleviate trucker's workload with AI and allow for these JIT channels to operate more efficiently
- Offer scalable production opportunities by reducing costs associated with human interaction in supply chains
  - Wages, human error, quality assurance, theft, and unpredictability

Process Map


Knife Supply Chain
offloading
reloading
① Station A
② Station B
molding
assembly
packing
onloading
trucking
offloading
③ Station C
④ Station D
restocking

Human Dominated System

Identifying the Problem

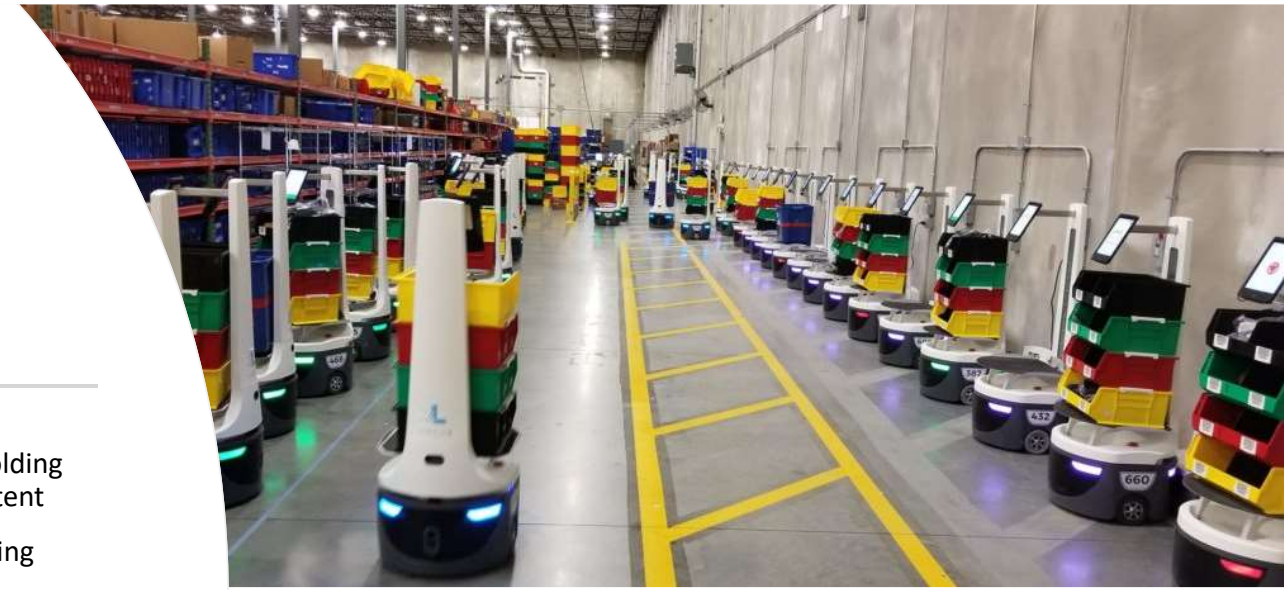
Station	#	Activity	# Resources	Job Desc	
A	1	offloading	**20**	offloader - offload materials from tier 1 & 2 suppliers	4 per truck
	2	reloading		reloader - reload molding machines w/ resources	2 per line
B	3	molding	**2**	engineer - program/ service machines, oversee molding/ blade carving	2 per plant
	4	assembly	**20**	assembler - stenciling & quality check	2 per line
	5	packing	**50**	packer - pack final products & place for onloading	5 per line (1 per loc)
C	6	onloading	**10**	onloader - load final products at manufacturing plant	2 per loc or truck
	7	trucking		trucker - route to physical store location	2 per loc or truck
	8	offloading		offloader - unload final products at physical stores	2 per loc or truck
D	9	restocking	**25**	stocker - unpacking, restocking shelves & store reserves	5 per store
		total	**127**		

Utilization by Station

Station	# Resources	Activity Time (mins)									Workload	Capacity	Utilization
		1	2	3	4	5	6	7	8	9			
A	40	120	120								240	0.1667	42.86%
B	72			180	240	60					480	0.1500	47.62%
C	30						120	180	120		420	0.0714	100.00%
D	25									180	180	0.138	51.43%
	167										**1320**	**0.0714**	
											22	**hrs**	

AI Implementation

- This example illustrated in the previous slide utilizes molding machines to ensure the quality of the blades are consistent
- Notable examples of AI implementations in manufacturing and distribution processes:
  - KUKA Robotics & Automation demonstrates how robots produce higher quality kitchen knives than traditional grinding methods
  - Locus Robotics specializes in AI warehousing bots that deem to be a crucial aspect of the supply chain



AI Dominated System

Station	#	Activity	# Resources	Job Desc	
			1	**plant supervisor - oversee facilitiy ops (#'s 1-6)**	**1 per plant**
A	1	offloading	**5**	ai loaders - offload materials from tier 1 & 2 suppliers	1 per truck
	2	reloading	**5**	ai picker (reloader) - reload molding machines w/ resources	1 per 2 lines
B	3	molding	**2**	engineer - program/ service machines, oversee molding/ blade carving	2 per plant
	4	assembly	**10**	ai assemblers - stenciling (no quality check needed)	1 per line
	5	packing	**5**	ai picker (packer) - pack final products & place for onloading	1 per 2 lines
C	6	onloading	**5**	ai loaders - load final products at manufacturing plant	1 per truck
	7	trucking	**5**	trucker - route to retailer wait for loading phases to complete	1 per truck
	8	offloading		ai loaders - unload final products stores	1 per truck
D	9	restocking	**5**	ai picker (restocker) - unpacking, restocking shelves and reserves	1 per store
		total	**43**		

Utilization by Station

Station	# Resources	Activity Time (mins)									Workload	Capacity	Utilization
		1	2	3	4	5	6	7	8	9			
A	10	60	120								180	0.0556	50.00%
B	17			180	120	180					480	0.0354	78.43%
C	15						60	180	60		300	0.0500	55.56%
D	5									180	180	0.0278	100.00%
	47										**1140**	**0.0278**	
											19	**hrs**	

Conclusions

More Automation

- Offers Improved efficiency and accuracy of the of the manufacturing and distribution activities
  - reduced costs associated with wages, human error, quality assurance, theft, and unpredictability
- Opportunities:
  - expansion into downstream channels especially with regard to online spaces, digital platforms, and fulfillment networks to reach more customers
  - Also provides investment opportunities exploring the benefits of more innovative or sustainable resources like 3-d printing materials, given the supply chain issues with commodity goods

Thank you

Sources

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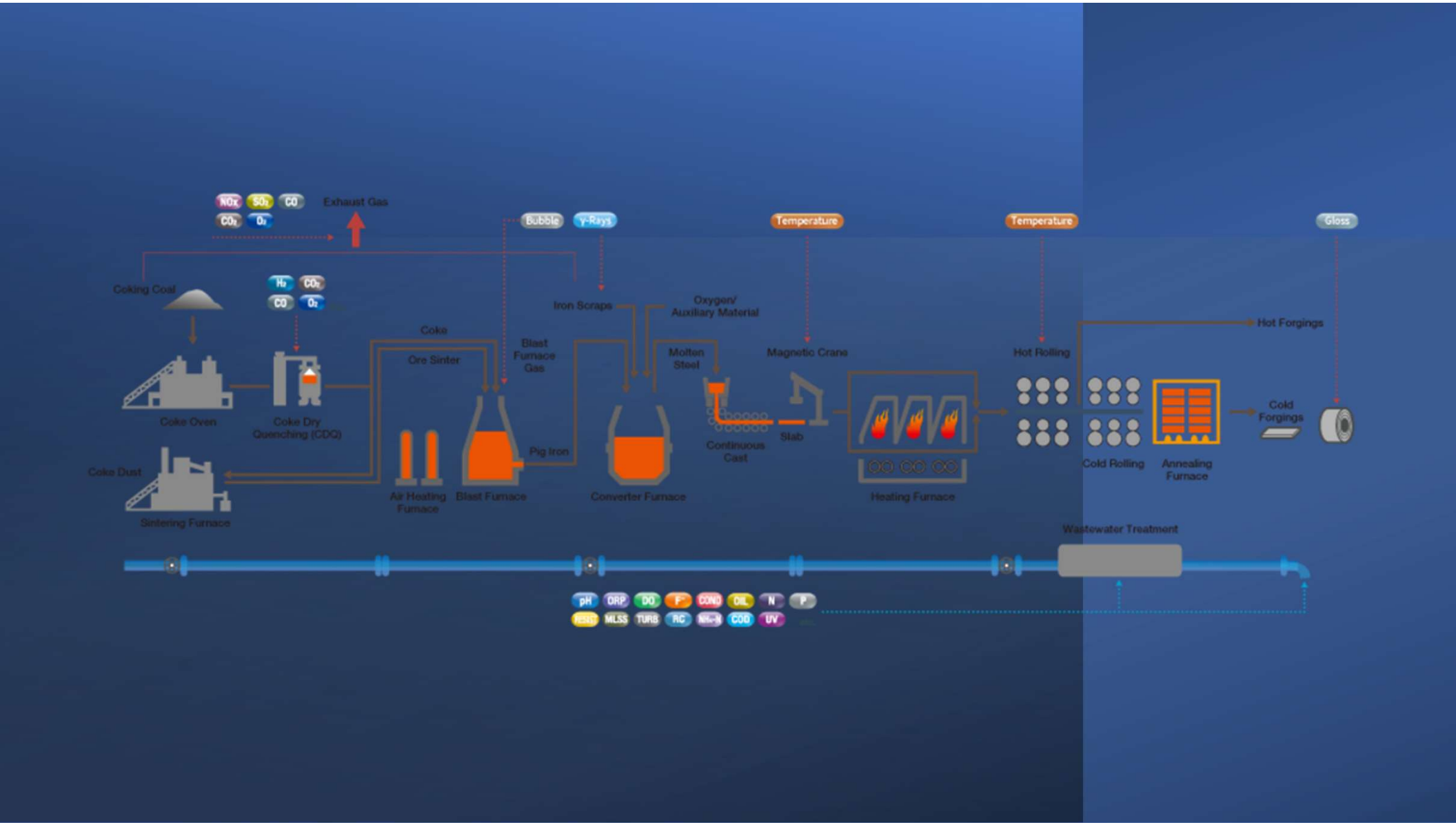
NOx
SO2
CO
CO2
O2
Exhaust Gas
Bubble
γ-Rays
Temperature
Temperature
Gloss
Coking Coal
H2
CO2
CO
O2
Iron Scraps
Oxygen/
Auxiliary Material
Hot Forgings
Coke
Ore Sinter
Blast
Furnace
Gas
Molten
Steel
Magnetic Crane
Hot Rolling
Coke Oven
Coke Dry
Quenching (CDQ)
Pig Iron
Continuous
Cast
Slab
Cold
Forgings
Coke Dust
Air Heating
Furnace
Blast Furnace
Converter Furnace
Heating Furnace
Cold Rolling
Annealing
Furnace
Sintering Furnace
Wastewater Treatment
pH
ORP
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COND
OIL
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P
MLSS
TURB
RC
NH3-N
COD
UV

Issues with Retail Supply Chains

- 3 significant problems for retail supply chains include
  - labor shortages (specifically for truckers)
  - lack of warehouse space
  - growing online consumer demand