Six Sigma Projects in Supply Chain Management

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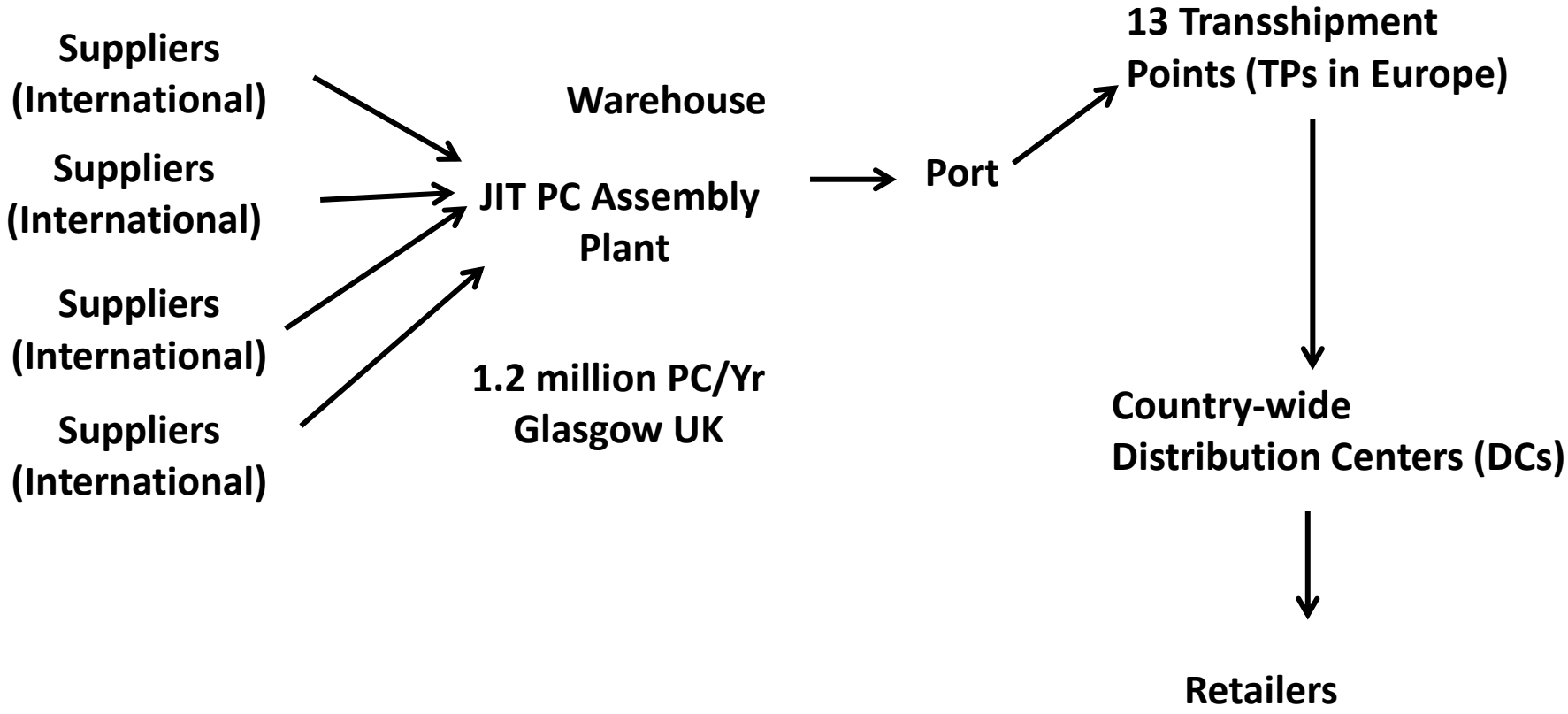


What SCM is

A Supply Chain is a network of organizations

Goal: Produce value for the ultimate consumer

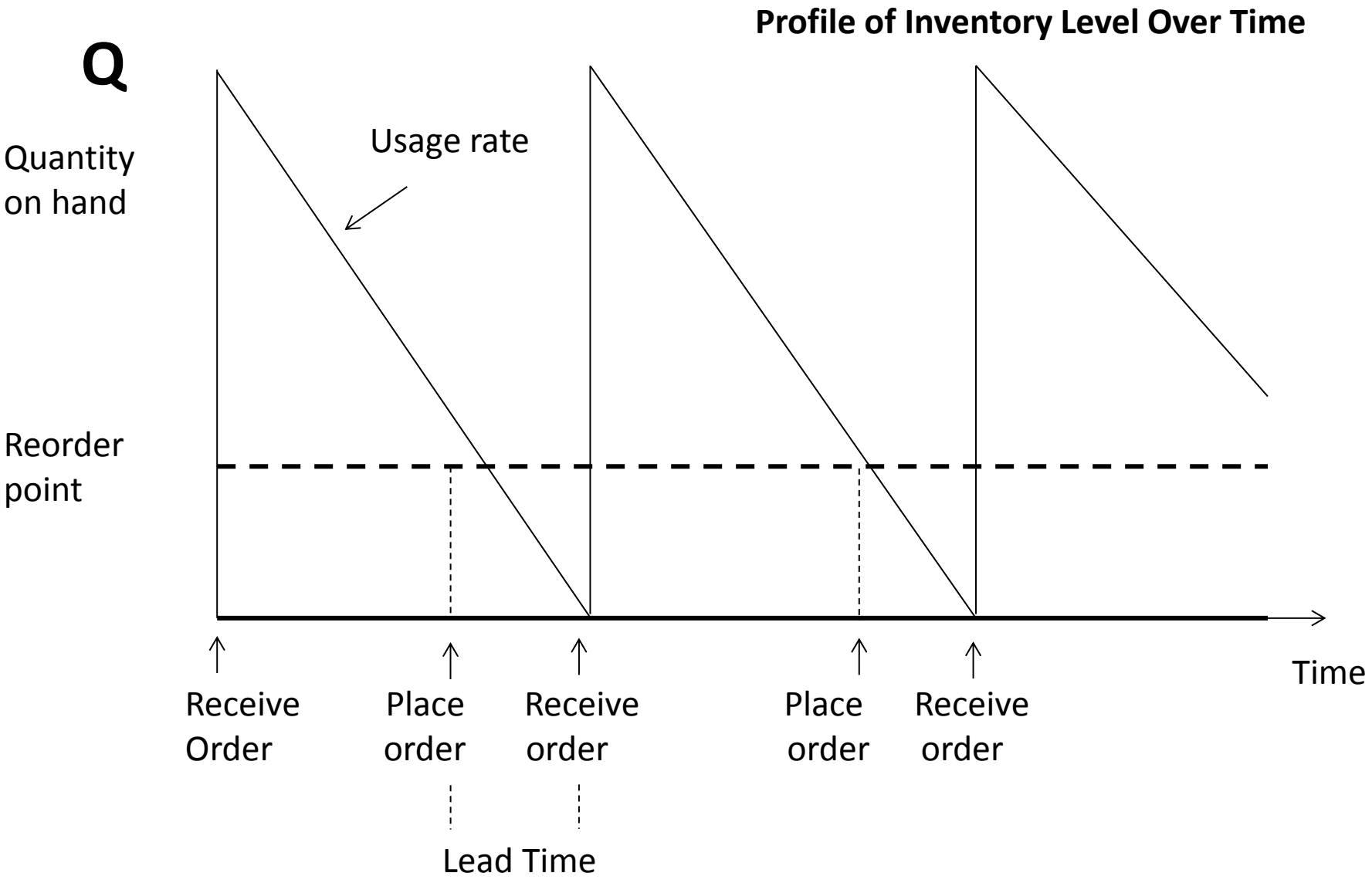
Primary purpose:
- Satisfy customer needs
- Manage flows of goods and information
- Generate profits for itself
- Decide locations, which products to produce at what stage, how to produce and how to distribute

The Supply Chain Process

Integrated, coordinated network of value delivering business processes that procure raw materials, transform them into final products, services and delivers the product to the customers involving…

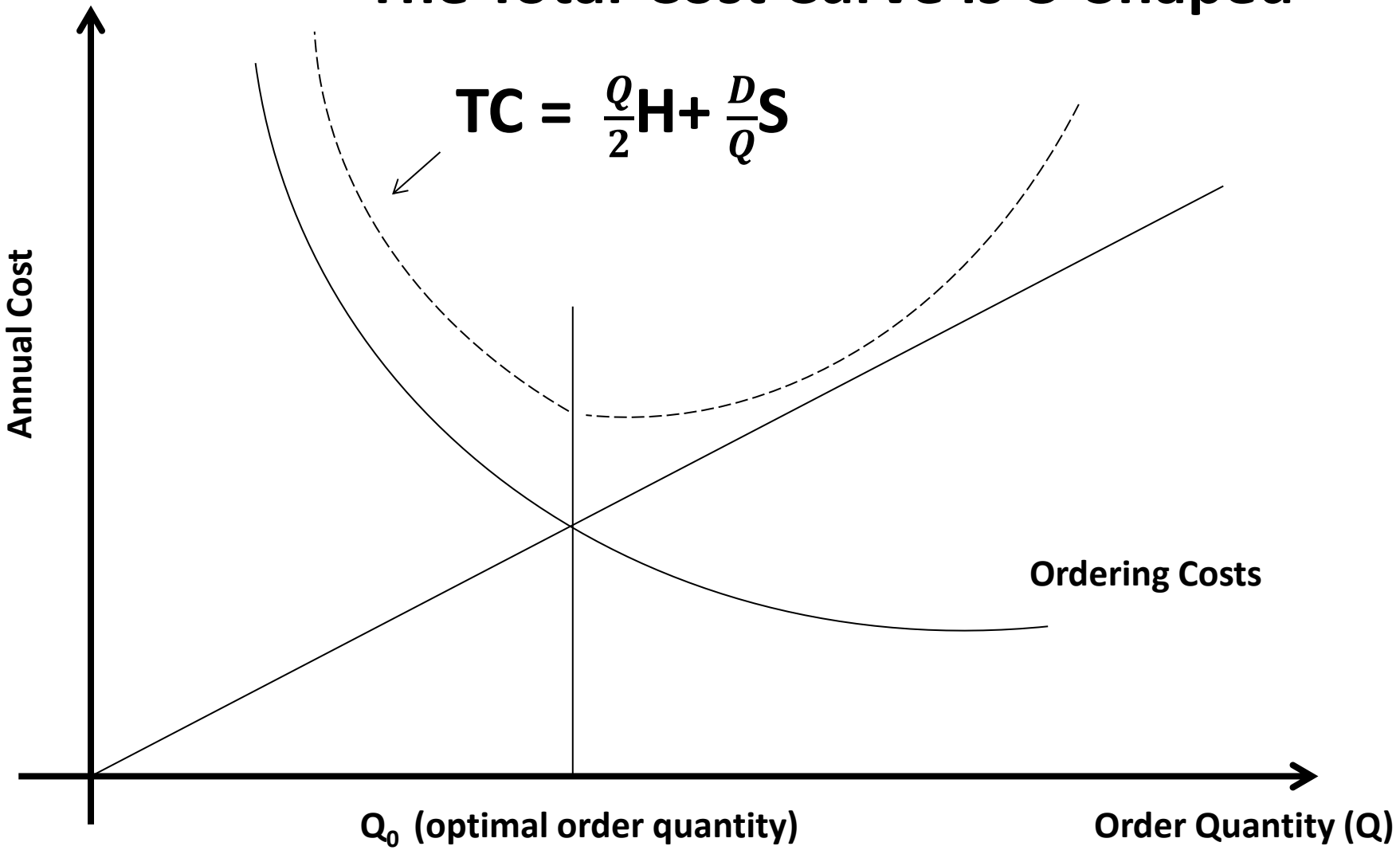
- Procurement
- Manufacturing/Assembly
- Inbound logistics
- Warehousing
- Distribution
- Outbound logistics

The Inventory Cycle



Cost Minimization by EOQ

The Total-Cost Curve is U-Shaped



A Key Challenge in SCM

Goal is to design and manage a supply chain network that delivers high-quality products to the right customers at the right time at minimum cost.

Good supply chain management aims at reducing inventory and freeing up working capital without affecting service levels.

A great deal of inventory piles up along the supply chain due to:

- Poor quality of supplies – production may stop if there are no materials and parts in the buffer stock
- Poor management of logistics and no monitoring of lead times
- Machines break down resulting from poor quality culture, causing production interruption – again buffers are needed
- Quality of finished goods may not be high enough to support JIT mode of operation in your customer's operations

Examples of Supply Chains operating in India – All have buffers ("just in case")

Automotive – Telco, ALL, Mahindra, Maruti
Aerospace – ADA, HAL
Chemicals – Asian Paints, Apollo tyres, Reliance
Apparel – Madura Coats, Reliance
Food – Cadbury, Parle, Amul Products, HLL
Consumer durables – HLL, P & G
Forest Products – Papermills
Construction – L & T
Pharmaceutical – Ranbaxy, Glaxo
Electrochemical – Kirloskar, L & T
Tooling, HMT, Widia, Mico
PC and Computer – IBM, WIPRO, HCL, Intel

Why bring TQM into SCM?

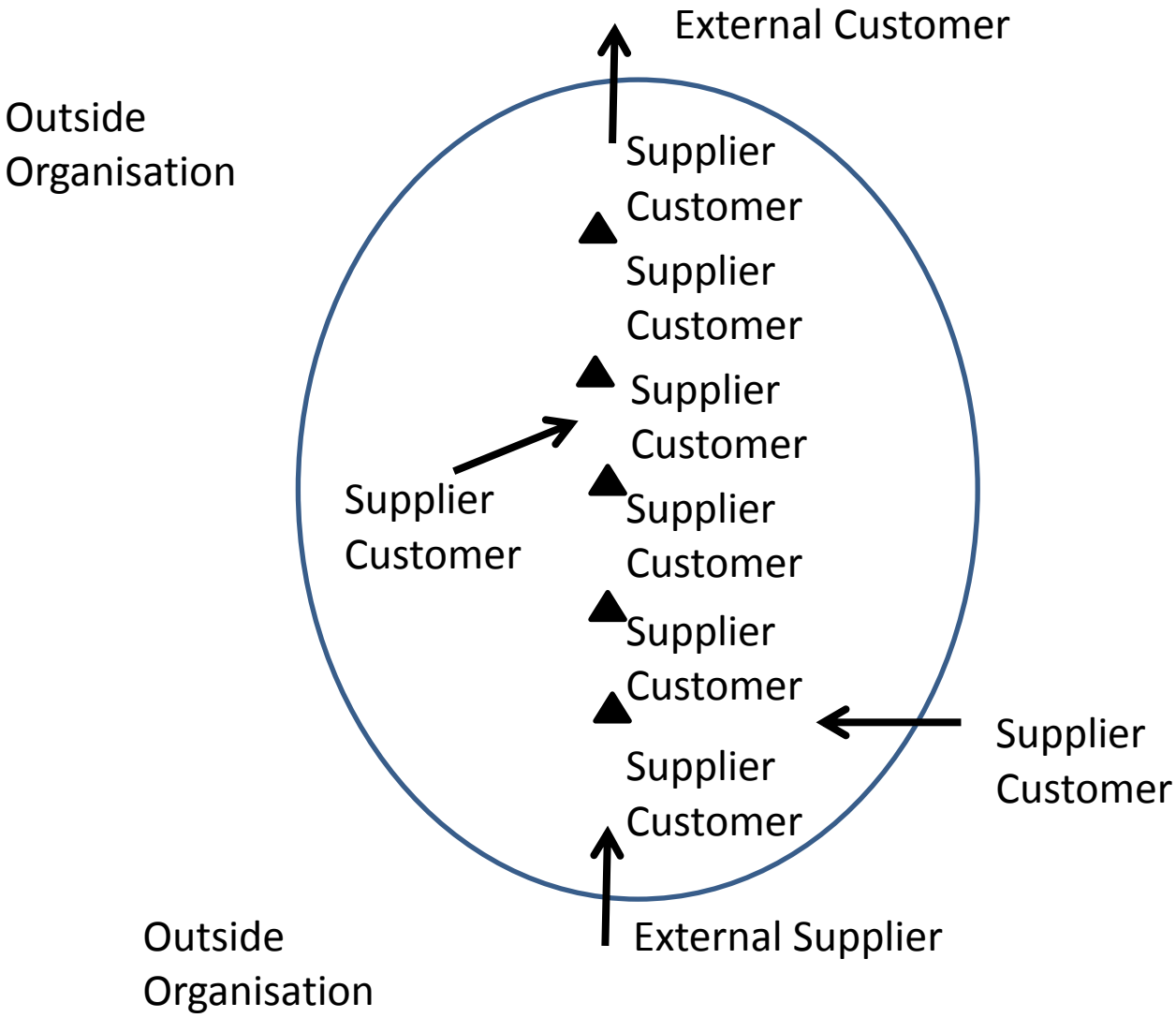
Each entity in a supply chain is both a supplier and a customer

Thus, important to have a customer focused corporate vision while implementing TQM and SCM practices both upstream and downstream

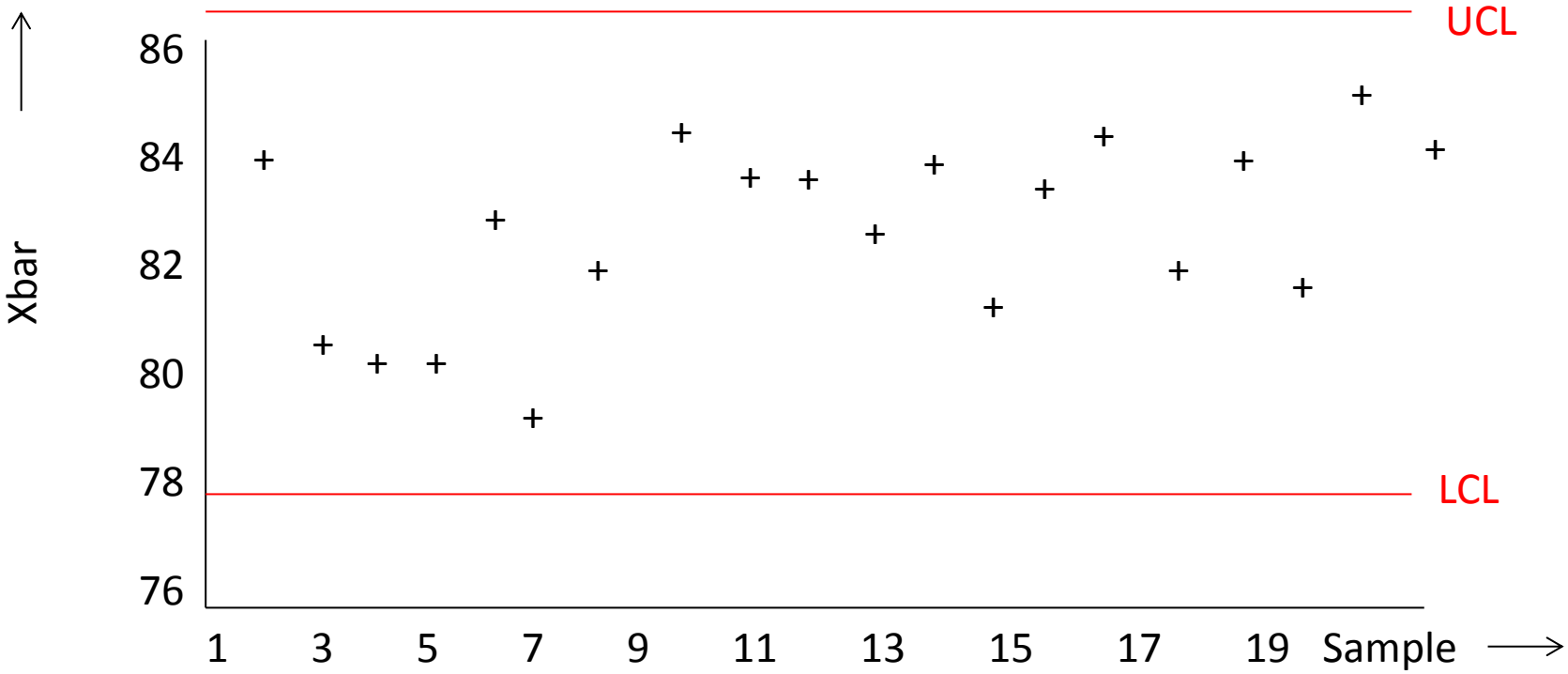
Customer-driven vision can produce a number of competitive advantages for the supply chain by

- Helping improve productivity
- Reducing inventory and cycle time
- Boosting customer satisfaction, market share and profits

The Quality Chain



SPC – Xbar Chart Helps Control Accuracy



Average Xbar = 82.5kg

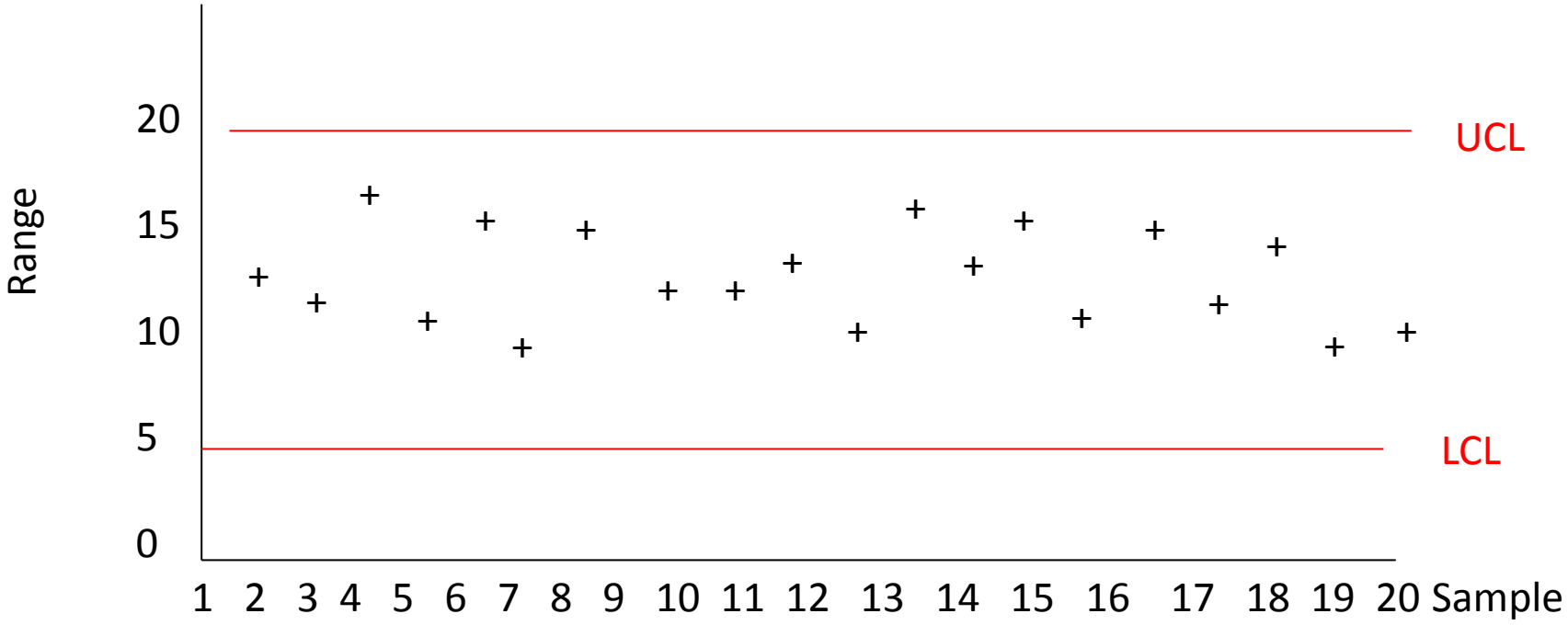
Standard Deviation of X bar = σ_{xbar} = 1.6kg

Control Limits = Average Xbar +/- 3 σ_{xbar}

= 82.5 +/- 3 1.6 = [77.7 87.3]

Here the process is “in control” (i.e. the mean is stable)

SPC – Range (R) Chart Helps Control Precision



Average Range R= 10.1kg
Standard Deviation of RAnge= 3.5kg
Control Limits : 10.1 +/- 3.5 = [20.6, 0]

Process is “in control” (i.e. precisionis stable)

SCM and TQM

Supply Chain Management (SCM) and Total Quality Management (TQM) are two key tools used by manufacturers and service providers to make their business competitive.

Quality: Value addition during production and delivery.

Sustaining quality throughout the chain has significant implications for reducing costs and raising customer satisfaction, hence sales.

SCM and TQM contd.

Many end-products producers now recognize the potential benefits of partnering with their suppliers in managing quality in their supply chains.

A key example is Chrysler:

- In 1935 Chrysler's suppliers showed a quality level of 300 to 400 defective parts per million (ppm)
- To achieve < 100 ppm for its suppliers, Chrysler forced its 2^{nd} and 3^{rd} tier suppliers to implement the same quality standards as its 1^{st} tier suppliers
- Same procedures through the entire supply chain improved quality performance of all suppliers
- Chrysler also used quality as a deciding factor to reduce the number of its suppliers

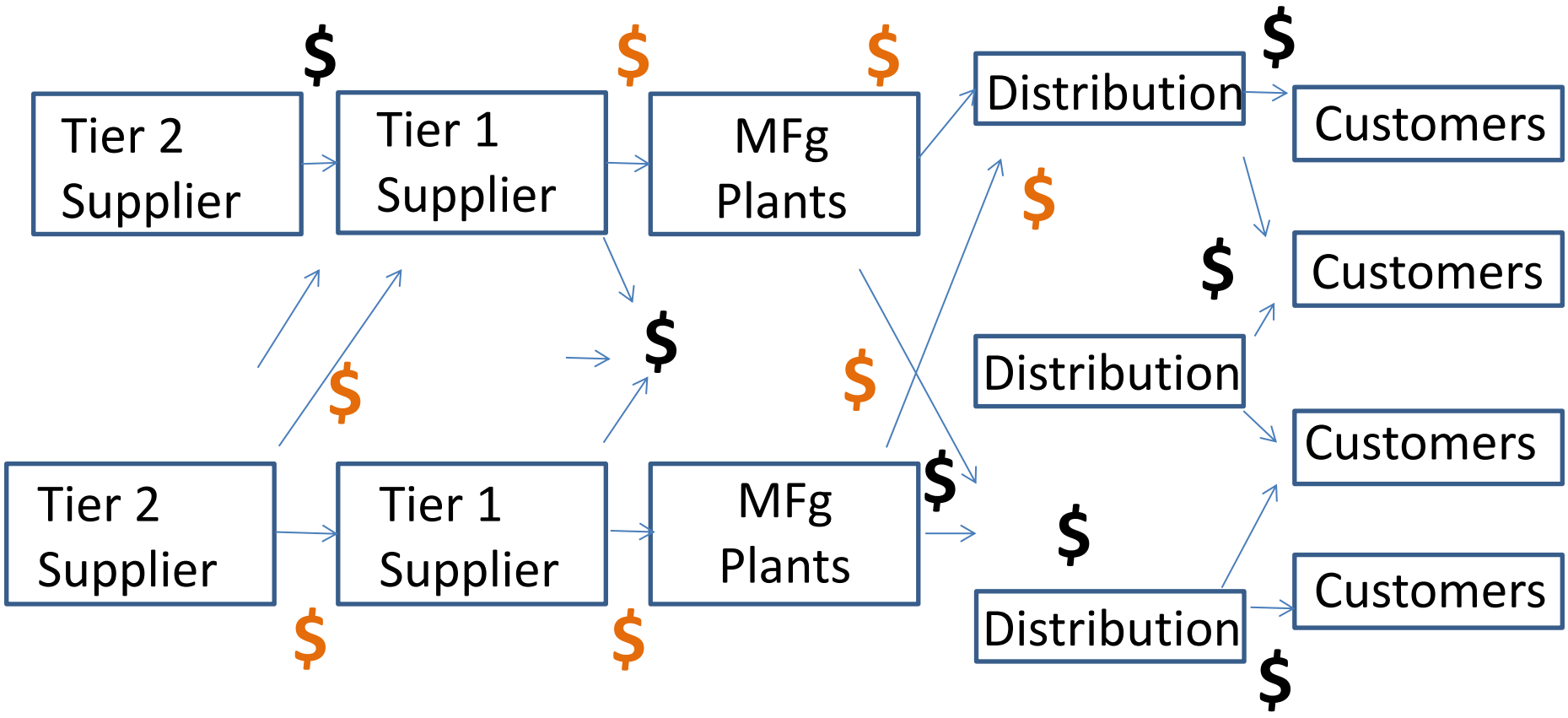
Consequences of Poor Quality

➔ Huge Buffers

- Raw, WIP and Finished Goods Inventories
- Capacity Buffers (e.g. understated capacity)
- Lead time Buffers (e.g. Overstated lead time)

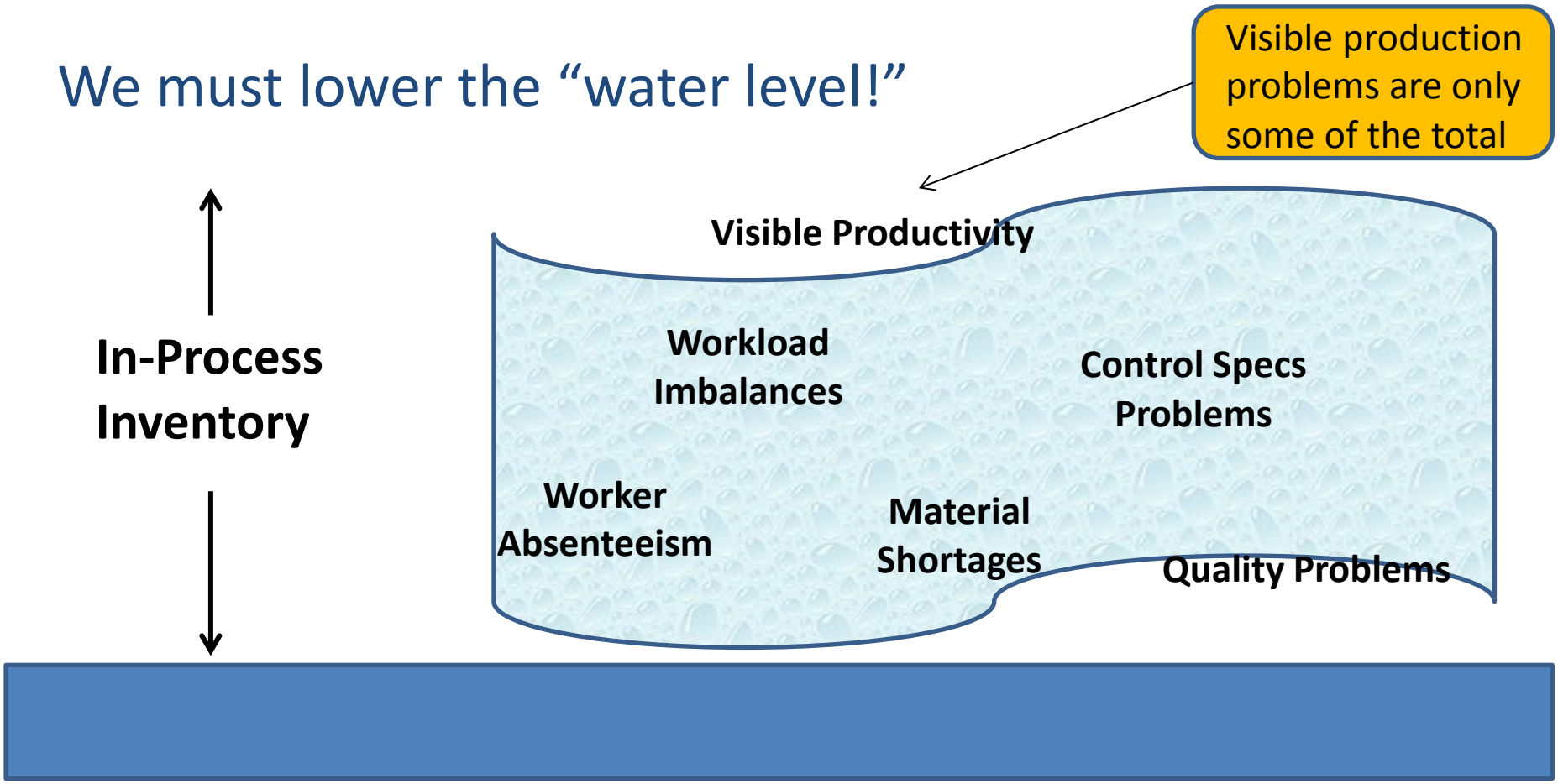
Detailed Network Analysis and Management by SCM helps minimize the Total Cost

But! Many $ buffers are added due to poor quality – man, machine, materials & methods used



Uncovering Production Problems due to Quality

We must lower the "water level!"



Dimensions of Quality

Quality Improvement

Quality improvement is the reduction of variability in processes and products.

Alternatively, quality improvement is also seen as “waste reduction” (muda).

The Link Between Quality and Productivity

Effective quality improvement can be instrumental in increasing productivity and reducing cost.

The cost of achieving quality improvements and increased productivity is often negligible.

But how does the company save $?

It does so by targeting and attacking Cost of Poor Quality Elements…

- Inspection and Test
- Rework/Repair
- Scrap
- Warranty

} **Low process yield**

- Besides, the company has large hidden costs

Visible and Hidden Costs

- Scrap
- Rework
- Warranty costs

VISIBLE COSTS

- Conversion efficiency of materials
- Inadequate resource utilization
- Excessive use of material
- Cost of redesign and re-inspection
- Cost of resolving customer problems
- Lost customers/Goodwill
- High inventory

HIDDEN COSTS

How a Company averted a Supply Chain Quality Failure

- Recognize the rising dependence on Supply Chain Quality – Requirements, Time Cost

- Shift immediately to Supply Chain Collaboration

- Find Benchmarks – Quickie Tools (http://ww.quickie.com)
- Manufacturer of cleaning tools, relies exclusively on more than 100 suppliers, many overseas
- Needed a system to monitor and manage their suppliers quality – all the way down to the shop floor – as the products were being manufactured – implemented real-time SPC
- Goal: Improve supplier quality. Was critical to identify problems caused by a breakdown in manufacturing process control up front rather than at the tail end of the process – after producing hundreds of products and packaging and shipping them
- Realized benefits within just a few weeks of SPC implementation
- Drastically reduced the risk of receiving defective lots
- Implemented incentive programs that share savings to reward the better suppliers and reduce the costs of working with poor performing suppliers

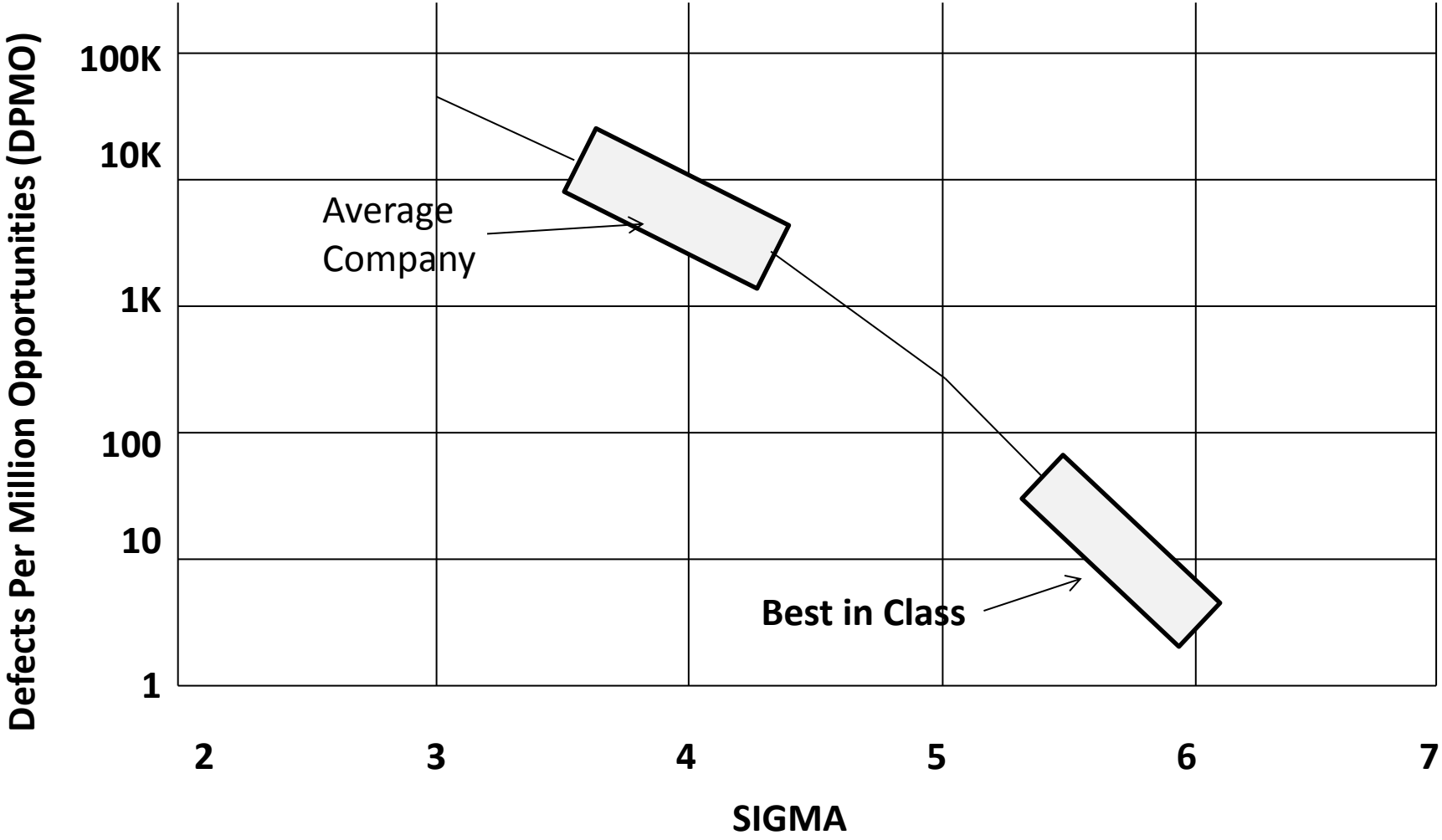
Quality Tools that work in SCM

TQM philosophy to guide all plans, operations and activities

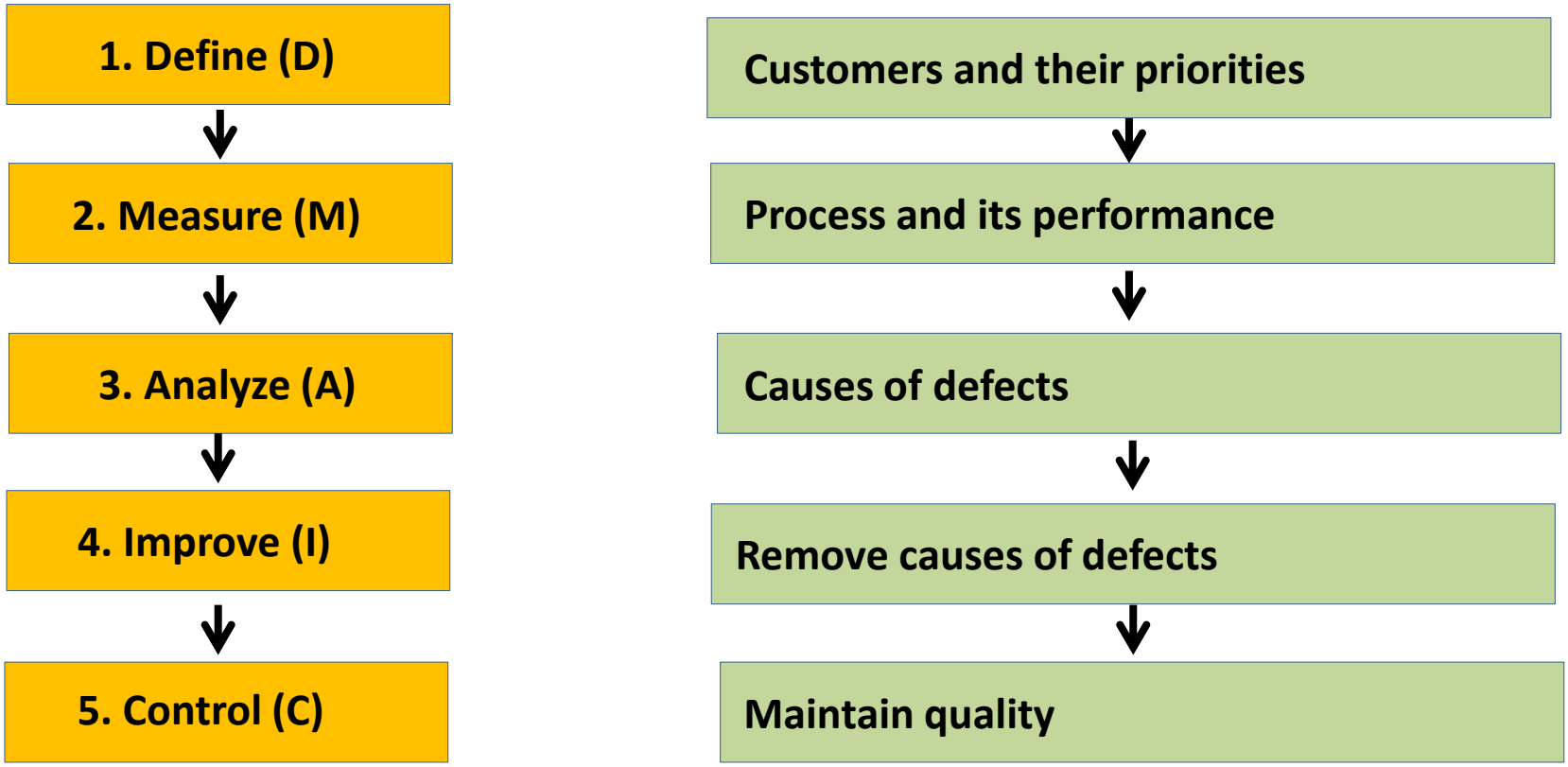
- Top management's direct involvement
- Strong internal/external customer orientation
- Systematic problem solving using statistics
- Everyone participates – suppliers, organization, customers

- 7 tools to solve problems at the floor level: QS 9000 for culture
- SPC to monitor variability in all that can be measured: Sampling to provide evidence
- DMAIC projects to focus improvement efforts in meeting requirements, delivery times and cost/profit targets

Is Six Sigma Realistic? Let your customers tell you



Six Sigma Implementation: DMAIC Framework



NISSAN Motor Company Supply Chain Problem: Logos won't stick!

Factor	Level	
	High	Low
Adhesion Area (cm^2)	15	20
Type of glue	Acryl	Urethan
Thickness of Foam Styrene	Thick	Thin
Thickness of Logo	Thick	Thin
Amount of pressure	Small	Big
Pressure application time	Short	Long
Primer applied	Yes	No

NISSAN's DOE Design Array

A – Adhesion Area (cm^2)

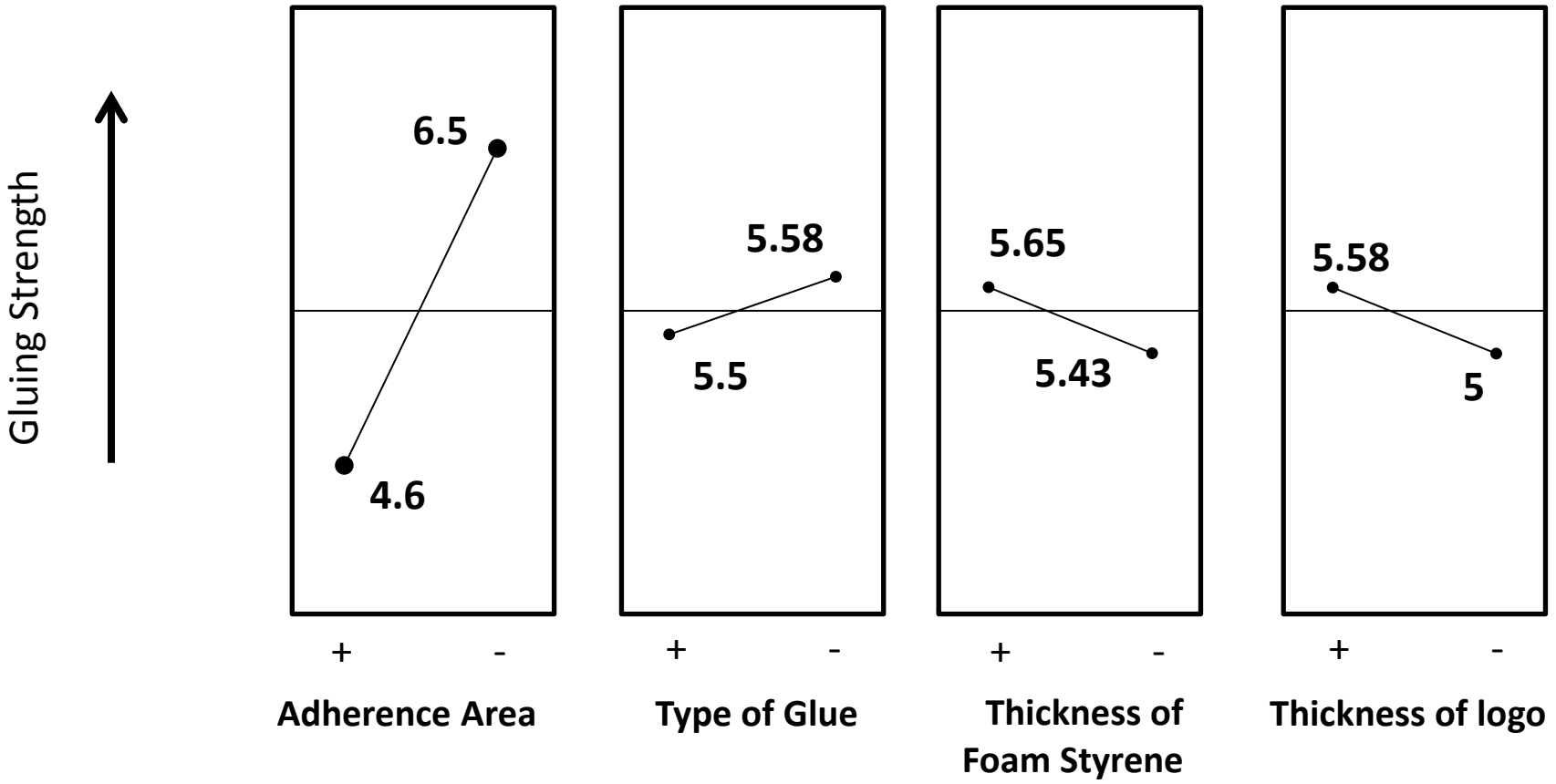
B – Type of Glue

C – Thickness of Foam Styrene

D – Thickness of Logo

No.	A	B	C	D	Gluing Str
1					9.8
2					8.9
3					9.2
4					8.9
5					12.3
6					13
7					13.9
8					12.6

Factor Effects Plot



QS 9000 Certification is a must for all suppliers of the Automotive Industry