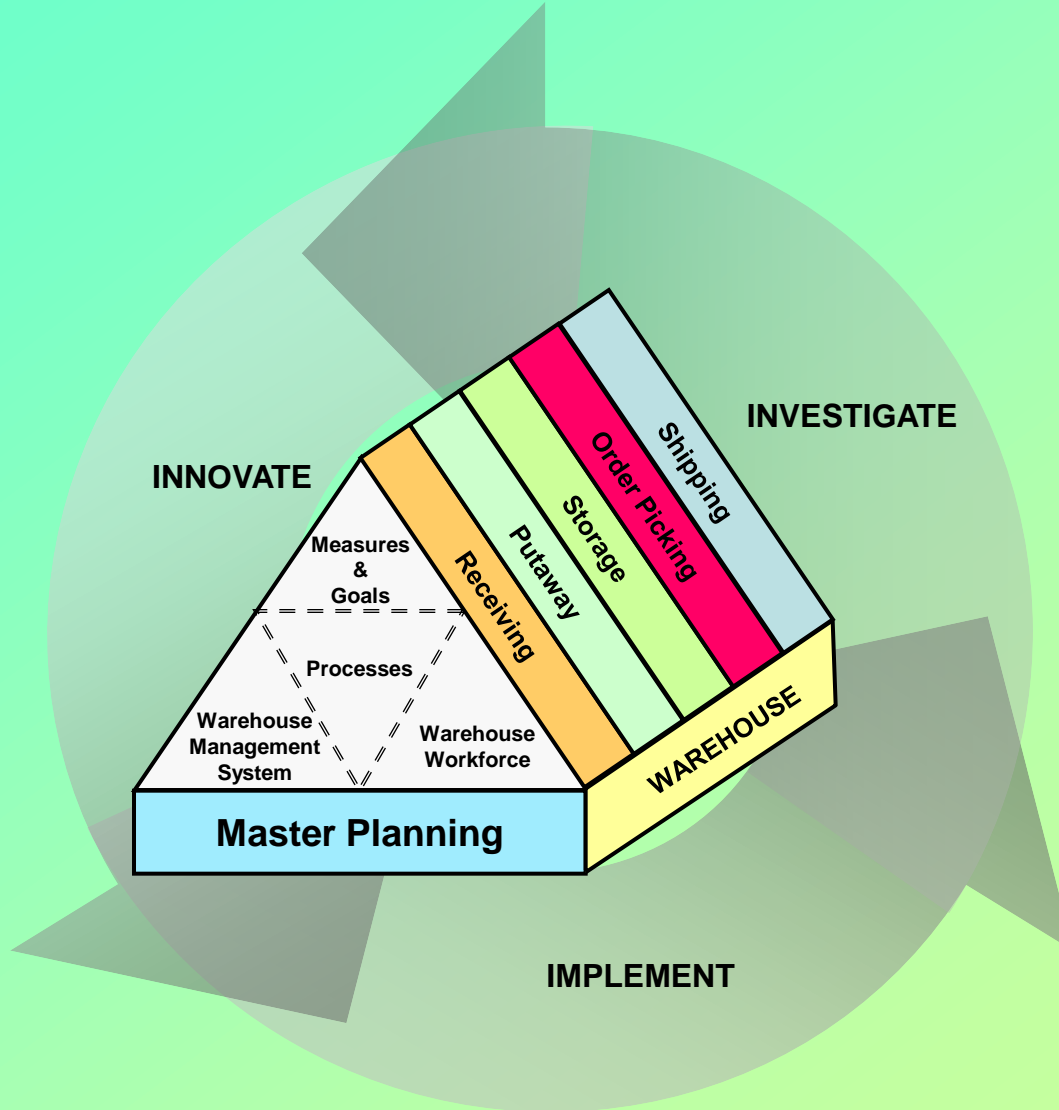


WAREHOUSE MASTER PLANNING METHODOLOGY



INVESTIGATING

WAREHOUSE OPERATIONS

ONE OF THE MOST IMPORTANT STEPS

- WAREHOUSE ACTIVITY PROFILING -

For lack of knowledge, lack of tools, and/or lack of time, *many warehouse reengineering and layout projects commence without any understanding of the root cause of the problems and without exploration of the real opportunities for improvement. So -*



Warehouse activity profiling is the systematic analysis of item and order activity. The activity profiling process is designed ***to quickly identify root causes of material and information flow problems,***
to pinpoint major opportunities for process improvements, and
to provide an objective basis for project-team decision making.

Motives and Minefields

Profiling provides the right baseline to begin justifying new investments. Profiling gets *key people involved*.

During the profiling process, it is natural to ask people from many affected groups to *provide data*, to *verify and rationalize data*, and to help *interpret results*.

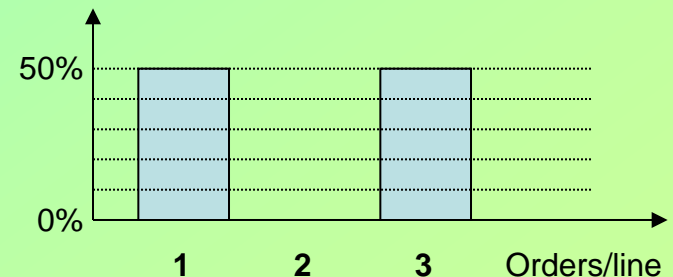
Experience:

"People will only successfully implement what they design themselves"

Tools we use:

at first statistics

- Parameters – what means *average*
- Distributions – very important to have



Other sources of information's:

Pictures, Interview, questionnaires ...

Warehouse Design issues and Related Profiles

Planning and Design Issue	Key Questions	Required Profile	Profile Components
1. Order picking and shipping process design	<ul style="list-style-type: none"> • Order batch size • Pick wave planning • Picking tour construction • Shipping mode disposition 	Customer order profile	<ul style="list-style-type: none"> • Order mix distributions • Lines per order distribution • Lines and cube per order distribution
2. Receiving and putaway process design	<ul style="list-style-type: none"> • Receiving mode disposition • Putaway batch sizing • Putaway tour construction 	Purchase order profile	<ul style="list-style-type: none"> • Order mix distributions • Lines per receipt distribution • Lines and cube per receipt distribution
3. Slotting	<ul style="list-style-type: none"> • Zone definition • Storage mode selection and sizing • Pick face sizing • Item location assignment 	Item activity profile	<ul style="list-style-type: none"> • Popularity profile • Cube-movement/volume profile • Popularity-volume profile • Order completion profile • Demand correlation profile • Demand variable profile
4. Material transport systems engineering	<ul style="list-style-type: none"> • Material handling systems selection and sizing 	Calendar-clock profile	<ul style="list-style-type: none"> • Seasonality profile • Daily activity profile
5. Warehouse layout and material flow design	<ul style="list-style-type: none"> • Overall warehouse flow design: U, S, I, or L flow • Relative functional locations • Building configuration 	Activity relationship profile	<ul style="list-style-type: none"> • Activity relationship distribution
6. Warehouse sizing	<ul style="list-style-type: none"> • Overall warehouse space requirements 	Inventory profile	<ul style="list-style-type: none"> • Item family inventory distribution • Handling unit inventory distribution
7. Level of automation and staffing	<ul style="list-style-type: none"> • Staffing requirements • Capital-labor substitution • Level of mechanization 	Automation profile	<ul style="list-style-type: none"> • Economic factors distribution

Customer Order Profiling

The first think we must understand to plan and design warehouse operations is the profile of customer orders

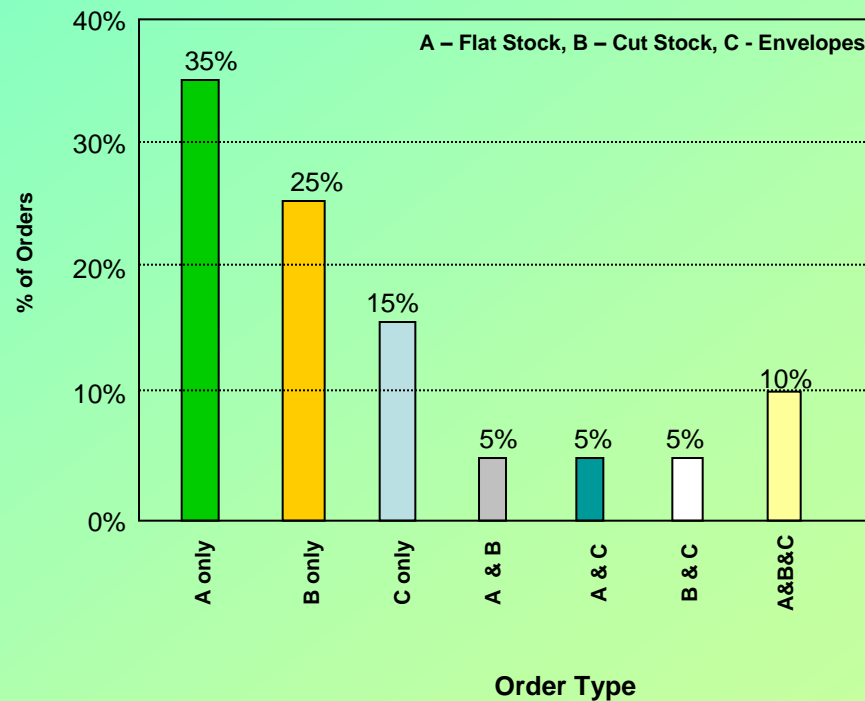
They includes:

- **Order mix distributions**
- **Lines per order distribution**
- **Cube per order distribution**
- **Lines and cube per order distribution**

Order Mix Distribution

There are variety of order mix distributions important for defining warehouse operating strategy. As an example, here is shown *Family mix distribution*. The aim is to find out doe's exist typical order mix (or few of them) from multiple families of items. If it is present, we can increase productivity and customer service.

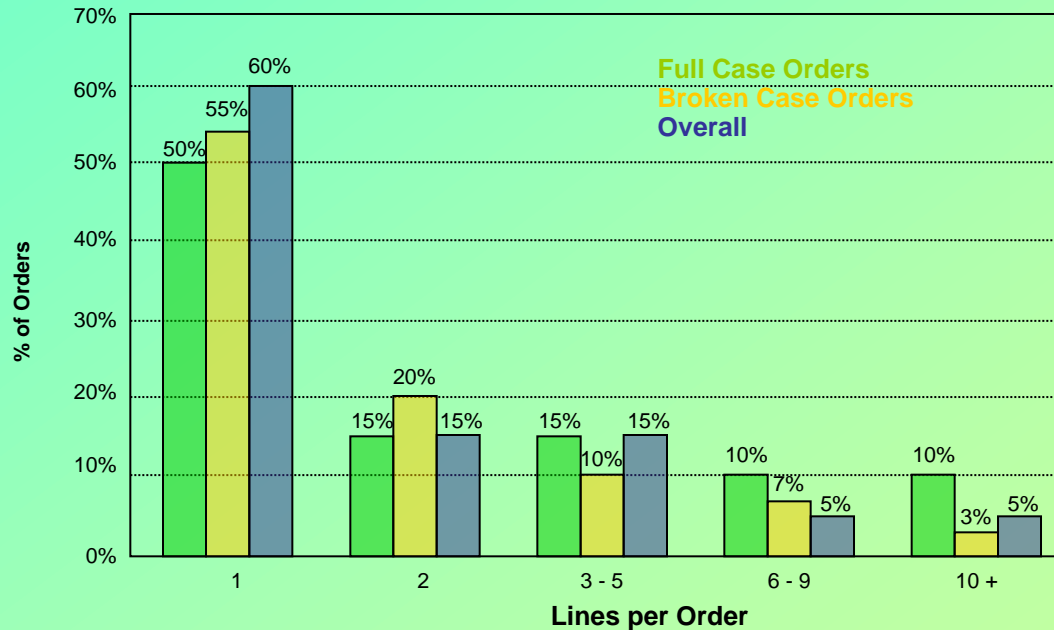
The next distribution shows one example:



Line per Order Distribution

This distributions is one of the most interesting information about picking orders. The aim is, as well, to find out the which kind of order picking will be better

There is one of lines per order distribution:



What is happened – the most (50% or more) orders are for one line item, what is a peak.

It is common for service part logistics. Those orders can be batched and it would be possible to make efficient picking tours.

Line per Order Distribution (contd.)

In **opposite (mirror) case** of distribution what to do?



there is typically enough work to do within an order and it is efficient worksheet.

Lines and Cube per Order Distribution

The lines and cube per order distribution brings together in one profile the critical information needed to define order picking strategy. It illustrates the typical daily picking activity.

Lines per order distribution

Lines per Order	0-1	1-2	2-6	6-10	10-20	20+	Total orders	% of orders	Total lines	% of lines
	Cube per Order (Ft ³)									
1	176	15	16	7	3	3	220	49%	220	17%
2 - 5	100	24	27	15	10	2	178	40%	623	47%
6 - 9	8	6	6	6	4	3	33	7%	248	19%
10 +	2	1	1	6	4	1	15	3%	225	17%
Totals	286	46	50	34	21	9	448	100%	1.316	100%
% of orders	64 %	10 %	11 %	8 %	5 %	2 %	100 %			
Total Cube	143	69	175	255	315	270	1.227			

Cube per order distribution

Those frequent and small volume orders are candidates for single operator to batch together into picking equipment

One order with more than 10 lines but more than 20 ft³ is probably candidate for a single operator to pick a pallet

Purchase Order Profiling

The purchase order profile includes the same distributions as the customer order profile. The only difference is *that activity is inbound instead of outbound*. Strategies are the same as for customer order profile except the batching and processing strategies for receiving and putaway are opposed to order picking.

Purchase order is inbound and *customer order* is outbound from your warehouse.

Item Activity Profiling

The item activity profile is used primarily to slot the warehouse, to decide for each item (1) what storage mode the item should be assigned to, (2) how much space the item should be allocated in the storage mode, and (3) where in the storage mode the item should be located. The item activity profile includes the following activity distributions:

- *Popularity distribution*
- *Cube-movement/volume distribution*
- *Popularity-volume distribution*
- *Order completion distribution*
- *Demand correlation distribution*
- *Demand variability distribution*

Those analyses will be investigated more in one later lesson

Inventory Profile

The inventory profile includes the **item-family** inventory distribution used to reveal opportunities for improved inventory management practices and the **handling unit** inventory profile used in storage systems planning.

Handling Unit Inventory Distribution

The item-family inventory distribution is not very useful for storage systems design because the information is not presented in material handling terms (that is, pallets, cases, eaches, and so on) - the data is expressed in terms of dollars, pounds, pieces, days of supply, turns, and so on.

That is another motivation for the profiling exercise

- *to give the managers and designers of the warehouse operations a presentation of the activity of the warehouse in their terminology.*

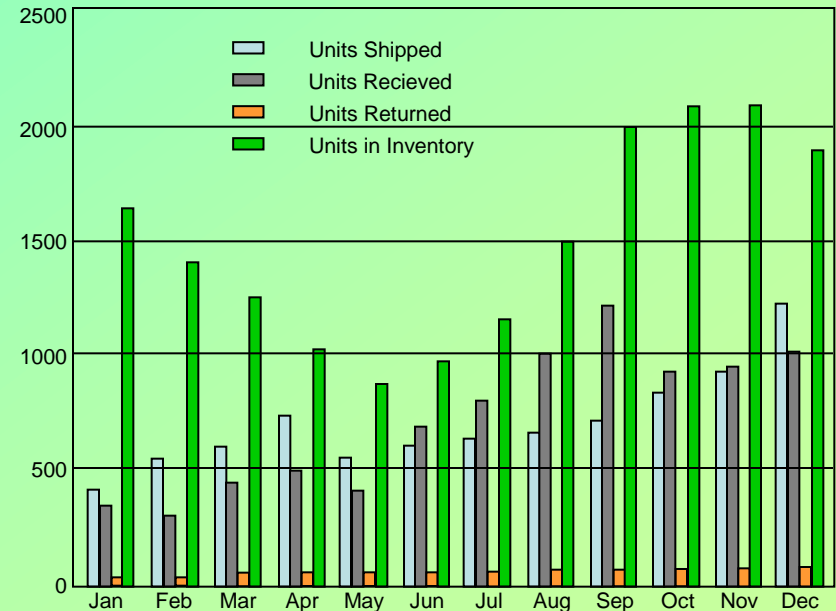
Calendar Clock Profile

The calendar-clock profile typically includes a **seasonality distribution** and a **daily activity distribution**. The distributions are designed to reveal peaks and valleys in warehouse activity so that material handling systems can be properly sized and so that proper staff scheduling programs can be designed.

Seasonality Distribution

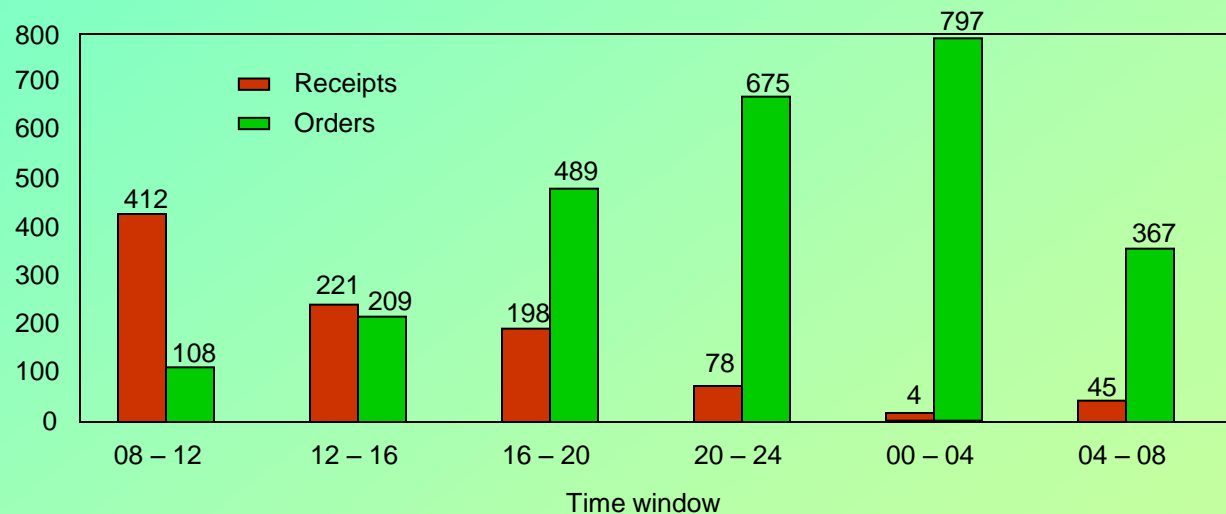
The seasonality distribution indicates the peaks and valleys in inventory levels as well as receiving, shipping, and returns activity. **Because storage systems need to be sized to accommodate near-peak inventory levels, and material handling systems need to be sized to accommodate near-peak activity levels, it is critical to identify peak inventory and activity levels.** A distribution like this also indicates an opportunity for workforce shifting by moving the extra staff required for receiving in August/September to shipping in October/November to returns handling in January.

With the seasonality distribution in hand, **a popular rule of thumb for planning purposes is to design material handling systems to accommodate the average day of the peak week.**



Daily Activity Distribution

The daily activity distribution, which is typically present in practice, indicates hourly peaks and valleys in receiving, storage, picking, and shipping activity. Material handling systems *should be designed* for peak activity periods, and offsetting peaks represent opportunities for shift staggering and interdepartmental workforce shifting.



For thinking: could be usefully to analyze this distribution over same days on week during month (s) / year?

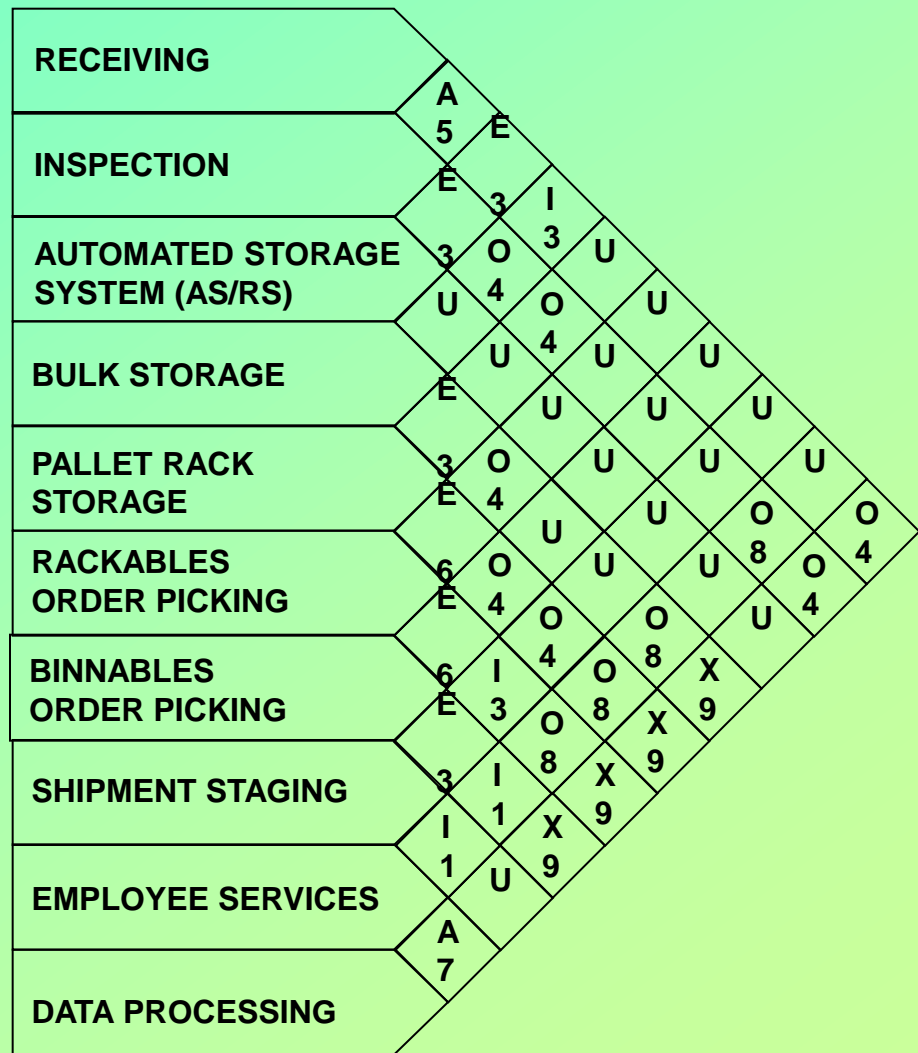
The activity relationship profile and 'distribution' reveals the interfunctional and interprocess relationships in the warehouse. It is used to suggest the location of processes and function relative to one another in a block *layout*.

PROXIMITY IMPORTANCE REASONS FOR IMPORTANCE

- A** Absolutely necessary
- E** Especially important
- I** Important
- O** Ordinary important
- U** Unimportant
- X** Undesirable

- 1** Supervision
- 2** Safety
- 3** Material flow
- 4** Work flow
- 5** Material control
- 6** Equipment proximity
- 7** Shared spaced
- 8** Employee Health & Safety
- 9** Security

Using this distribution, we investigate the importance of locating some processes adjacent to one another. As an example, it could be important that reserve storage be adjacent to receiving staging for efficient putaway.



Investment Profile

In the most cases, one of the very important analyze. The investment profile indicates the cost and operating parameters necessary *to make design and investment decisions*.

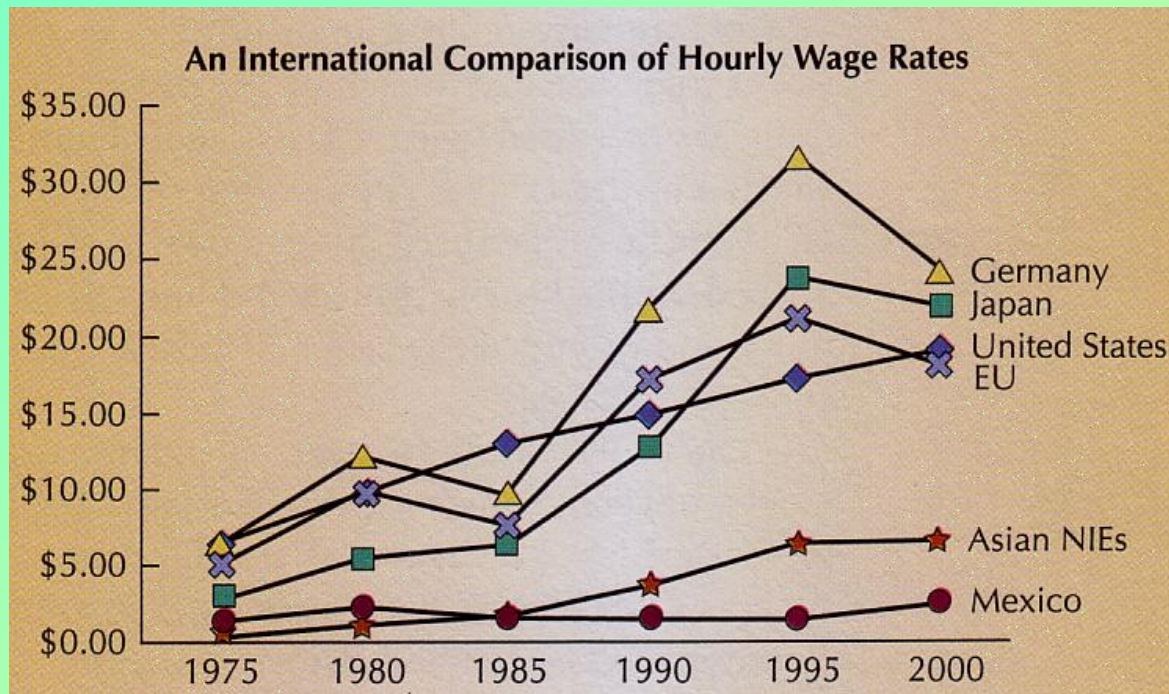
The profile includes, typically, the

- Wage rate (dollar per hour)
- Cost of space (dollar per square foot per year)
- Cost of capital (percent per year)
- Required ROI and/or payback period (percent or years)
- Working days per year (days per year) and working hours per day
- Planning horizon (years)

Just discuss some of them.

In Problem of profiling **wage rate** could be very specific. You will have a lot personnel with different education, experience ... So, the wage rate you have to find out, especially to operators for sophisticated equipment.

The figure shows wage rate differences between some regions in the World.



Cost of space

In practice, this problem is not simple. It depends on lot of factors.

On the other hand, it is much easier to justify high-density storage systems (such as, vertical carousels, mezzanines, storage drawers, and AS/RS) when the cost of space is \$20 to \$50 **per square foot per year** than in the case of a recent project where a 15 year lease is signed for \$2.25 per square foot per year.

It is much easier to justify highly automated systems when the cost of capital is low (2 percent to 5 percent), when the required return-oninvestment (ROI) is low (7 percent to 12 percent), and when the required payback period is extended (three to five years).

Those economic justification conditions are more common in *Japan* and *parts of Europe*. That is why the level of automation in warehousing and distribution in Japan and those parts of Europe is so much higher than that found in the United States. Unfortunately, finding out those facts is not easy task.

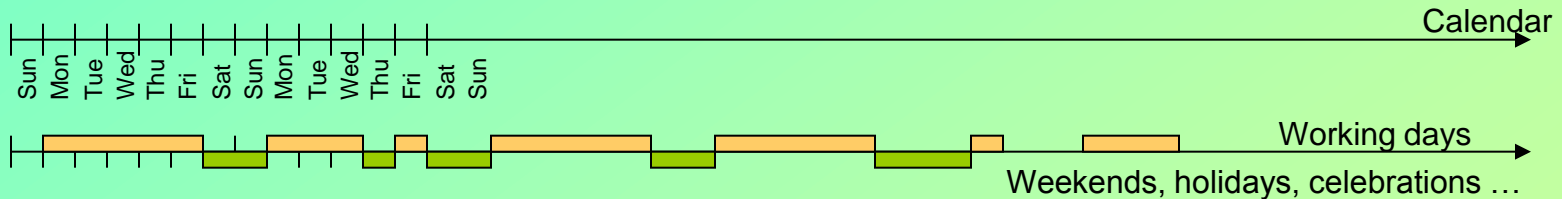
Q: If I need warehouse space, what should I expect to pay?

http://www.nfia.com/qanda/location.php#question_3

Warehouse space can be found across the Netherlands, but the majority of the premises are concentrated around the logistical centers such as the ports of Rotterdam and Amsterdam, Schiphol airport, and the big cities. The annual rent per square foot currently ranges from approximately € 4.7 - 7.4 per square foot.

Working days per year

Typically, to find out this information is not complicated. But it could be a respected having in mind that a wage rate is usually higher on holidays, weekend and so on. You have to take care that your warehouse is a element of supply chain, one integrative part so you have to plan working days (and nights, also) adequately.



Customer's requirements are sometimes a reason that you have to change your working days schedule.

Planning horizon

One of very hard tasks. You have to predict something what is usually stochastic, dynamic, uncertain. For some tasks, there are a lot of forecasting methods which are less or more complex and reliable.

Typically, there are short, medium and long term horizon involved with type of planning.

Type of Planning	Reason	Need
Strategic	Determine the overall objectives and resources requirement	Policy making
Tactical	Translate the strategic objective of the system into an action plan	Long/mid term
Operational	Process of assuring that specific tasks are implemented into the day-to-day operations	Short term
Contingency	Exceptions or responses to emergencies	Just-in-case

We will short discuss about them, simplified

Strategic planning is

- **an offensive tool designed to guard against a predictable change in requirements, the timing of which can be anticipated**
- **directed at forecasting future needs far enough in advance of the actual requirements**
- **only way to survive the rapidly changing environment ...**

Tactical planning

- **time frame is one to two years**
- **primary purpose is to preplan policies, develop programs, and set targets, both in terms of actions to be taken and the timing that will move the firm *to accomplish its long-term strategic objectives***

Some types of tactical planning include inventory policies, freight rate negotiation, cost reduction, productivity improvements, and information system enhancements and additions ...

Operational Planning

Operational planning (serving tactical and strategic planning) can vary from daily to weekly to monthly. The major components of operational planning involve managing resources such as labor and capital assets and measuring performance with regard to both aiding operating efficiency and anticipating future operating issues

Contingency planning

is a defensive tool used to guard against an unpredictable future change in distribution requirements. Typically, contingency planning involves asking "what if" questions as they are:

- *Energy shortages*
- *Strikes*
- *Natural disasters*
- *Product recalls ...*

The idea behind contingency planning is to significantly reduce the lead time required to implement a plan of action. It is important to be organized properly to minimize cost and minimize damage to the company's image.

Profiling usually asks for a lot of work. It is. However, it is the work necessary to insure an accurate plan and design for the warehouse, because the design follows so quickly from the profile.

Remember, there is no other time during the project life cycle - *profile, conceptualize, design, implement, and maintain* – that design changes are less expensive and the opportunity for improvement greater than during the profiling and conceptualizing phases of a project. Once you leave those phases, you need to be completely confident that you have made the right planning and design decisions based on thorough and objective considerations of the alternatives. Turning back or second guessing at that point is a high penalty to pay for impatience with the profiling process.

Finally, something. As soon as the warehouse activity profile has been created, it changes. Hence, once initiated, *the profiling process should never end*. In fact, once initiated, warehouse activity profiling should never end. World-class warehouse management systems support continuous warehouse activity profiling, *which in turn support continuous warehouse problem solving*.