Pareto analysis-simplified

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What is it ?

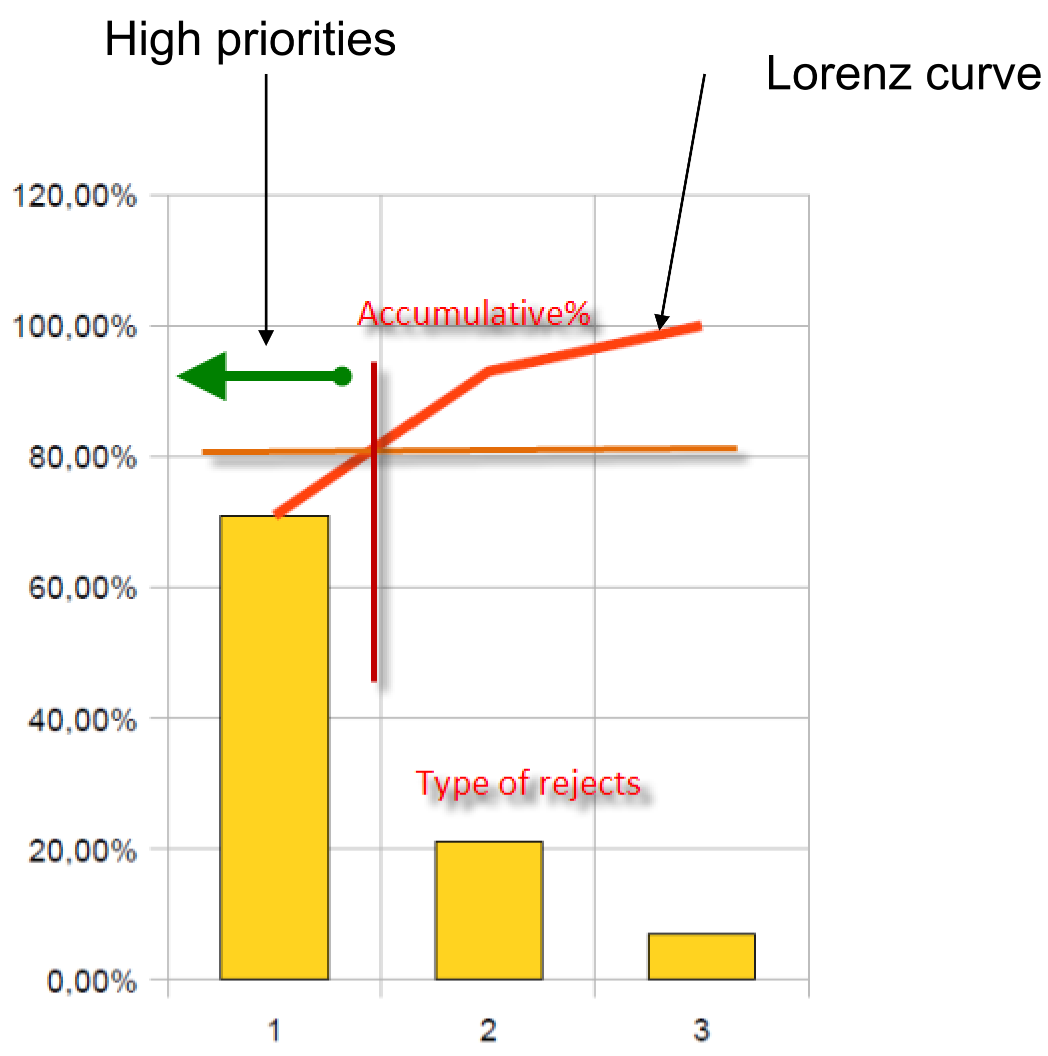
- tool to specify priorities
- which job have to be done earlier than the others
- which rejects must be solved firstly
- which product gives us the biggest revenues
- 80|20 rule

How to construct Lorenz Curve and Pareto chart

- list of causes (type of rejects) in %
- table where the most frequent cause is always on the left side of the graph

Reject	Type	Importance	Importance (%)	Accumulative (%)
1	Bad size	10	71%	71 %=71%
2	Bad material	3	21 %	92%=71%+21%
3	Rust	1	8%	100 %=92%+8%

Pareto chart



Use of PA in Inventory Management

- ABC analysis = Always Better Control
- Use in Selective Inventory Control based on different criteria :
  - VALUE ($\sum(Annual\ demand\ * Unit\ price)$- ABC
  - CRITICALITY (Vital, Essential, Desirable) = VED
  - USAGE FREQUENCY (Fast, Slow, Non moving) = FSN

Statements I.

- ABC analysis divides an inventory into three categories :
  - "A items" with very tight control and accurate records
  - "B items" with less tightly controlled and good records
  - "C items" with the simplest controls possible and minimal records.

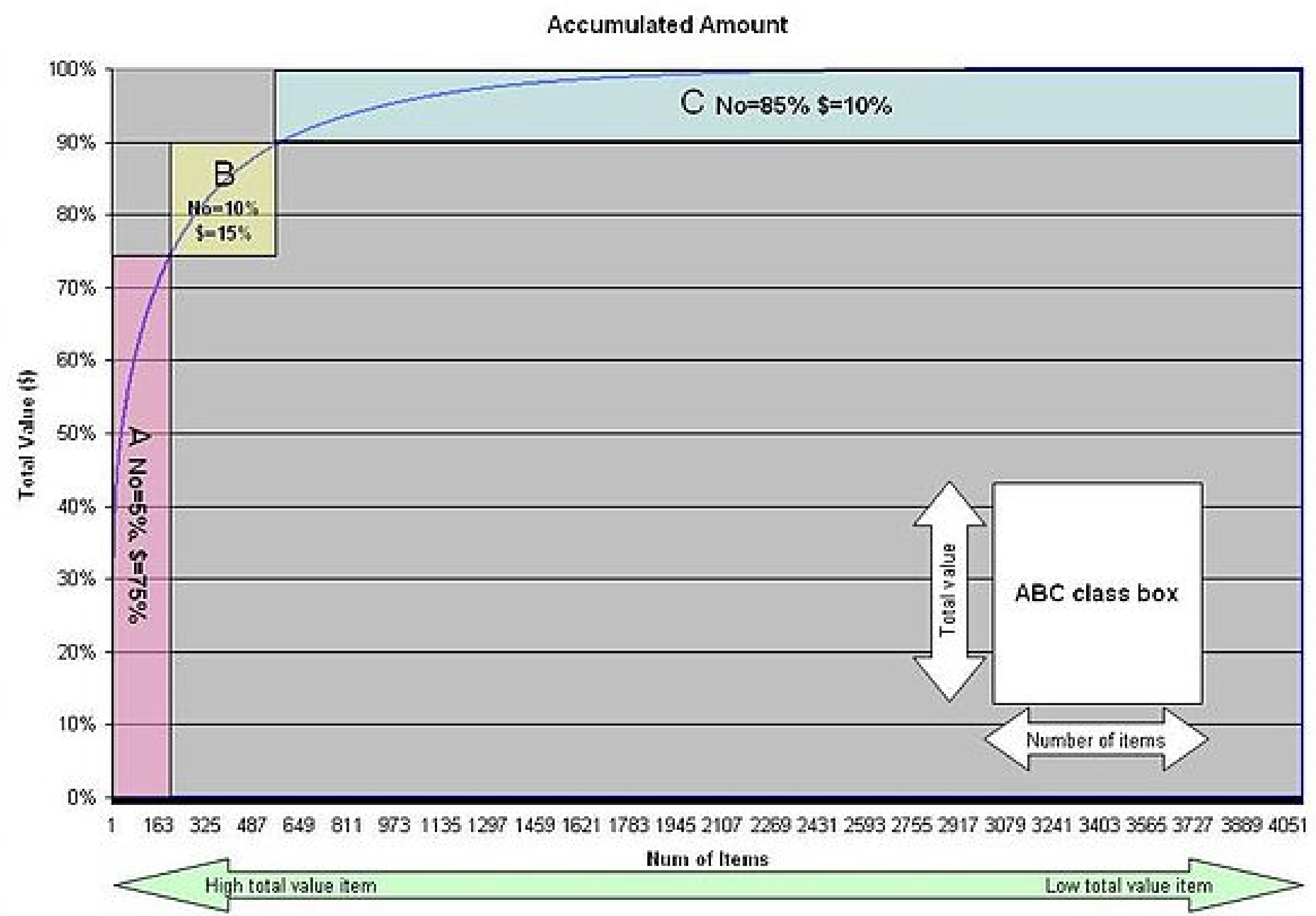
Statements II.

- The ABC analysis suggests that inventories of an organization are not of equal value
- The inventory is grouped into three categories (**A, B, and C**) in order of their estimated importance.

Example of possible allocation into categories

- **A’** items – 20% of the items accounts for 70% of the annual consumption value of the items.
- **‘B’** items - 30% of the items accounts for 25% of the annual consumption value of the items.
- **‘C’** items - 50% of the items accounts for 5% of the annual consumption value of the items

Example of possible categories allocation-graphical representation (4051 items in the stock)



ABC Distribution

ABC class	Number of items	Total amount required
A	10%	70%
B	20%	20%
C	70%	10%
Total	**100%**	**100%**

Objective of ABC analysis

- Rationalization of ordering policies
  - Equal treatment
  - Preferential treatment

See next slide

Equal treatment

Item code	Annual consumption (value)	Number of orders	Value per order	Average inventory
1	60000	4	15000	7500
2	4000	4	1000	500
3	1000	4	250	125

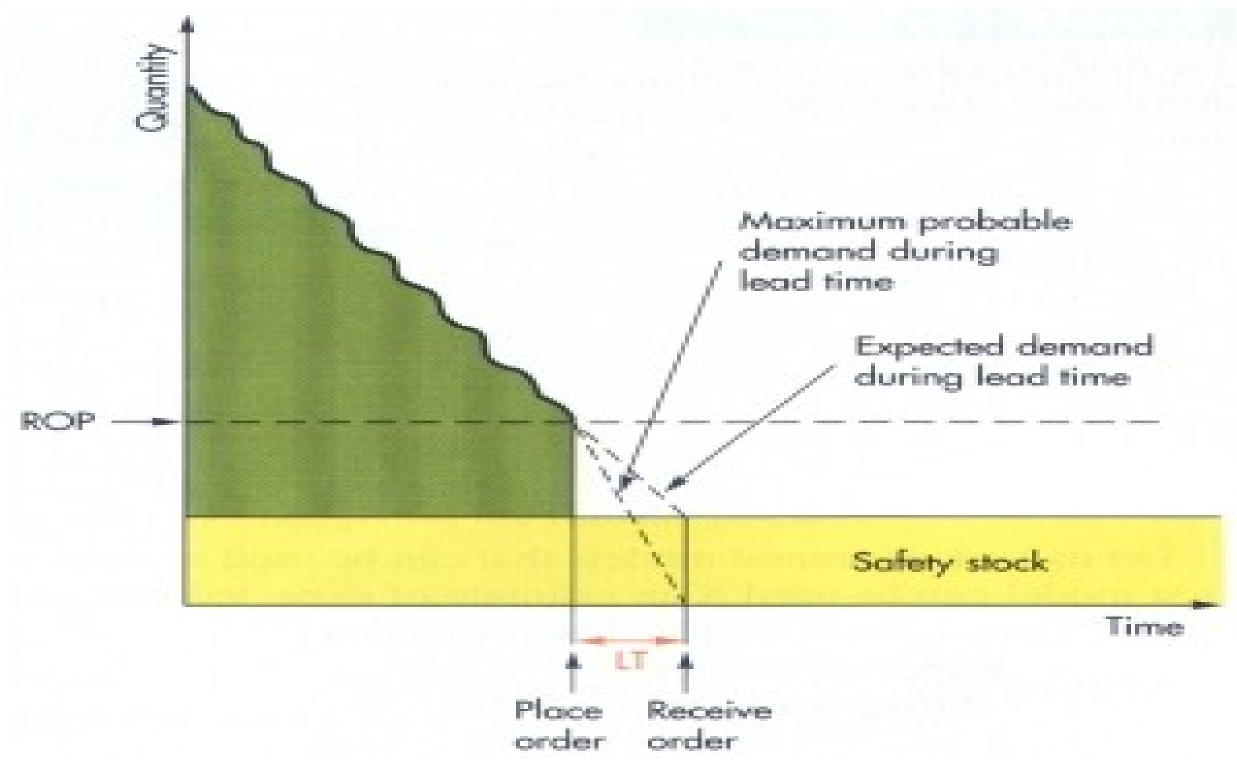
TOTAL INVENTORY (EQT) **8125**

Preferential treatment

Item code	Annual consumption (value)	Number of orders	Value per order	Average inventory
1	60000	8	7500	7500
2	4000	3	1333	666
3	1000	1	1000	500

Determination of the Reorder Point (**ROP**)

- ROP = expected demand during lead time + safety stock

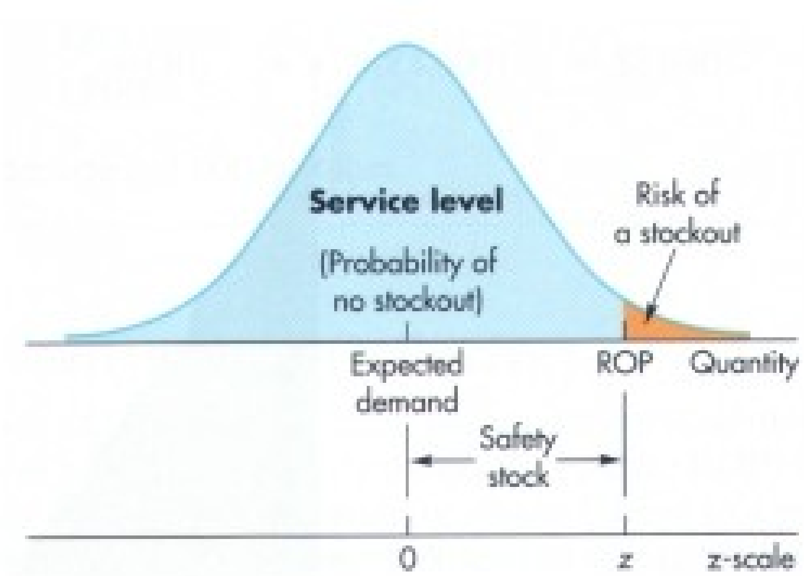


Determination of the Reorder Point (ROP)

- **ROP =** expected demand during lead time + z* σ_{dLT}

where **z** = number of standard deviations and

$\boldsymbol{\sigma}_{\mathbf{dLT}}$ **=** the standard deviation of lead time demand



Example

- The manager of a construction supply house determined knows that demand for sand during lead time averages is 50 tons.
- The manager knows, that demand during lead time could be described by a normal distribution that has a mean of 50 tons and a standard deviation of 5 tons
- The manager is willing to accept a stock out risk of no more than 3 percent

Example-data

- **lead time averages** = 50 tons.
- $\boldsymbol{\sigma}_{\mathbf{dLT}}$ = 5 tons
- **Risk** = 3 % max
- Questions :
  - What value of **z** is appropriate?
  - How much safety stock should be held?
  - What reorder point should be used?

Example-solution

- **Service level =**1,00-0,03 =0,97 and from probability tables you will get z= +1,88

See next slide with probability table

Probability table

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670

Example-solution

- **Service level =**1,00-0,03 =0,97 and from probability tables we have got : z= +1,88
- **Safety stock = z * σ_{dLT}** = 1,88 * 5 =9,40 tons
- **ROP** = expected lead time demand + safety stock = 50 + 9.40 = **59.40 tons**
- ***For z=1 service level =84,13 %***
- ***For z=2 service level= 97,72 %***
- ***For z=3 service level = 99,87%***

ABC and **VED** and service levels

A items should have low level of service level (0,8 or so)

B items should have low level of service level (0,95 or so)

C items should have low level of service level (0,95 to 0,98 or so)

D items should have low level of service level (0,8 or so)

E items should have low level of service level (0,95 or so)

V items should have low level of service level (0,95 to 0,98 or so)

Matrix

High cost of stockout

decreasing ↑

	V	E	D
A	0.80	0.75	0.6
B	0.95	0.90	0.85
C	0.99	0.97	0.95

→ decreasing

Resource : https://www.youtube.com/watch?v=tO5MmOBdkxk
Prof. Arun Kanda (**IIT**), 2003