Lecture 10
Stock Counting and Warehouse Management System

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Outline

source: General references [BH09, Mul94, Fra02, **?**]

Why do we need stock count?

- **Regulation:** accounting → government tax bureau
  → share holders (public company)
- **Management:** data update system, generate report
- **Operations:** re-location, check condition, planning & control

Example: 360,000 inventory records from 37 stores of a major US retail chain:

- 65% of records were inaccurate
- 29% were inaccurate before opening
- Average error: 30% of on-hand inventory

source: Dehoratius, N. & Raman, A. 2008. [DR08]

Sources of inaccuracy

- **Inbound:** # item shipped $\neq$ # on bill, misplaced on arrival
- **Outbound:** pick from wrong locations/items
- **In-house:** company own faults
  - System: scan errors, bad units of measure, human integration
  - Item: shrinkage, obsolete
  - Human: theft (pilferage), carelessness (put-away at wrong position)

Effects of inaccurate stock

- **Tax complications:** black list, investigation
- **Bullwhip Effect:** more safety stock downstream $\rightarrow$ inconsistency order upstream
- **Stock outs:** (actual $<$ system)
  - reduced customer service level
  - increased levels of safety stock
- **Disruptions:** (actual $>$ system) thought that $\nexists$ storage location
  - lose creditability, no storage space, dead stock
  - high inventory cost

source:

How do we do stock counting?

Periodic Count/Physical Count

- **What:** count all SKUs at the same time (1-2 time a year) → big gap
- **Pro:** easy to implement, easy to reconcile
- **Con:** no business, many workers, know in advance, difficult to write-out values

Cycle Count

- **What:** count few SKUs everyday; some SKU may more often
- **Pro:** adjustable workload & workforce, prevent inside thefts
- **Con:** consistency, negotiate with accounting
- **Issue:** How often each SKU gets count (ABC analysis of stock value)

Example: Suggested count frequency

You are a project engineering, who hires to implement cycle count in a warehouse. Currently, this warehouse have 397 SKUs, which can be classified by their values as follow:

Class	# of SKU	frequency	
		minimum	suggested
A	26	6	f_A
B	96	4	f_B
C	275	2	f_C
D	71	1	f_D

The warehouse can spare the last 20 minutes of 4 workers to perform cycle count. Assuming that there are 250 working days & each SKU requires 15 minutes to count, on average. What are your suggested frequency of each class?

Solution: Suggested count frequency

- **Idea:** average cycle count $\leq$ total man-hour
- **Total resources:**
  $250($ day/year$) \times 4($ workers$) \times 20($ minute/day$) = 20000($ worker-minute$)$
- **Estimated counting time:**

	frequency				
Alternative	A	B	C	D	worker-minute
A0	6	4	2	1	17,415
A1	9	5	2	1	20,025
A2	6	5	2	2	19,920

Issues:

- **Management:** x-worker $\rightarrow$ 1 SKU for each worker?
- **Methods:** man-hour **VS** #SKU, average value, recording system
- **Operation:** inventory cycle

Stock Count Strategy

- **Eliminate counting:** eliminate loose carton
- **Simplify counting:** weight item

Counting is not productive warehouse activity, so plan your next count.

When to count

- **Count before replenishment:**
- **Few inventory left:** counting 3 units & 300 units are totally different
- **Every so many transactions:** because errors tend to happen

What is WMS?

- **Information System:** IT/IS for operational in warehouse
- **Integration:** collect, analyze, & report all activities
- **Important:** strategic decision to modernize WH
- **Industry:** high transaction, require tracking
- **Standard Function:** search & track SKU, batch processing, individual report
- **Advance Function:** cycle count, profiling, RF, data transfer

History of WMS

1975	First WMS installed at J.C. Penney.
1990's	Hundreds of new stock locators & WMS systems; enable RF; Windows NT platform emerges.
1995	become $100 million business
2000	Expanded suites with TMS .
Today	User-configurability & scalability remain key differentiator

source: Brett Peters. "Collect-Industry Council on Material Handling Education"

Thailand

1997	introduce by modern trade
2000s	adopted by large retailers
Today	more adoptees, niche market

Evil cycle in a warehouse

- **Business growth:** fear of lost sale → more SKUs & qty
- **Warehouse managing:** inaccuracy, miss delivery → no space, long cycle time
- **Warehouse expansion:** deadstock, seasonality → expansion, more equipments & workers
- **Costs increasing:** more capital → economy of scale

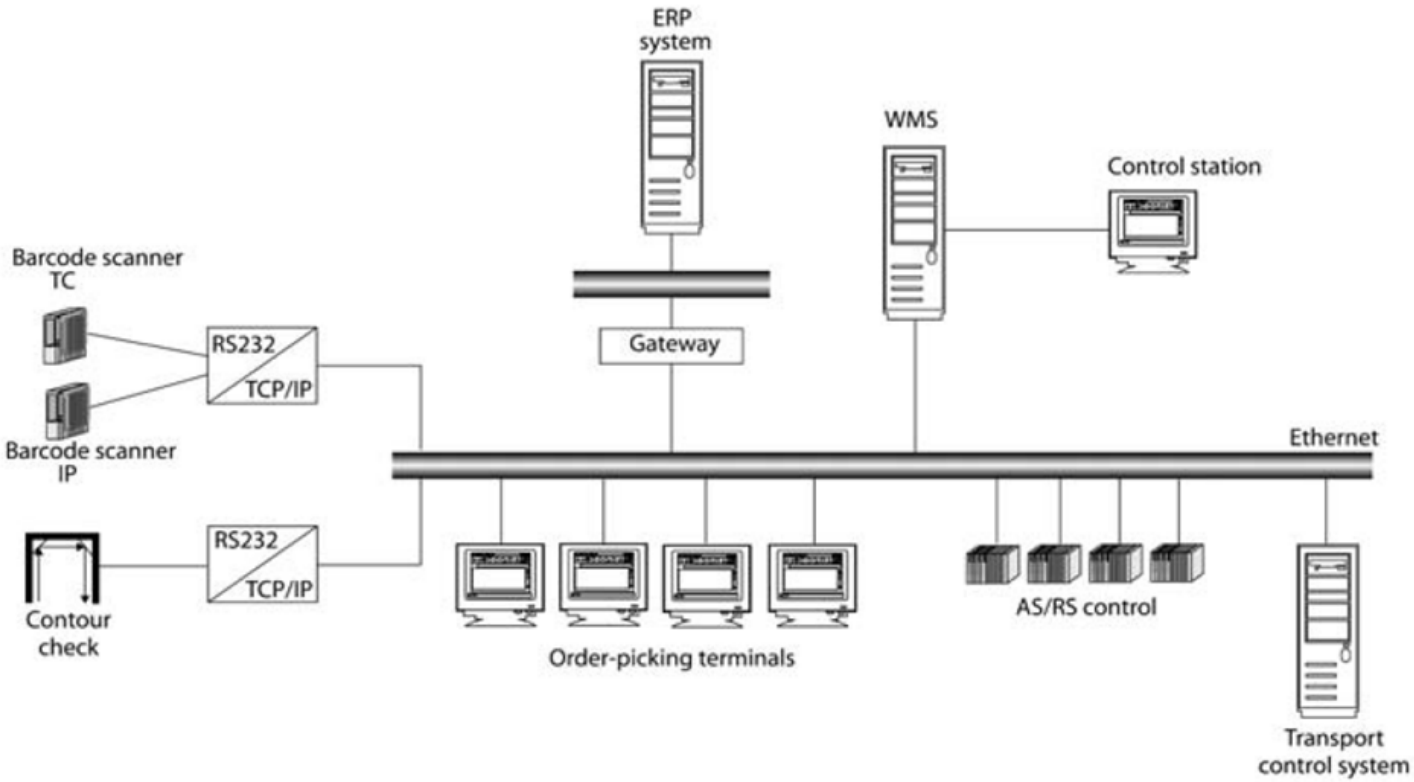
How to break this cycle? → better management with WMS

- **Efficiency:** 1^{st} step of automation & modern Warehousing Mgt.
- **Transparency:** enabler to change → less flexible to do thing

Minimum Requirement of WMS

- **Access & Tracking Control:** multi-users, roles & authorization
- **Radio Frequency:** realtime access, hand held device (Villa Grocery)
- **Flexility :** unit-change, adjust picking policy, manual overwrite, export data
- **Management:** cycle count, picker KPIs, report, integration

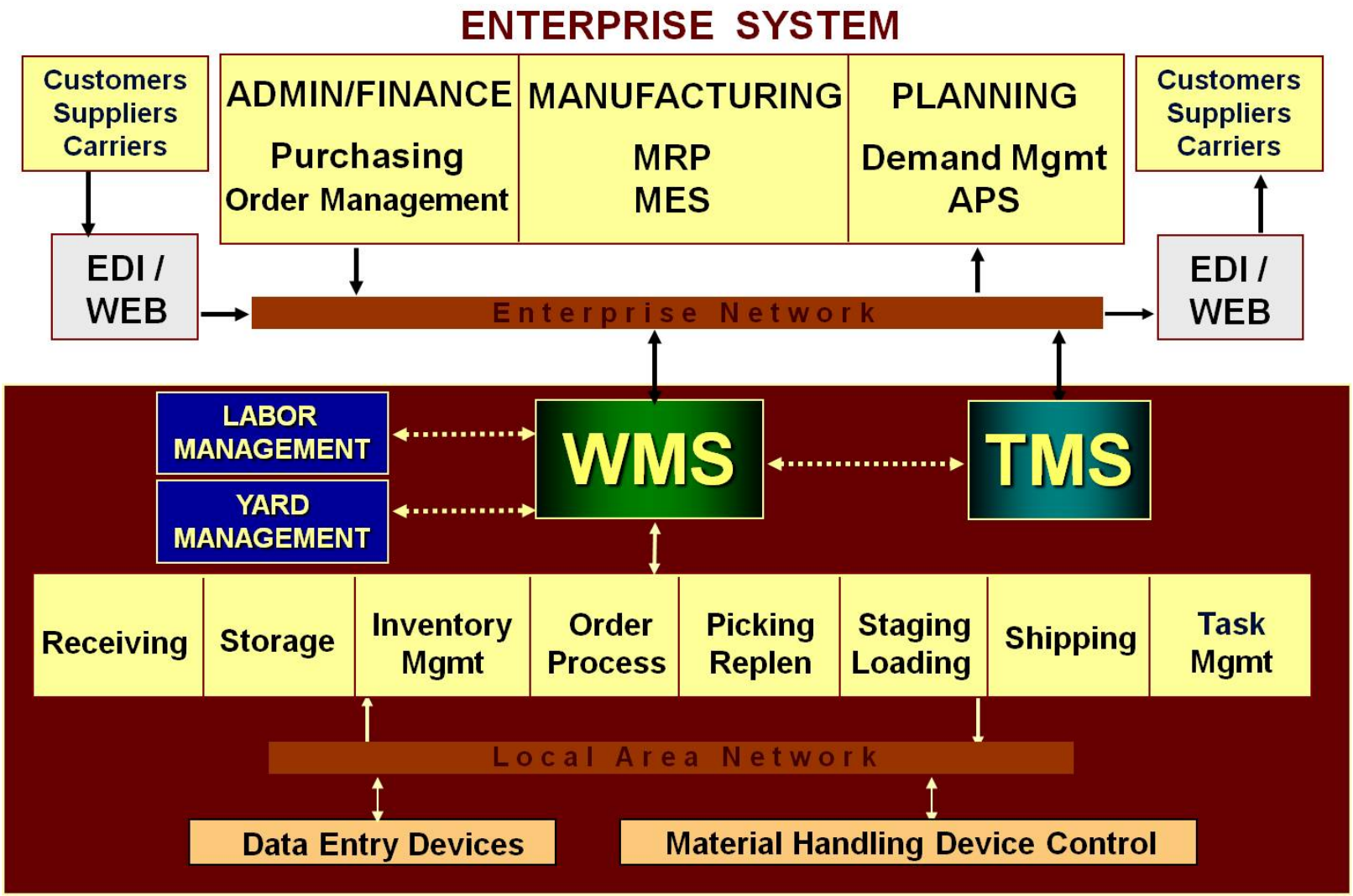
World of WMS



source: ten Hompel & Schmidt. "Structure of a WMS from the Example of myWMS" [tHS07]

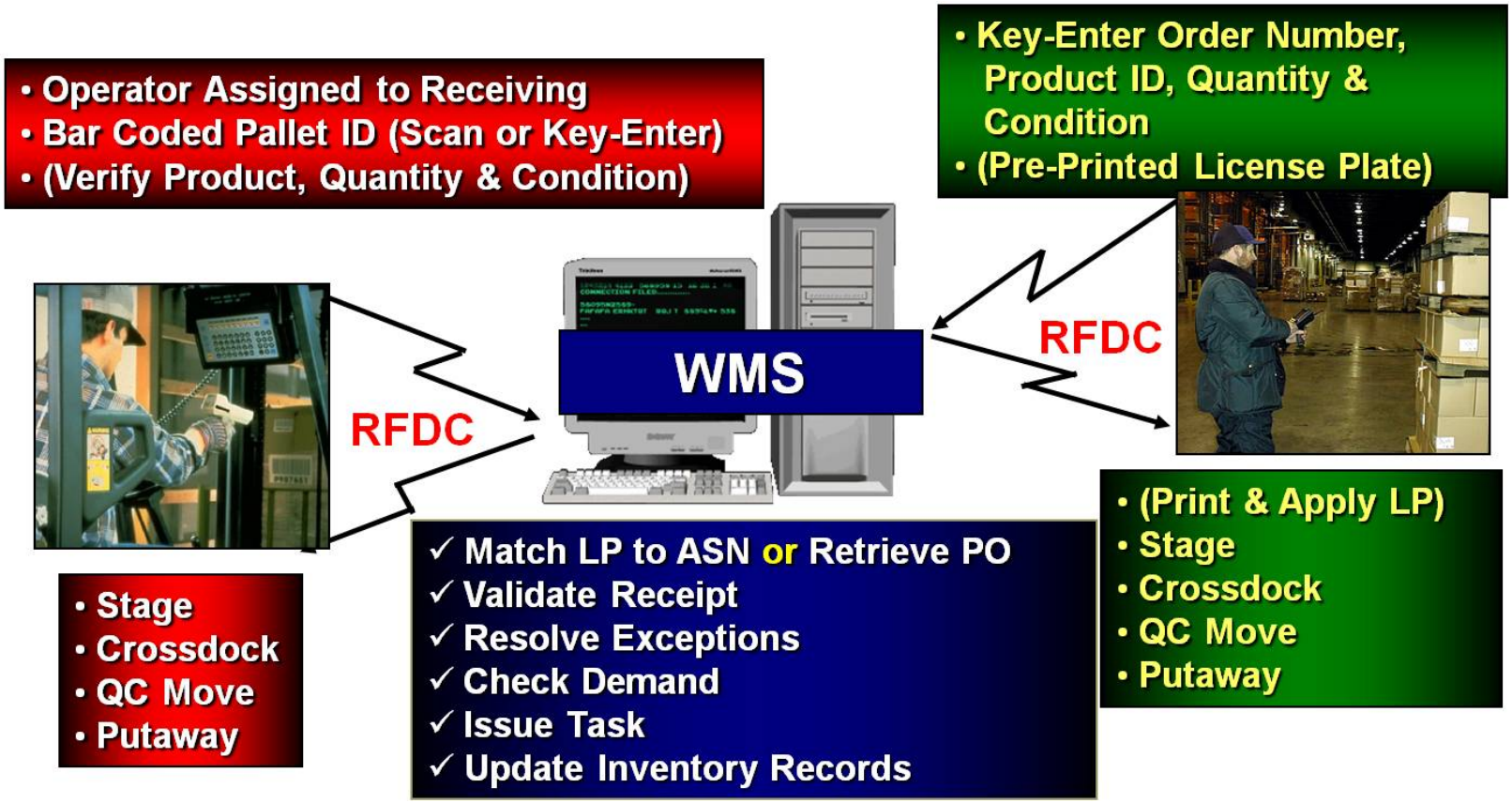
- WMS market is niche IT market $\leftrightarrow$ equipment, trading, data sharing
- In US, $\exists$ many new & extinct vendors
- Thailand limited in big company, high volume

ERP/WMS/TMS



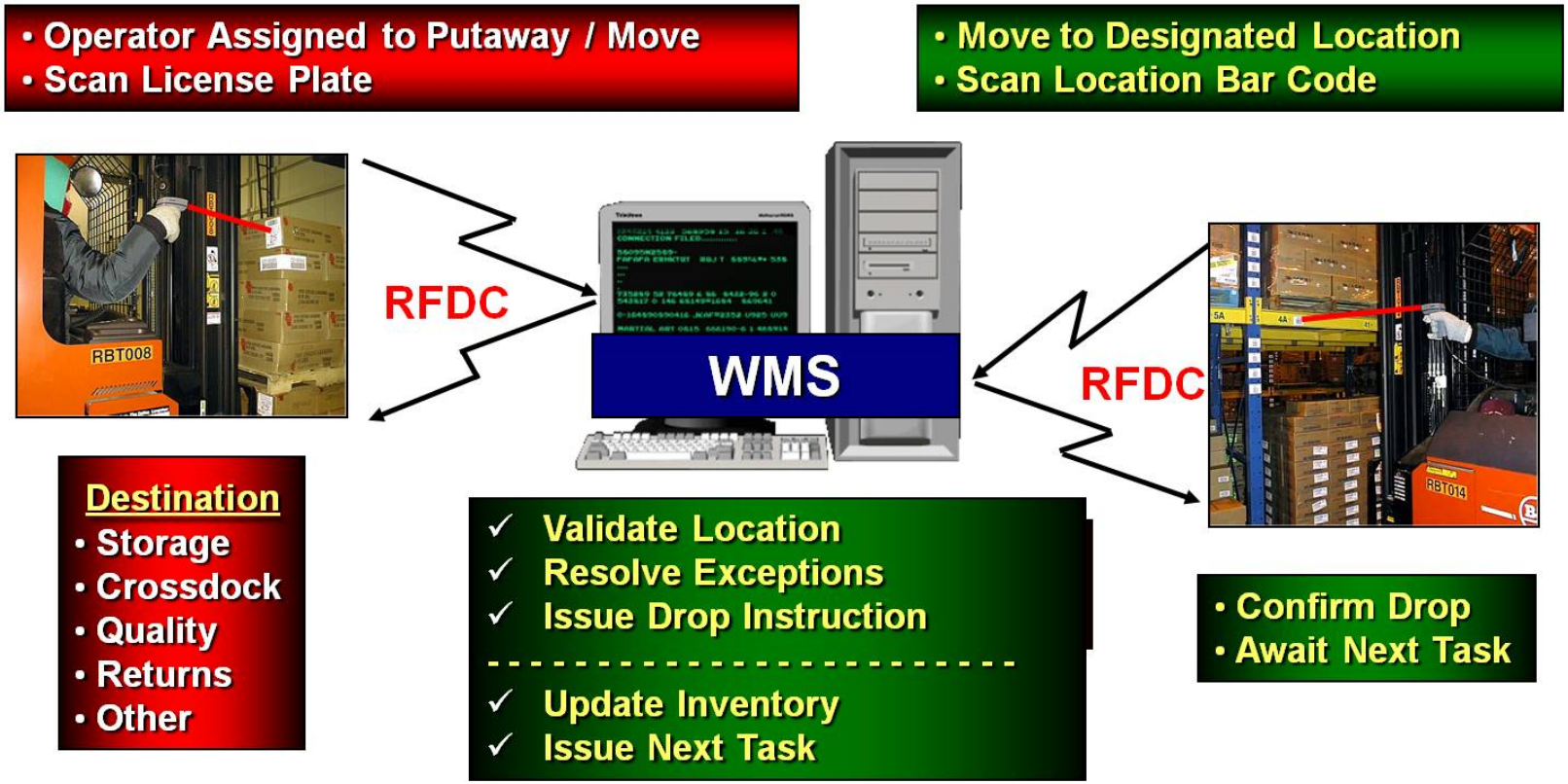
source: Brett Peters. "Collect-Industry Council on Material Handling Education"

Receiving with WMS



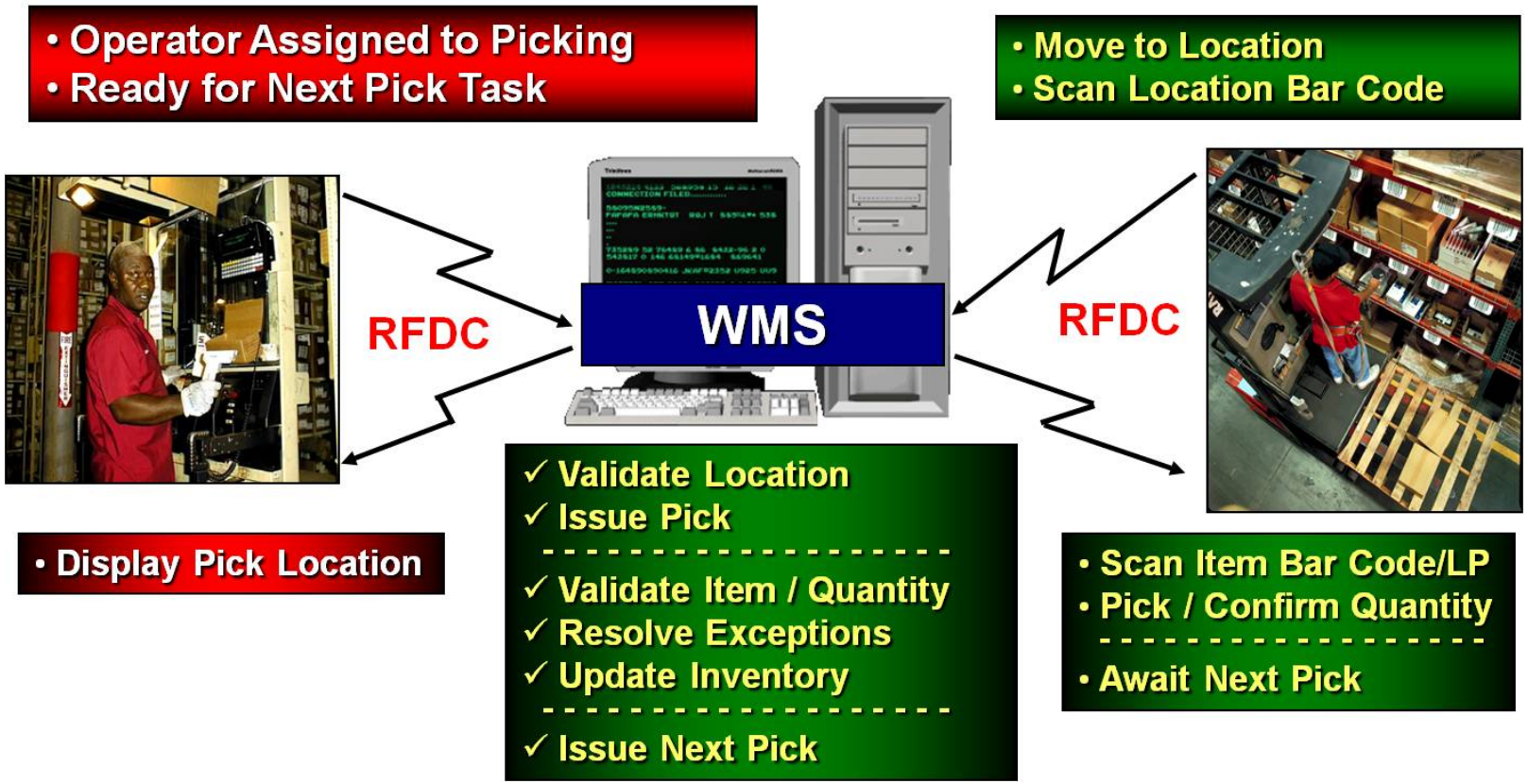
source: Brett Peters. "Collect-Industry Council on Material Handling Education"

Put-Away with WMS



source: Brett Peters. "Collect-Industry Council on Material Handling Education"

Picking with WMS



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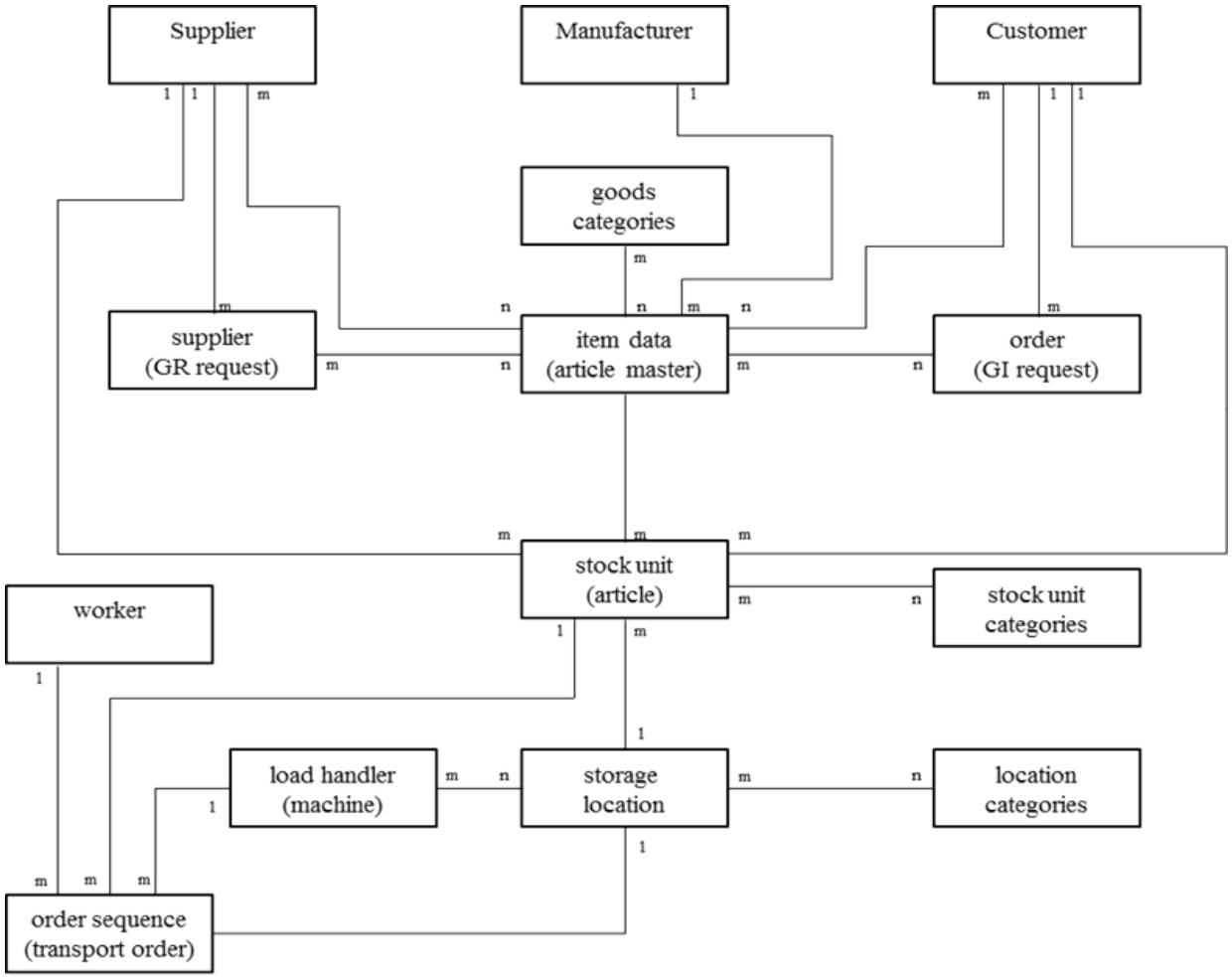
ER diagram of WMS



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Components in WMS

- **Product Files:** (Item Master): SKU ID, descriptions, dimensions, date, lot, units, bills of material, substitutions
- **Location Files:** (Location Master): address ID, layout, quantity, sequencing, dimensions, capacity
- **History Files:** (Order Master): date, customer/supplier, document ID, quality, unit
- **Equipment Files:** equipment ID, location, status, capacity
- **Employee Files:** worker ID, labor standards, operator-equipment matrices, incentive,
- **Customer Files:** customer ID, contact, term of payment, evaluation

source: Brett Peters. "Collect-Industry Council on Material Handling Education"

WMS Cost breakdown

Components	% Total Costs
Hardware	
Computer	6
RF Data Comm	24
Bar Code Applicator	8
Software	
WMS Licence	8
WMS Enhancements	10
Host Interface	6
Other Software Licence	4
Implementation	
Location Labels	6
WMS Installation Service	21
Project Team Cost	6

Signs for WMS consideration

- **Complaints:** ship accuracy, ↑ # checker,
- **Data management:** cycle count, multi-crowded, picker KPIs
- **Productivity:** 1000 line/ man-hr
- **Cycle time:** hot released for truck
- **Business:** short cycle or long cycle count, high turnover

WMS Justification

Task Related Cost

- **Direct labor:** better measure/control individual performance
- **Indirect labor:** reducing training & supervising
- **Administration:** automate collecting & analyzing data

Possible saving

- **Tangible savings:** space utilization, paperwork, expedited delivery
- **Intangible savings:** customer service,inventory turnover, performance measurement

source: Brett Peters. "Collect-Industry Council on Material Handling Education"

Choosing WMS providers

- **Complete package:** limited target group, special functions in modules
- **State-of-Art technology:** text-interface **VS** GUI, web-browser, shorter life cycle
- **Implementation capabilities:** adjustable parameters, experienced consultants
- **Considerable customer base:** recommendation, match with equipments or operations, 'best practice',
- **Professional organization:** trustworthy, after-sale service, stay in business

source: Jeroen van den Berg Consulting. 2002

WMS Trends

- **Connectivity:** RFID, other information system (e.g., supplier ERP)
- **Costing analysis:** activity based costing & management of individual picker
- **Embedded profiling:** facilitate re-layout & inventory slotting
- **Leveraging data:** utilizing more data/information
- **Sharing data:** accessing data by other parties, including consumer
- **Software as a Service (SaaS):** rented on-demand at low monthly cost per user

Problems

1. Explain the similarities and differences between *Enterprise Resource Planning* and *Warehouse Management System*
2. Elaborate the main features in Warehouse Management System

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