Design for Payback

A Model For Selecting Warehouse Automation Technology Based on Return On Investment

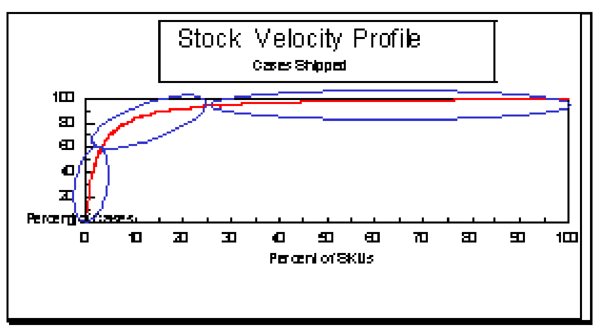
Your mission is to improve your distribution operation. Your CEO sets goals for increasing productivity by 20%, inventory and order accuracy to 99.9%, capacity and throughput to meet the 15% annual growth rate, and you must reduce order cycle time for your customers. There is no money for additional space, but you're told to look at automation as a solution.

How do you select the right technology to achieve your goals? How can you improve your project's chances of receiving the necessary capital when it competes with other internal investment proposals?

Design For Payback (DFP) may be right for you. DFP is the concept of requiring payback analysis on every element of an improvement plan, not just measuring the return on investment on the project as a whole. If you just consider payback on the overall project, you are almost certain to spend more money than you should. You will also lower the project's ROI compared to what it could be, and reduce the likelihood of funding.

DFP is based on putting your investment into those parts of your operation which have the greatest potential for savings due to increases in productivity, accuracy, and throughput. It is directly related to the velocity of your products. The faster moving SKUs can justify the greatest investment. The slowest moving SKUs can justify little, if any, investment.

This graph shows a Stock Velocity Profile that is very typical among our clients. The curve represents the cumulative percent of cases shipped by the cumulative percent of SKUs. The profile shows each SKU's relative consumption of labor in a facility because the fastest moving SKUs consume the most labor.



Pareto's Law says 20% of the SKUs will represent 80% of the cases shipped. Well, Pareto didn't work in this distribution center, and our experience is that he may never have worked in a DC. In this typical example, just 3% of the SKUs (55 SKUs) represent 61% of the cases shipped, and 27% of the SKUs (502) represent 95% of the cases shipped. The low velocity group, 70% of the SKUs, are the last 5% of the cases shipped.

Pareto, whose Law is observed by many warehouse designers, would apply technology to at least 20% of the SKUs. However, only 10% of this client's SKUs ship more than 6 cases per day. How much are you willing to spend to reduce the labor content of the bottom 90% of these SKUs, which average fewer than 6 cases per day? If you don't analyze the velocity at the SKU level, you'll probably overspend, especially if you are considering some material handling automation.

Here are a couple of examples:

A large apparel company with a velocity profile very similar to the one above was considering automating full case picking with "pick-to-belt" technology, picking cases from staged pallets to an adjacent conveyor belt. Using Pareto's Law, they planned to provide pick slots for 900 SKUs (20%) with 2-4 pallets per SKU in a three level, pick-to-belt module. The cost was budgeted at $2.9 million, and it required over 35,000 sq. ft. With the SKU level velocity analysis inherent in DFP, they found that only the first 200 SKUs had the case volume to justify the pick-to-belt technology. On a per SKU basis, the cost of the 200th slot was justified with a two-year payback due to productivity improvements. The entire module for the 200 SKUs cost about $450,000 and experienced a 1.4 year payback. It also occupied less than one-fourth of the space.

A warehouse design concept for **a small retailer** included numerous technologies, including narrow aisle rack, high density, rack, standard aisle rack, intermediate replenishment module requiring additional touches prior to replenishing an active pick module, carton flow rack with "conveyorized" tote picking, and an 18-lane sortation system. The cost of capital was estimated at $3.2 million (plus lift trucks) and the expected order accuracy was 87%. The budget could not support a warehouse management system (WMS). The facility had 92 direct employees. At a labor rate of $10.00 per hour, a 35% benefits rate, and a 15% headcount savings this retailer would need 8.3 years to reach a simple payback. Distribution center designers using Design For Payback would probably reduce the complexity of the operation, decrease space needs, spend far less capital and add a WMS to improve productivity and the 87% order accuracy.

Design For Payback does not suggest what types of technology are right for your operation, but it does guide you in the evaluation of different technologies. Naturally, all technologies will be praised by their vendors as "right" for you. More than likely, what's right for you is a combination of design elements, each applied to the extent that it is justifiable with a payback of two to three years.

The Design for Payback Process

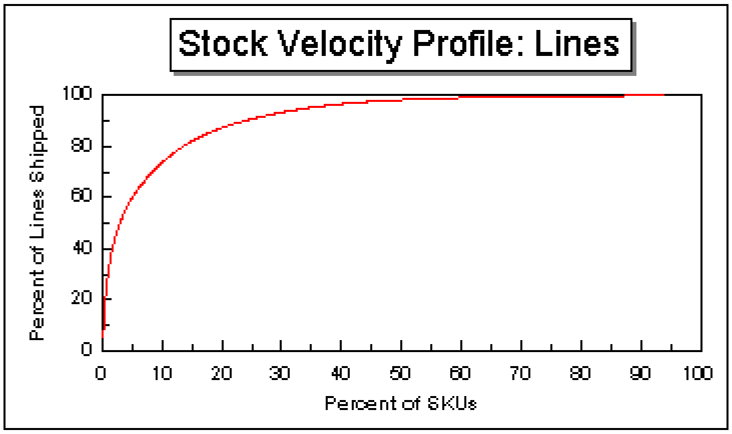
- Prepare a spreadsheet file for various shipment velocities appropriate for the business. Lines and units are always done. In an operation that is mostly full case shipments, a velocity profile of cases is needed. Suggested column headings are: SKU number; Description; Current Balance on Hand; Case Dimensions (1 column each for length, width, and height); Monthly Totals of Lines, Units, and Cases Shipped (1 column for each month for each velocity).

  In preparing the file, count backorders as an original order or as a backorder, but not twice. Also, include all SKUs with an on hand balance (on the day the report is run) greater than zero, even if they were not ordered during the time frame.

- Sort in declining line velocity, arranging the SKUs with the most frequently picked item first and the least frequently picked last.

- Create new columns for Average Per Day, Cumulative Percent of SKUs, and Cumulative Percent of Lines Shipped.

- Produce a stock velocity graph such as the one below.



- Determine the break points between the velocity groups. The general area of the break points are usually obvious from looking at the graph.

- Set the specific break points between groups by reviewing the Line Velocity's detailed data. Find an SKU in the general area of the break points which is either a whole integer of the Cumulative Percent of SKUs, a whole integer of the Average Lines Per Day, or a whole integer of the Cumulative Percent of Lines.

- Produce a table like the one below. The focus on a small set of the SKUs is obvious from the table.

Group	% of SKUs	No. of SKUs	Group's % of Lines Shipped	Highest Lines Per Day	Lowest Lines Per Day
High	6	54	64	181	8
Med.	24	217	29	7	1
Low	70	626	7	<1	0
Total	100	897	100		

- Repeat the steps for each of the remaining profiles for Units Shipped and Cases Shipped. Whichever profile produces the steepest curve in the graph is usually the better design tool.

- Using the best profile as a design tool, determine how each group of SKUs will be picked. Usually, some type of active pick area is appropriate to reduce the travel component of picking orders. The most commonly used storage media and techniques for the velocity groups are:

High	Medium	Low
Pick-To-Belt	Case Pick from Reserve	Bin Shelving
Pallet Flow Rack	Carton Flow Rack	Open Shelving
Carton Flow Rack	Carousels	Case Pick From Reserve
Pick-To-Light	Floor level pallets	Cluster Picking
Conveyor supported picking	Conveyor supported picking	

- Look for an opportunity to pick full pallet quantities for one customer and full cases directly from Reserve Storage, thereby eliminating the need to replenish these quantities to an active pick area. Generally, a Warehouse Management System (WMS) will be required to fully optimize the picking processes.

Most WMS systems will also support batch and wave picking, zone pass, simultaneous picking of components of an order across multiple zones, merging parts of an order back together, and system-directed replenishment of the active pick areas. With good systems features, an active pick slot may not be needed for all SKUs. You may even be able to omit a floor level pallet pick slot, reducing space requirements, replenishment labor, and equipment.

When making these decisions, consider the **total logistics costs** of the decision. In addition to labor, space and equipment, cost tradeoffs must be considered for each option.

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