



WHITE PAPER

Keys to Supply Chain Competitive Advantage

Balancing Processes, Systems, People & Assets

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In order to achieve success in today's challenging supply chain environment, it is necessary to design and implement process and system changes from a holistic point of view. Competing aspects of your operation must be balanced. Processes, systems, people and assets are all keys to supply chain success, however, you may be challenged with addressing each uniquely as well as addressing them as part of the total solution.

BALANCING ASSETS

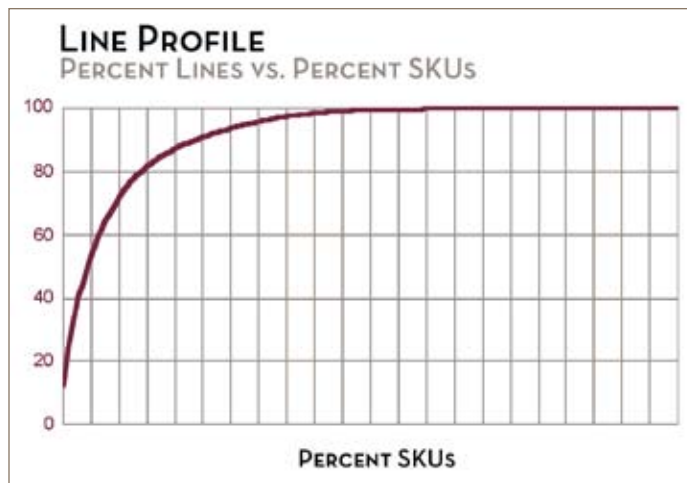
One of the keys to effective asset management is selecting the right storage media. And in order to make the right decision for your operation, you must understand your inventory's velocity (movement), and physical characteristics – namely it's cube and weight. By analyzing the velocity, it will become clear which Stock Keeping Units (SKUs) are most in demand vs. those that are least in demand.

One of the first steps to determine your velocity is to collect customer order and physical SKU characteristics data. The data collected should be representative of your business. Ideally, twelve full months, or more, of data is desired. This allows for identification of any changes to order characteristics due to seasonality or business conditions.

After the data is collected and audited for correctness, it can be modeled or profiled. Warehouse profiling is the key to understanding activity, pinpointing opportunities for process improvements, and providing an objective basis for team decision-making. Profiling provides a baseline for justifying new investments and promotes team decisions, which eliminates biased decisions and forces data driven designs.

In general, this customer demand usually follows the Pareto principle or the 80-20 rule, where 20% of SKUs are responsible for 80% of order volume. The 80-20 rule is considered a power law. Power laws are not linear, but rather grow by an order of magnitude. This is a special case of the wider phenomenon of Pareto distributions. If the parameters in the Pareto distribution are suitably chosen, then one would have not only 80% of order volume coming from 20% of SKUs, but also 80% of that top 80% of order volume coming from 20% of that top 20% of SKUs, and so on (80% of 80% is 64%; 20% of 20% is 4%, so this implies a "64-4 law"). Typically, one will find that 4% to 5% of the SKUs generate more than 50%

of your business and approximately 1% of the SKUs will generate over 25% of the activity. An example of Pareto law as applied to SKUs and line activity is shown below:



Ironically, most of our clients (around 80%), actually have less than 20% of SKUs that result in 80% or greater of the line activity, as shown above.

Inventory can then be categorized by its velocity as shown the table below:

VELOCITY	SKUs	PERCENT	PERCENT	DESCRIPTION	
A	1,624	6.57%	4,397,091	61.29%	VERY FAST
B	3,324	13.46%	1,964,450	27.38%	FAST
C	5,346	21.64%	726,007	10.12%	MEDIUM
D	7,756	31.40%	86,268	1.20%	SLOW
E	6,653	26.93%	0	0.00%	DEAD
Total	24,703		7,173,816		

Breaking SKUs into velocity categories allows you to optimize storage and picking methodologies, and make decisions based on velocity categories.

A PICTURE IS WORTH A THOUSAND WORDS (PROFILING)

Profiling or data mining translates issues into the language of management and enables teams to quickly develop consensus decisions as a team – a picture is truly worth a thousand words. Examples of data driven decisions include:

- Accurately sized facility
- Best practices and staffing plans
- Optimal storage media, cube utilization and slotting
- Minimized material handling systems

Fortna's data modeling software, FortnaDC-modeler™, provides information on orders, lines, units, seasonality, cube, SKU life cycles,

Day and Week analysis, shipping analysis, location analysis, one line order analysis, and velocity, just to name few. Data mining will help you find the mother-lode of opportunities, focus your efforts, and help avoid digging for fool's gold.

SELECTING THE RIGHT MEDIA

After the velocities are determined, you can make decisions on the location of the inventory based on storage requirements, cubic movement, and SKU class.

Inventory is typically split into reserve and forward areas. Usually, the forward

area is designed to hold, on average, at least a week's supply. This industry rule of thumb balances the size of the forward area with the amount of replenishment. The forward area can be configured into a multi-level module arrangement. Again, this is done to maximize the cube and keep similar inventory velocities

together to reduce travel distances between picks.

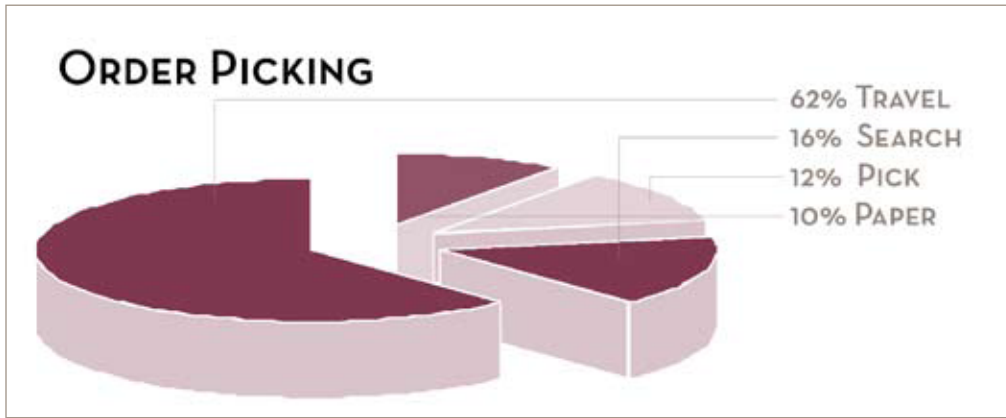
BALANCING PEOPLE

Two keys to balancing your labor are minimizing travel time to your fastest movers and creating an overall facility layout to optimize order fulfillment. These two issues go hand in hand.

The first key to maximizing your labor productivity is grouping fast, medium, and slow movers to minimize travel time between picks and optimize replenishment.

As shown on the next page (A), travel time is usually the most significant element in order picking and should be minimized by grouping the fast items together if a large percentage of the orders can be completed with just fast items (as shown in the chart below), where about 1/3 of the orders can be completed by A, B, AB combination.

Figure A



In a Pareto analysis, the fastest moving items should be the most accessible, closest to the shipping docks, and the easiest to pick. Some examples of forward media types are wire deck rack, pallet flow, carton flow, bin shelving, and horizontal carousels, to name a few.

Forward Media Types	Velocity	Cube Size
Bin Shelving	A-D	Small
Wire Deck	A-D	Medium to Large (*)
Horizontal Carousels	C-D	Small to Medium
Carton Flow	A-B	Small to Large (*)
Pallet Flow	A-B	Medium to Large (*)

Note(*): In some cases, these media types are applicable for large conveyable items, as well.

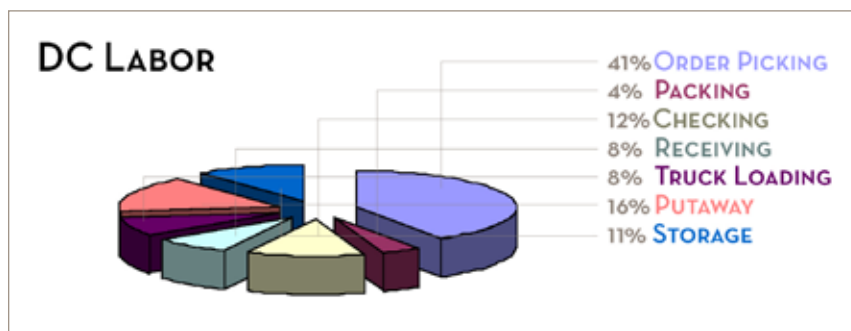
Horizontal carousels are typically used for “B” through “D,” but predominantly “C” and “D” inventory categories. The pick rates for horizontal carousels are greater than wire deck rack and bin shelving and horizontal carousels take up less of a footprint than wire deck or bin shelving. The challenge with horizontal carousels is replenishment and capital justification over wire deck and bin shelving for “C” and “D” items. Horizontal carousels are usually a good fit where space is constrained, its usage is a premium, and / or the labor rates are high. If you have stand-alone horizontal carousels with no additional automation, a light tree, batch lights, and rotation / pick optimization software with host interface can significantly improve the productivity rates.

Some examples of reserve media types are wire deck rack, pallet rack (single and double deep), pallet flow, bulk storage, push back, drive-in, and ASRS, to name a few. The types chosen are again based on cube movement, physical characteristics of the load, and the facility / aisle-way / equipment constraints. After the media has been selected, the requirements are adjusted to account for

growth up to the design year and an overall approximation on square footage with allowance for aisles and operational surplus can be developed.

BALANCING SYSTEMS

The second key to maximizing labor productivity is creating an optimized facility layout. The purpose of the layout is to facilitate efficient order picking, since most dollars are spent on labor picking, packing, and shipping and are typically heavily interrelated. An optimized layout will provide the strongest payback when teamed with an effective overall systems design. However, many companies design the facility first. I suggest you first design your material handling systems, allowing throughput goals to be the focus of your design effort.



For greenfield facilities, columns should be designed around the desired aisle ways to bury the columns between the racks for the reserve storage. After the column spacing has been determined. The first area to be detailed designed is the forward area and shipping. The principle apply here is to “begin with the end in mind”. The forward modules usually house conveyable items. One of the commandments of DC design is to keep fast moving SKUs “close to the shipping doors and close to the floor,” which means placing the forward area

closer to the shipping doors than the receiving doors. This reduces overall travel. The exact location is a balance of having adequate staging in front of the doors, having adequate room for accumulation, and keeping non-conveyable fast to medium movers close to the shipping doors as well. These non-conveyable reserve locations should be kept close to shipping because they will have to be carried the LTL/FT staging area or dock doors via forklift. The conveyor system makes your system flow; partition the DC into zones, and integrates the elements of the DC to function as a whole. Sortation is typically used to support parcel and LTL shipment to get the right product to the right place at the right time.

After the material handling system is designed, the building can be designed. The more square the facility, the more optimal the shape. The perimeter, total wall length, is less for equivalent square footage, for a square building over a rectangular building. The amount of docks determined by the modes of receiving and shipping and by the overall velocity and cube movement will tend to make the building more rectangular. Many facilities have “U” shaped flow - shipping and receiving on the same side. Larger throughput facilities may use straight through flow and even larger facilities that support retail stores may have a “door-per-store”.

BALANCING PROCESSES – BRINGING IT ALL TOGETHER

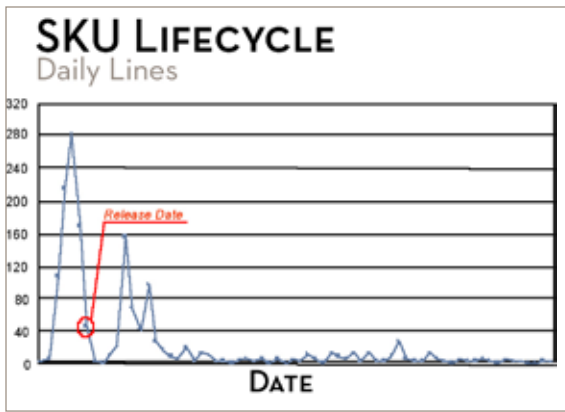
Keeping SKUs in the right place requires vigilance to slot adequately to support your business seasonality and associ-

ated SKU life cycle, because the SKU that is fast today may not be fast when the season changes. The process of slotting and profiling mixed with location analysis can reveal if there is slow moving or dead inventory taking up room in your fast forward areas. It is for these reasons that slotting should be performed regularly.

This example Life Cycle Curve shows SKU unit/line dynamics from introduction to

phase-out and can assist in forward/reserve media selection, as well as in selecting picking alternatives and slotting.

THE TRUTH ABOUT CATS AND DOGS – A SLOTING EXAMPLE



C and D inventories categories (Cats and Dogs) are many times stored in a dog pound. A dog pound is a very narrow aisle (VNA) configuration with single deep selective rack with wire deck level, which is accessible by a man-up order picker. This configuration is used extensively. On the surface, this solution appears to be appropriate, since it minimizes floor space used for slow moving inventories, and in many cases it is the correct solution.

Here's where the law of dimensioning returns comes in to play. One cannot simply add more resources (i.e., more people on order pickers) to get out the required orders. The space (aisle ways) are simply too constrained.

An alternative is to place these inventory velocities into a module. In a module configuration, the aisle ways of wire deck and bin shelving are perpendicular to the conveyor. The picker can walk past many SKUs quickly by walking past these aisle ways and then down the aisle where the pick(s) are located, then back to center pick aisle to place the item(s) onto a takeaway conveyor. One of the keys to make sure that the aisles are not too short and not too deep. Keep in mind that a majority of your inventories are C and D velocities. This could increase the number of modules or make the size of the modules large. This then requires numerous conveyor paths.

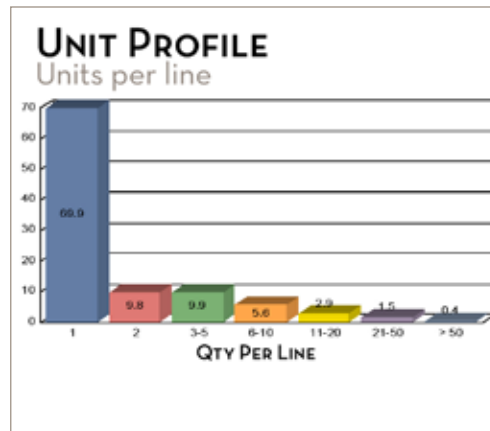
The key is to analyze the outbound order fulfillment rates derived from various concepts and determine the appropriateness of the solution. Most conveyable C's and D's should be in a

module for the above-mentioned reasons and if there is still a large quantity of SKUs, the "dog of the dogs" (slowest of the slow) should be kept in a dog pound.

A PICK METHOD FOR ALL SEASONS...

There are many pick methods. The level of sophistication is a function of the relative size of the DC as measured by units shipped per day and order characteristics. Orders can generally be characterized by two parameters: number of line-items and quantity of pieces per line-item, as shown below.

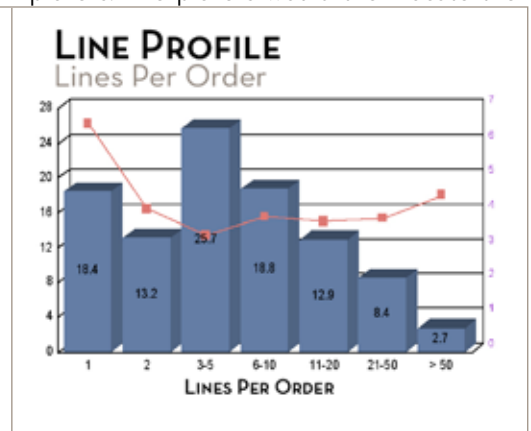
Internet orders (Direct Marketing/Fulfillment) can be categorized by a small number of units per line and small number of lines per orders, whereas retail distribution can be categorized by the opposite. Retail distribution will also have a tendency to have a greater percentage of A through D velocities to support store replenishment.



to name a few. Your order fulfillment volumes, customer compliance demands and ability to invest in technology will help you determine which pick method to use.

For example, the key for a PTL decision is density and process steps. Remember from earlier in this article, that based on Pareto's law, approximately 1% to 4% of your SKUs will account for up to 25% to 50% or more of the activity. Carton flow is a good candidate for PTL, since it creates pick face density. For the SKUs that fit into carton flow, PTL technologies may be a good candidate.

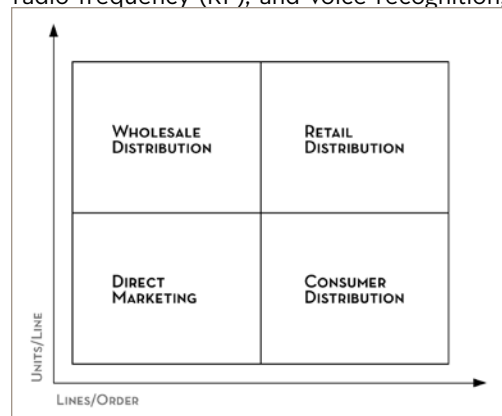
Another excellent application of PTL is with full case picking from a pallet flow module onto a takeaway conveyor to a print and apply system (PNA). Imagine being directed by lights and displays on which SKU to pick and the quantity, and then just placing the carton on a takeaway and then back to picking. With the old system, shipping labels were batched, printed, then sorted, and then given to the pickers. The pickers would then locate the



By knowing key order characteristics and ship volumes, you can determine the most appropriate fulfillment and picking strategy.

Some picking technologies to consider are traditional paper and labels, pick-to-light (PTL), radio frequency (RF), and voice recognition,

inventory, pick the inventory and then peel and stick the ship label on the carton, and then place the cartons on the takeaway conveyor. With these PTL and PNA systems, rates, productivity, quality, and labor saving are phenomenal over a traditional pick and stick system.



CONCLUSION

To remain competitive in today's challenging supply chain environment, you must balance the four components that can make or break your business goals. The keys to unlock "hidden" supply chain opportunities are maximizing your Processes, Systems, People & Assets.

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