

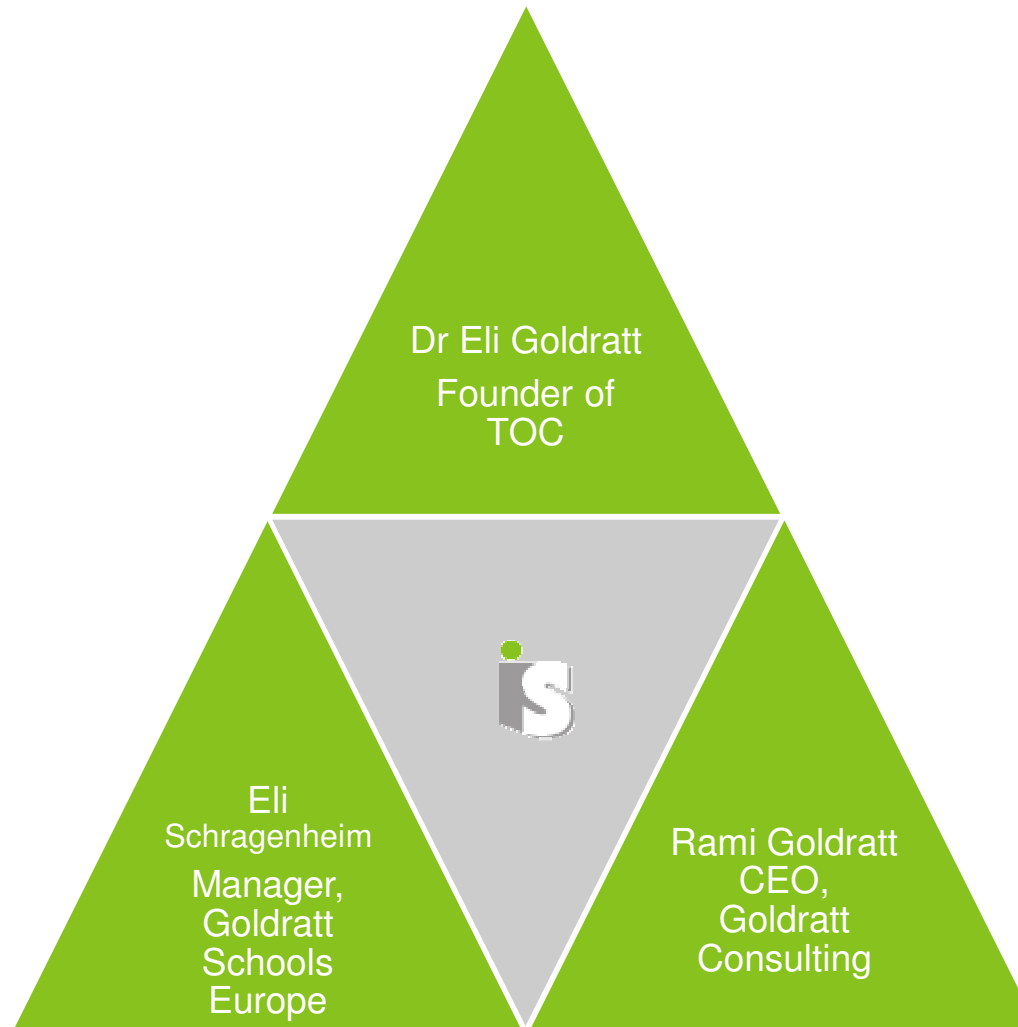


Supply Chain solutions

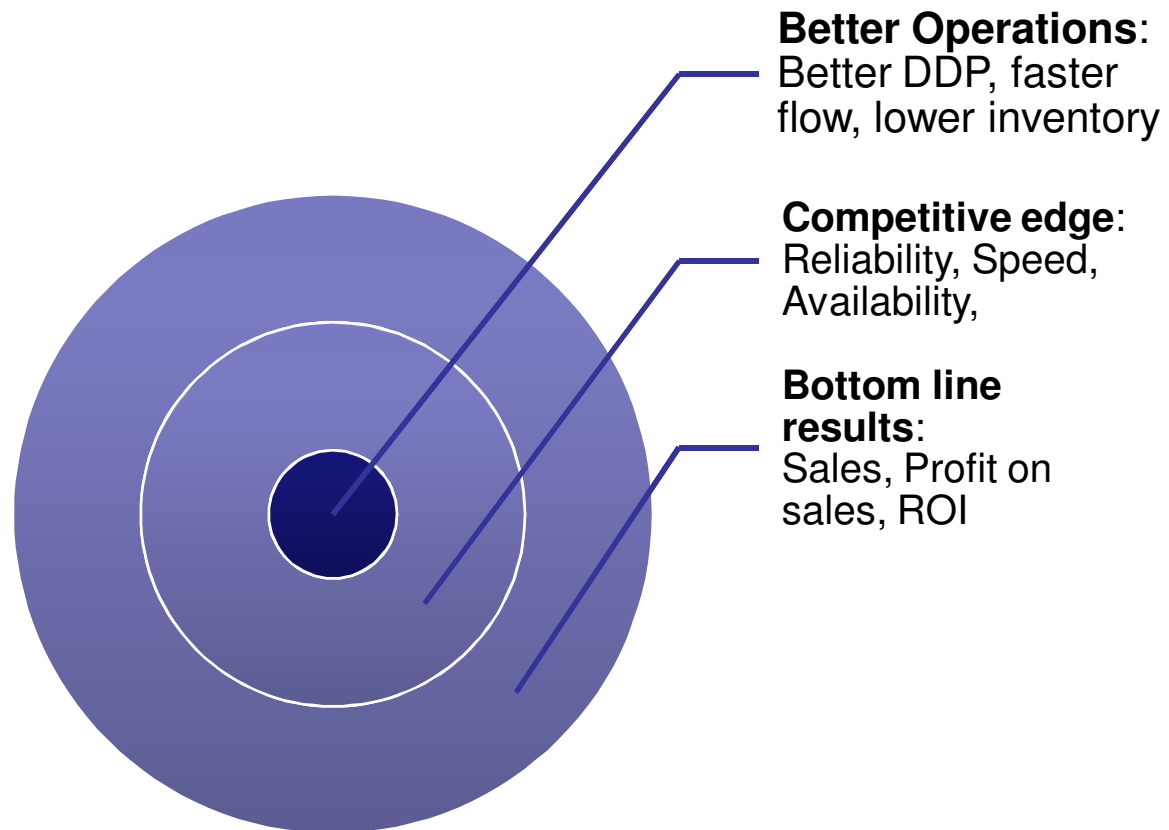
Inherent simplicity

- ◉ Software firm that specializes in TOC
- ◉ “Inherent Simplicity has a perfect combination between very strong TOC knowledge and a very good software product, making it the obvious choice of software for my Viable Vision projects in Goldratt Consulting” (Dr. Eli Goldratt)
- ◉ Over 40 implementation all over the world, among them:
 - Dr. Reddy's Laboratories, India – 1.3B\$
 - Premier Foods, South Africa – 500M\$
 - Kontinental Management, Russia – 500M\$
- ◉ Global implementation partner network

Key personnel in the TOC community that advise us



The impact we bring to our clients



What is Distribution

An environment in which

1. The product is not available immediately to the buyer
2. The tolerance time of the buyer is shorter than the time it takes to make the product available at the point of consumption

The Opportunity

- The consumer is not willing to wait

Therefore

- We can supply the consumer needs by holding inventory at the consumption point

The Inventory dilemma

Protect Sales



Guarantee the
availability of the full
product range at all
times



Increase inventory
level

Control Cost



Minimize the cost of
capital in stocks and
minimize no-sale risk



Decrease inventory
level





Risks and implications associated with **too-high** stocks

Overstocks

- ⦿ Block available cash and opportunities to increase product portfolio
- ⦿ Block space and display
- ⦿ Consume sales attention
- ⦿ Subjected to significant discounts therefore erodes margins

Risks and implications
associated with **too low**
stocks

Low availability/Out of Stock

- ⦿ Missed sales opportunities
 - No buy
 - Alternative product is purchased

- ⦿ Low availability perception:
 - Dissatisfaction
 - Giving up on store
 - Giving up on the chain

Low availability/Out of Stock

- Expediting costs
 - Cross shipments
 - Paying more to vendors
 - Higher transportation cost

What should be the stock level?

- ◉ How can we make sure that the right inventory is in the right place at the right time?
- ◉ Almost any choice we make seems inappropriate
- ◉ Should we forecast? And if yes for what period?

Setting inventory targets

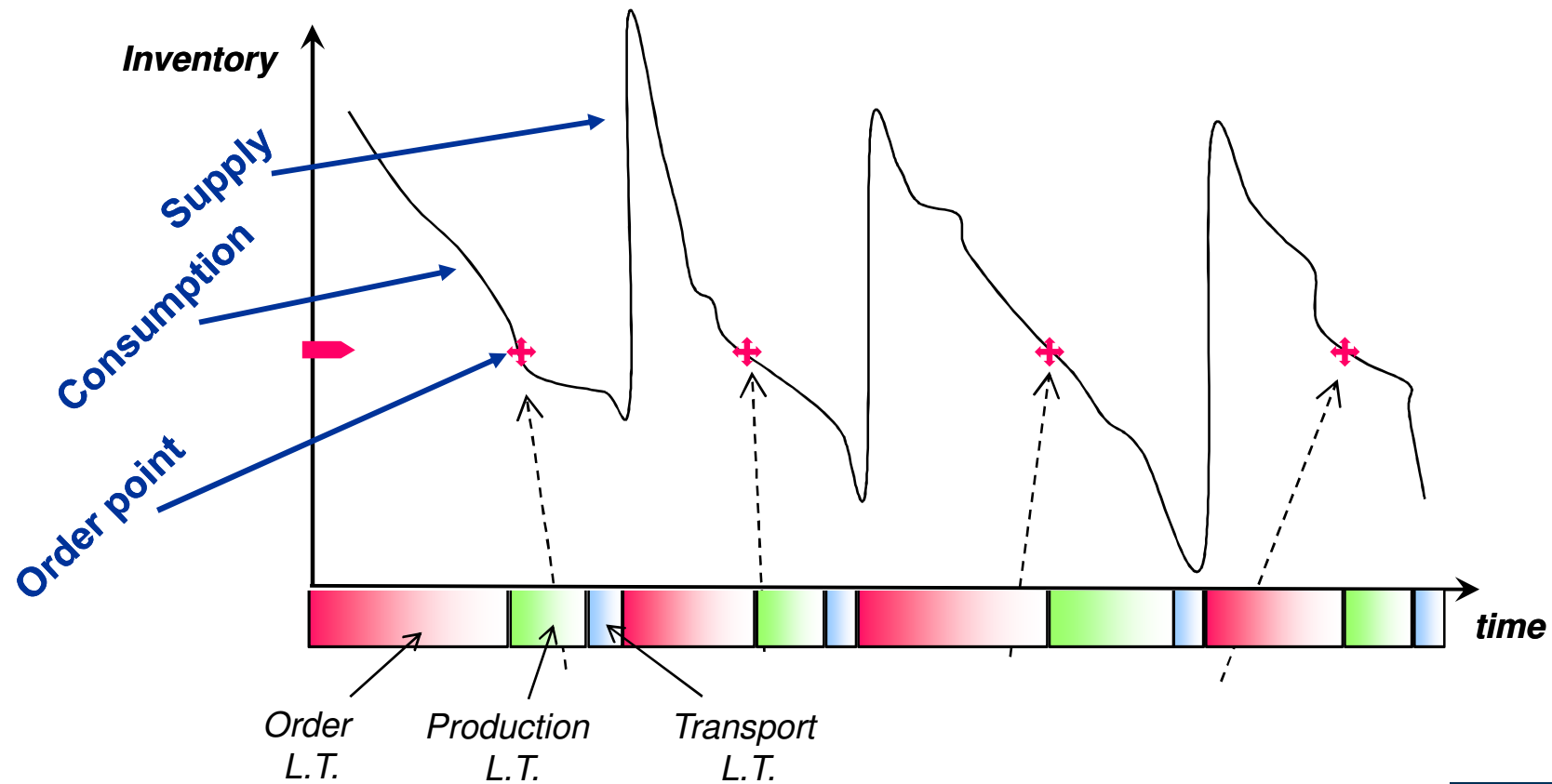
Demand & Supply

- ◉ We must keep enough stock to cover for consumption
- ◉ We must take into account the time it takes to replenish the consumed units
- ◉ We must take into account fluctuations
- ◉ Target = **maximum consumption** within the **replenishment time**
- ◉ Target inventory is split between
 - o The site
 - o On the way

Replenishment time components

- ⦿ Order lead time
 - the time it takes from the moment a unit was consumed until an order is placed to replenish it
- ⦿ Production lead time
 - The time it take the manufacturer from the moment it received the order until he finished producing it
- ⦿ Transportation lead time
 - The time it takes to transfer the goods from the moment production is finished until it reaches the site

Inventory graph



The effect of replenishment-time

- ◉ The longer the replenishment-time the higher the inventory level
- ◉ The longer the replenishment-time the more the unknown thus fluctuation is higher
- ◉ Doubling the replenishment-time more than doubles the inventory levels

Another effects of long replenishment time



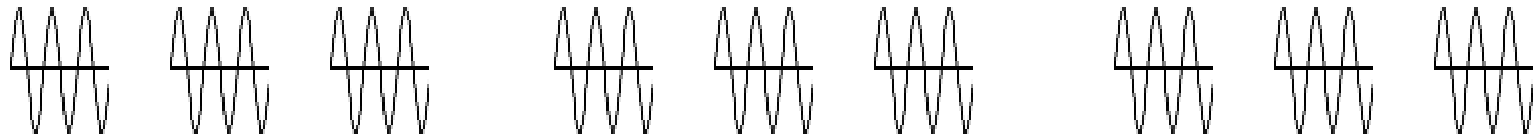
The higher the replenishment time
the slower the reaction to market demand



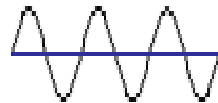
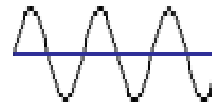
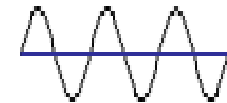
The power of aggregation

Aggregation yields less fluctuations

Store



Regional
WH



Central
WH



Placing inventory conflict

Maximize profit

Protect sales at
the consumption
points

Control cost

Push inventory as
close as possible to
the consumer



Maximize the
benefits of the
forecast by holding
the inventory at the
aggregated points

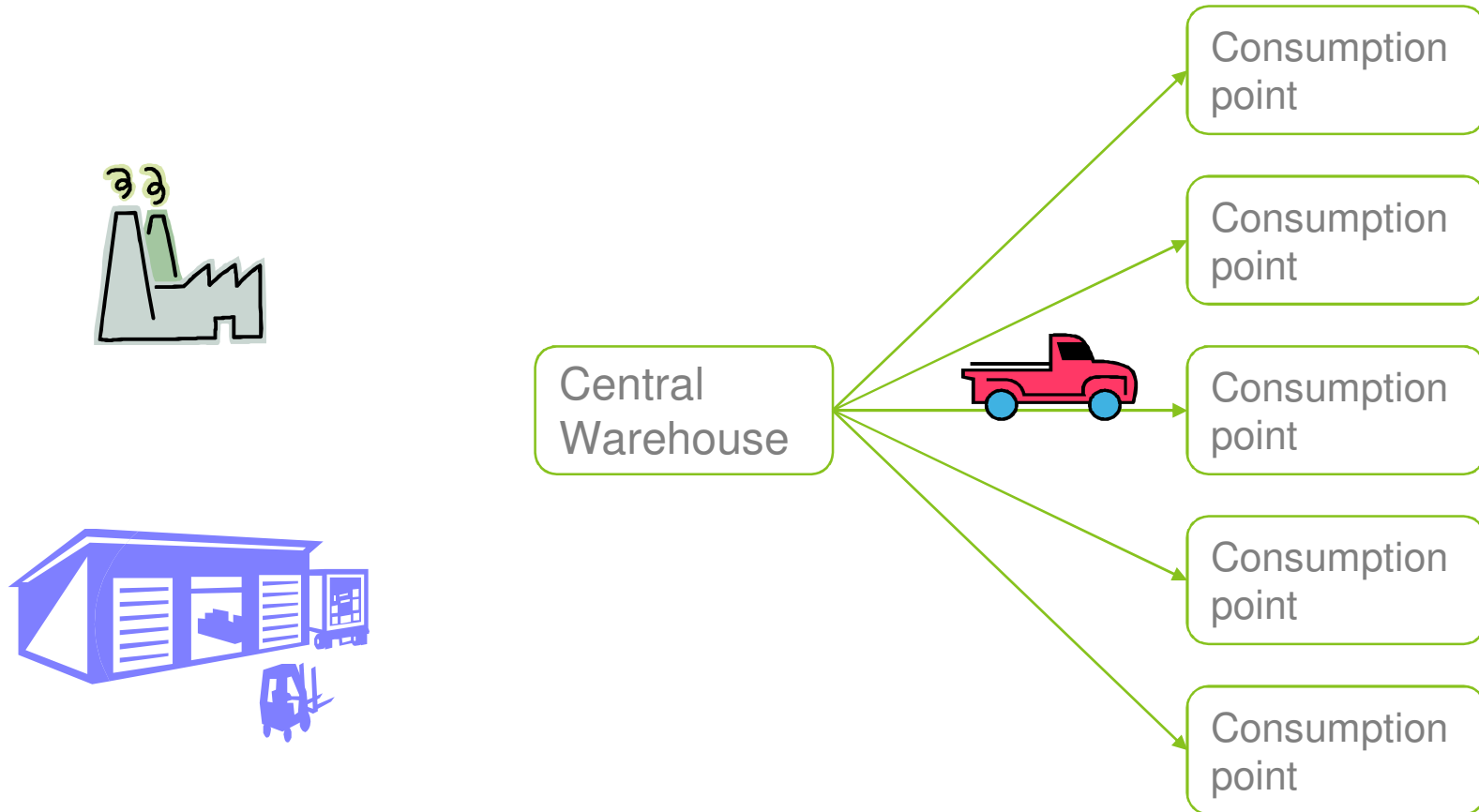
prevalent forecasting compromise

- ① Use the benefit of statistics to generate forecast
- ① Split this aggregated forecast to the store level
- ① This is losing the benefits and introducing back the fluctuations!

Example

- ◉ We are looking at one product (SKU)
- ◉ We have a chain of 100 stores
- ◉ Each location daily sales are between 10 and 30 units per week (average is 20)
- ◉ One day delivery between the WH and the stores (consumption points)
- ◉ Replenishing to the WH is 2 weeks (10 working days)

The central warehouse (CWH) concept



Benefits

1. Fluctuations of many consumption points is averaging thus
 - o Better forecast since it aggregates all consumption point data
 - o The central warehouse “maximum” consumption drops down and is less than the total maximum of all consumption points, thus total inventories go down
2. Replenishment time to regional warehouse/consumption points is restricted only to transportation time which is
 - o Shorter
 - o More reliable
 - o Therefore, inventory at the sites goes down while availability goes up

Benefits cont'd

3. CWH has enough inventory to serve sites without the need for cross shipment
 4. for Manufacturers – levels the load on the production plant
- TOC can vastly improve most plants using the operations solution

Solving the inventory conflict

Maximize profit

Protect sales at
the consumption
points

Control cost

Maximize the
benefits of the
forecast by holding
the inventory at the
aggregated points

Intermediate summary

- ◉ We used a different supply chain layout that effected in
 - Forecast to be more accurate
 - Replenishment time to be shorter
 - Variations to be lesser

- ◉ Can we go the extra mile and affect directly the replenishment time?



Shortening the replenishment time

Batching inflates replenishment time

- Batches in production (save on setup time)
- Batches in ordering (save head headaches, get discounts)
- Batches in transportation (fill in truck to justify cost)



Increase
replenishment time
and
Increase fluctuations

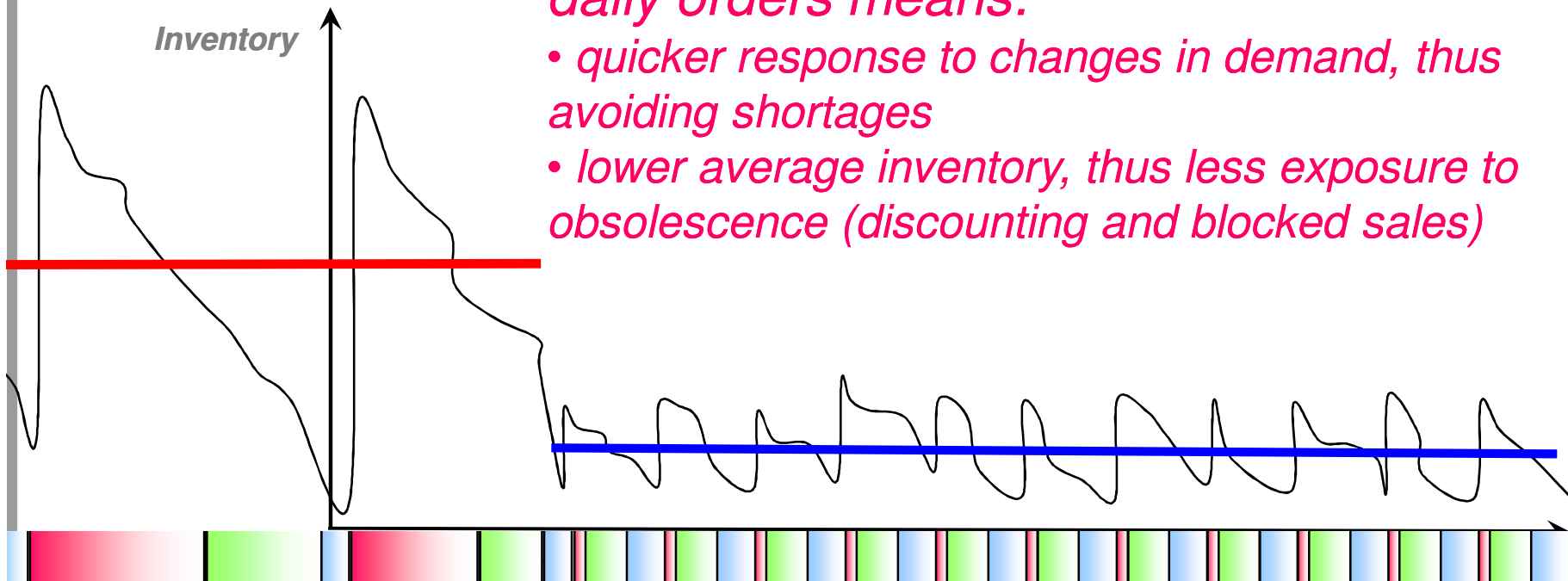


Inflate
inventories

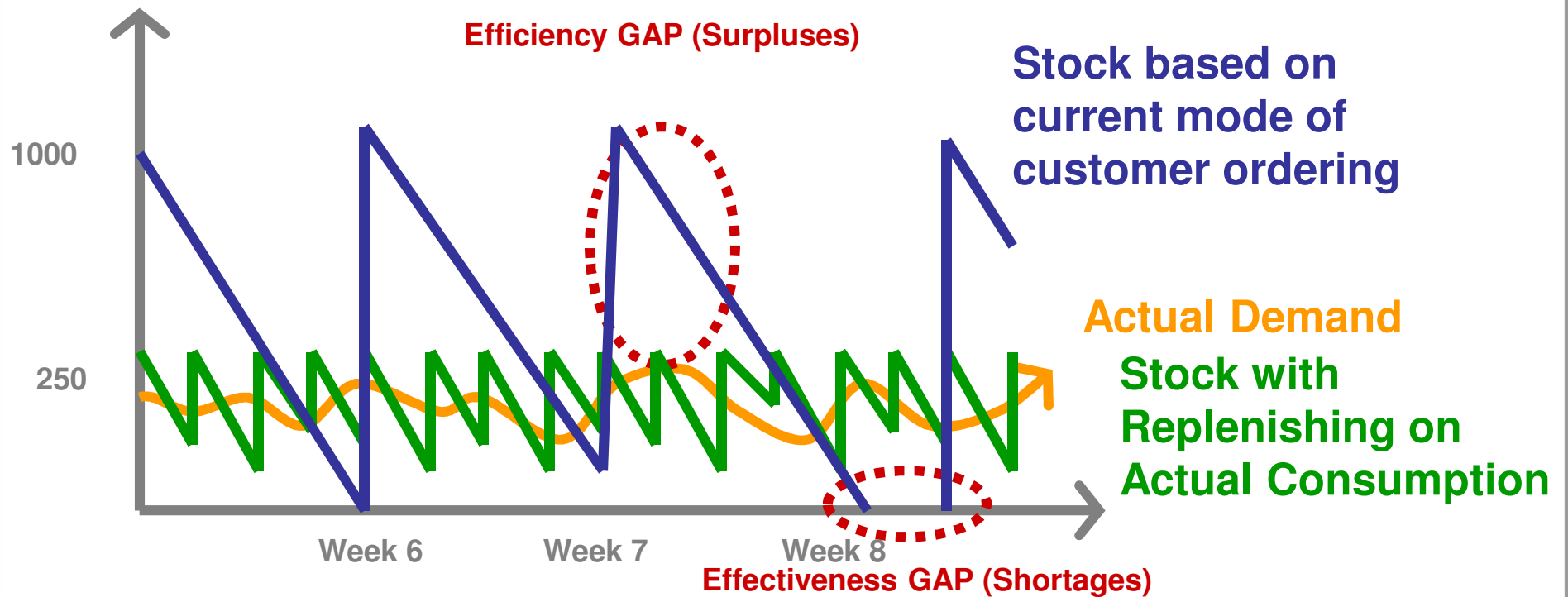
Aligning Ordering/Replenishment with Actual Consumption

Frequent replenishment with daily orders means:

- quicker response to changes in demand, thus avoiding shortages*
- lower average inventory, thus less exposure to obsolescence (discounting and blocked sales)*



Aligning Ordering/Replenishment with Actual Consumption



Shipping more frequently

- ◉ Shipping daily frequently might lead to more operating expenses
- ◉ Step 1
 - Can you fill trucks with several products?
 - Can you replenish several stores at the same geographic location?
- ◉ Step 2
 - Evaluate the business case of the benefits of inventory savings and increase in sales versus the cost

Adjusting targets based on actual demand

Reality is changing

- ◉ Our initial forecast may be right or wrong
- ◉ Even if correct, demand is subjected to fluctuations
 - The better availability by itself might create a change in market demand
- ◉ Even if correct, supply is subjected to fluctuations
 - Higher load on vendors reduces their response time
- ◉ Effect: Target levels are either too high or too low
- ◉ Conclusion: we must increase or decrease target levels based on changes in demand/supply

The inventory buffer

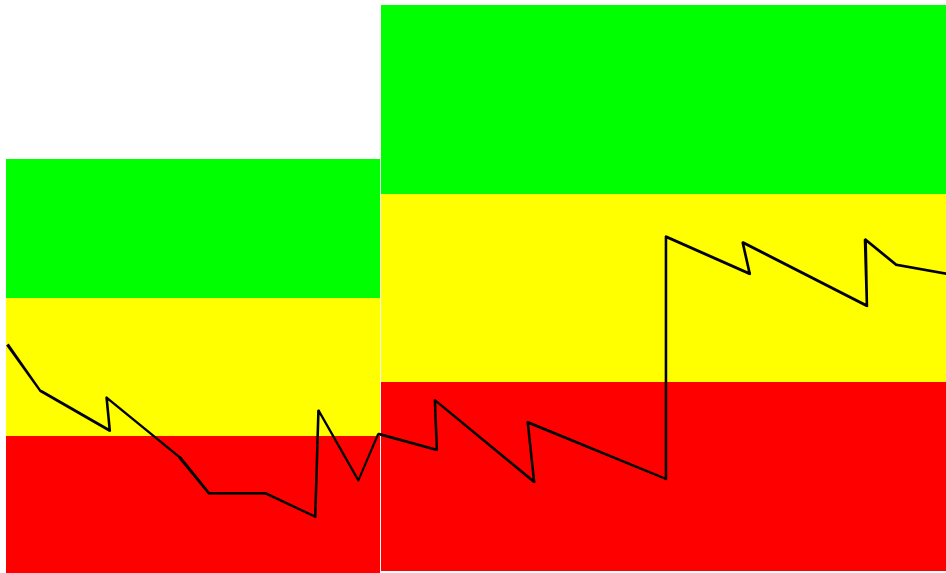
- For each product/site we determine a buffer for all inventory at the site and on the way



- At the supply chain we should be closer to the green level
- At the site we should be on average in the yellow zone

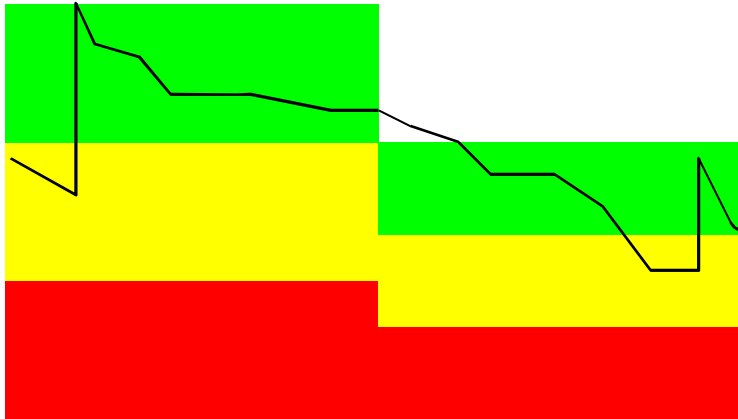
Increasing buffer

- ⦿ Examine if inventory at site has been penetrated too much to the RED
 - Deep penetration
 - Lengthy penetration
- ⦿ For such cases increase the buffer

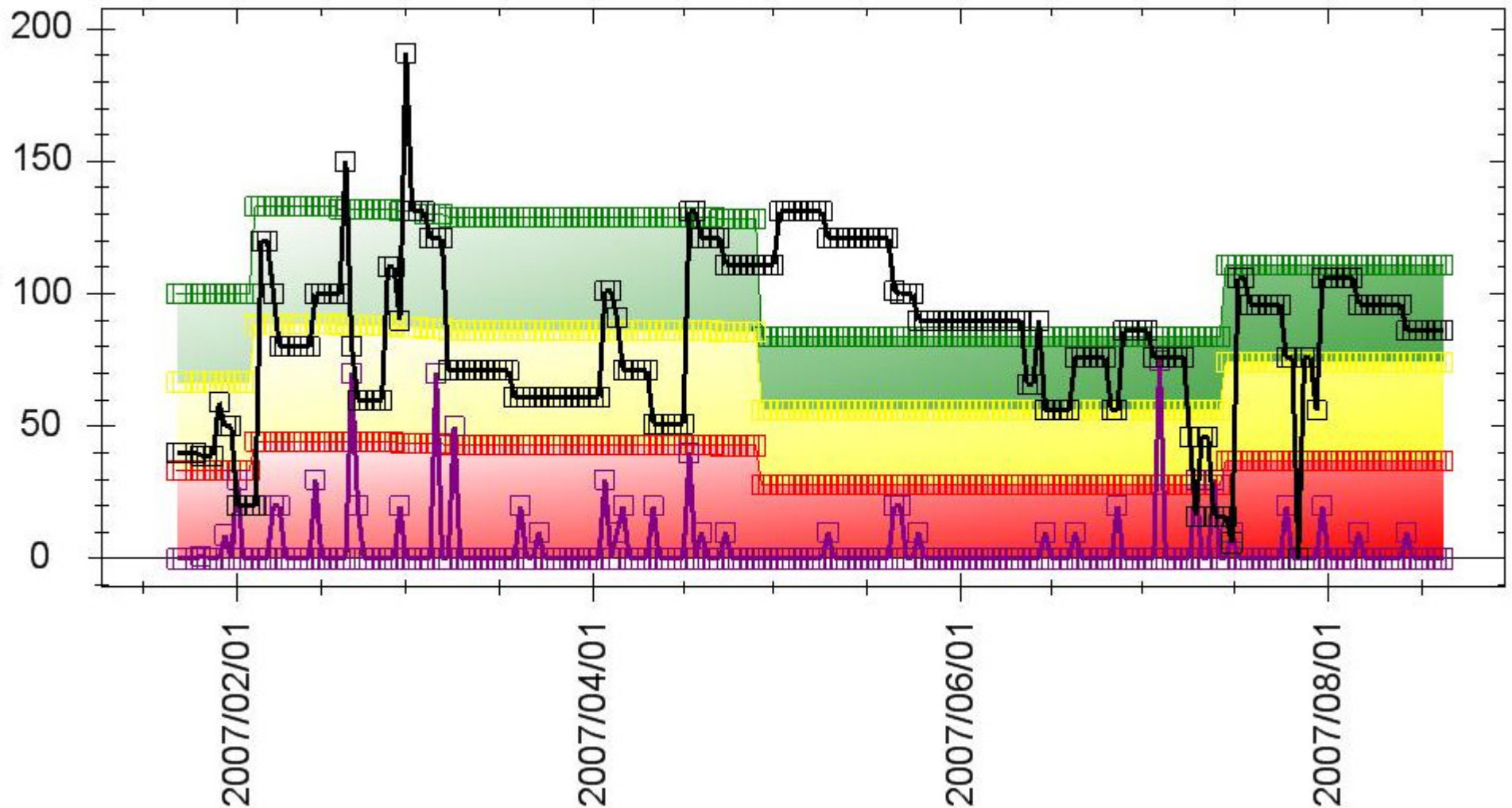


Decreasing buffer

- ⦿ Examine if inventory at site has been too much time in the Green
- ⦿ For such cases, decrease the buffer



SKU behavior along time



Measurements affect behavior

- Tell me how you measure me and I will tell you how I will behave
- Don't tell me how you measure me and I have no clue what I will do next

Are we working according to plan

- ◉ variations from the plan are:
 1. Things that should have been done, but were not = Non Reliability
 2. Things that should not have been done, but were = Non Effectiveness

Throughput value days

- ⦿ When we are responsible for a buffer and the buffer is empty we are unreliable
- ⦿ When a vendor misses on his commitment date he is unreliable
- ⦿ 2 dimensions
 - Price of product
 - Time of out of stock
- ⦿ We should have $TVD = 0$

Overstocks

- ◉ If we replenish above the green level we are not adhering to the method
- ◉ 2 dimensions
 - Price of product
 - Amount of overstock
- ◉ We should strive for overstocks = 0

TOC solution

1. Putting up a central WH to manage most of the stocks
2. Setting buffer sizes at stores and WHs
3. Collecting daily data from consumption points on consumption
4. Shortening the replenishment time as much as possible
5. Replenishing as quickly as possible (financially) from the WHs to the next links
6. Monitoring the buffer sizes using DBM

Back to the example

- One product (SKU)
- 100 stores
- daily sales are between 10 and 30 units per week (average is 20)
- One day delivery between the WH and the stores
- Replenishing to the WH is 2 weeks (10 working days)

Example – doing it the standard way

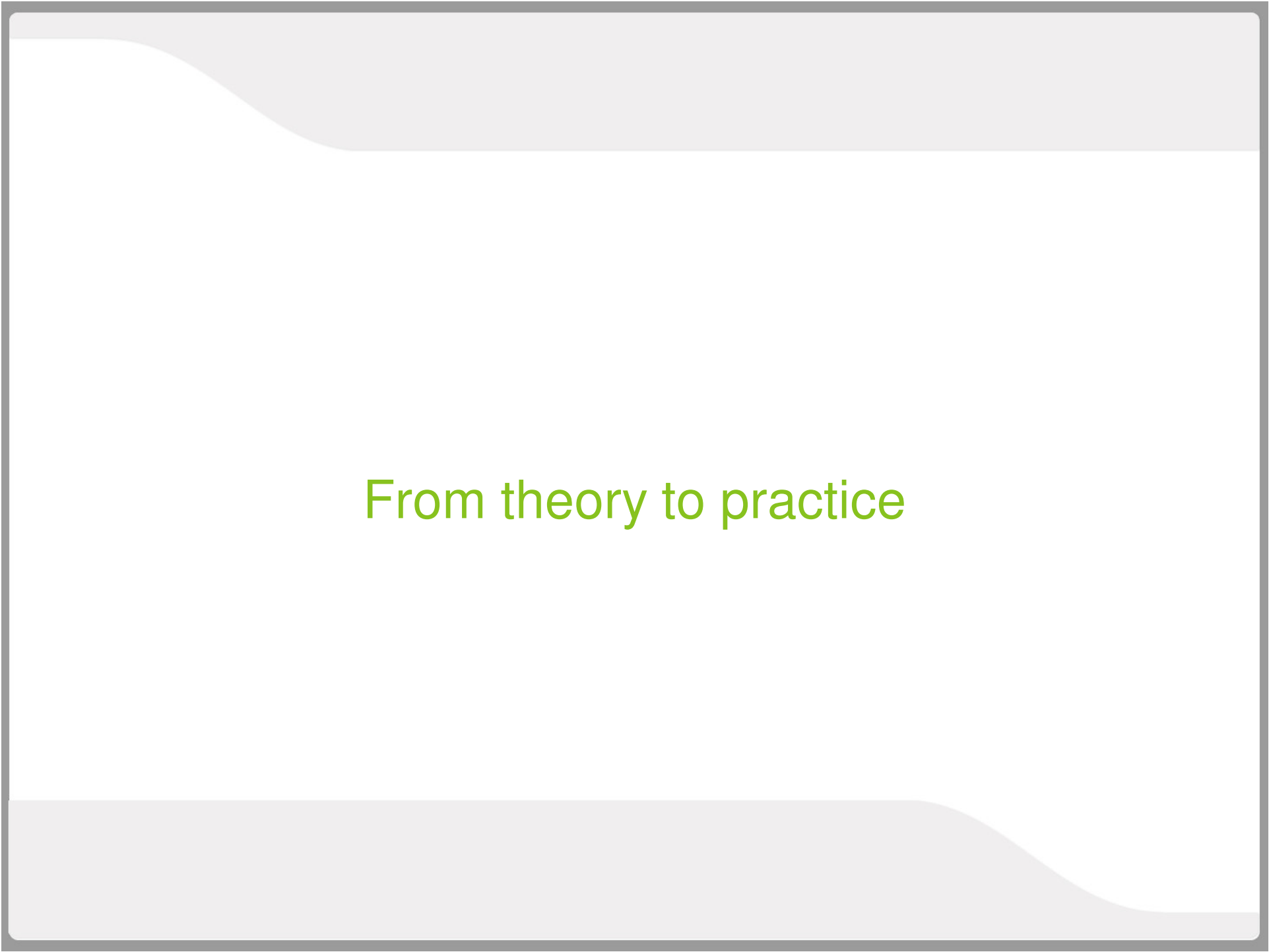
- Protecting at each of the stock locations
 - Need to keep 30 units at each location for each day for a protection of sales – $30 \times 11 = 330$
 - Overall stock kept in the system $330 \times 100 = 33000$

Example – the TOC way

- ⊙ Protecting at the PWH level
 - Keeping $2050 * 11 \text{ days} = 22550$
- ⊙ Protecting the stores
 - Keeping 30 units in each store
 - Keeping $30 * 100 = 3000$
- ⊙ Overall stock kept in the system is 25550

Typical bottom line results

- ◉ Volume is up between 10%-70%
- ◉ Inventory is down by 25%-50%
- ◉ inventory turns up by 1.4 – 3.4
- ◉ Profit on sales is up by 1.3 - 2



From theory to practice

Step 1: proper analysis with all internal functions

1. Analyze the environment: model the supply chain
2. Assess the benefits
3. Tailor a full solution and implementation process that handles all obstacles
4. If necessary, pilot to quantify the expected results

Step 2: Align systems and processes

- ◉ Design all operating procedures
 - Responsibilities
 - Who is responsible for updating buffer sizes
 - who is in charge of upstream/downstream replenishment
 - Who monitors execution
 - Who controls the mix of products
 - What systems are in use
 - Do we need to purchase a system
 - How does the system serve the procedures
 - How all systems work together holistically

Make or Buy

- ◎ The main IT decision of the organization when deciding to embark on the TOC road is what option to choose from the following:
 - Develop a custom-made TOC application that will either be part or work closely with the order entry system
 - Develop some excel charts that will exchange data with the order entry system
 - Purchase a low-cost TOC system
 - Purchase what is known to be the state-of-the-art system, which is relatively expensive

Custom-made development myths

- ◉ Myth: It's considered cheap as it's done with internal resources
- ◉ Reality: the internal IT people have to go through extensive training to understand properly the demands from the software
 - And the investment is an on-going one as the knowledge keeps developing and the needs are changing – making the investment quite high
 - Most TOC consultants, even those who understand S-DBR very well, cannot really lead a good software development because they lack good understanding of the IT norms.

Custom-made development myths

- ◉ Myth: The advantage of internal custom-made is that the organization can update and improve the functionality to suit the special needs and usability for the specific organization
- ◉ Reality: This is probably the highest risk:
 - By letting the users change the application is almost a guaranty to get many features that are not truly required and complicating the solution.
 - It requires constant training to all users on the TOC principles, otherwise the old practices would find their way back into the software, creating huge damage.

Custom-made development myths

- ◉ Myth: Since the solution is simple, it will take very short to develop
- ◉ Reality: What really takes time in developing are the design, which requires profound knowledge in the case of TOC, and the quality assurance. Testing the S-DBR features, and especially the buffer management and the planned load is a lengthy process and requires the QA people to be very proficient in TOC

Experience - custom-made systems

- A computer chip manufacturer in the USA used Symphony, but they wanted to put the S-DBR mechanism inside as they thought of a more sophisticated algorithm to exploit the CCR. It took them 6 months to have an initial color based system, and the CCR is no longer a CCR. Using Symphony to manage that would have taken 1 month
- A car part distributor in eastern Europe embarked on TOC and tried to develop their own software. One year later, and after investing 300K Euros in the task without achieving almost nothing they turned to us and now they're using Symphony

Experience - custom-made systems

- A very large steel manufacturer in India (one of the leading steel plants in the world) embarked on TOC and took my partner Amir Weisenstern to give them the specifications. They have an excellent internal IT function, and still getting the best specifications existing today and one of the worlds experts they achieved in over 1 whole year only partial functionality. Getting the same functionality with Symphony would have taken them 1 month

Excel sheet solutions myth

- ◉ Myth: An excel sheet system can be quickly built and used as an organizational tool to capitalize on TOC
- ◉ Reality: An excel sheet is even a worse solution than a custom-made system built into the organizational order-entry (inc. ERP or MRP) system.
 - It is impossible to debug when the sheet becomes more than a few lines,
 - it's very easy to ruin the logic by mistake (the user pressing the wrong button)
 - It is very easy to add unneeded data:
 - We had a client that used an excel sheet with 6 columns. A month later, they had 5 different sheets with 100 columns each!

The advantages of using the state-of-the-art solution

- ◎ The best TOC functionality available worldwide
 - Tested and retested by experts in TOC both on the technical side and on the logical side – so no logical bugs exist in the code
 - Used by a large number of clients in various organizational structures and businesses – so the product is already best fitted to most environments
- ◎ Tight control on features
 - There is huge temptation to develop too many features, which disrupts the priorities and disable the organization from achieving results.

The advantages of using the state-of-the-art solution

- Size matters

- Because of the large number of clients, the premium software providers are accumulating best practices, both software oriented and application oriented, and spreading them among the clients so that one client's discovery is all clients gain

- TOC knowledge

- Inherent Simplicity is connected with the best people in knowledge development in the TOC world – Eli Goldratt, Eli Schragenheim and all the leading TOC experts in the world share their knowledge with us and monitor our software specifications

Step 3: external links

1. Analyze the inbound and outbound supply
2. Assess the risks and benefits for you and the external party. Examples:
 1. Umbrella contracts for discounts
 2. How sell such deal to a client
 3. How to convince vendor to lower batches
 4. Compensation schemes where needed
 5. Legal contracts
3. Get a convincing method to overcome the resistance

Criteria for a good TOC distribution system

- ⦿ Support the TOC model
 - Support the decisions
 - Provides the proper measurements
- ⦿ Alerting of problems
- ⦿ Sustains the growth – from manual mode to full automation of normal behavior and manual exceptions management
- ⦿ Easy Integration with the local ERP
- ⦿ Prevent vicious cycles



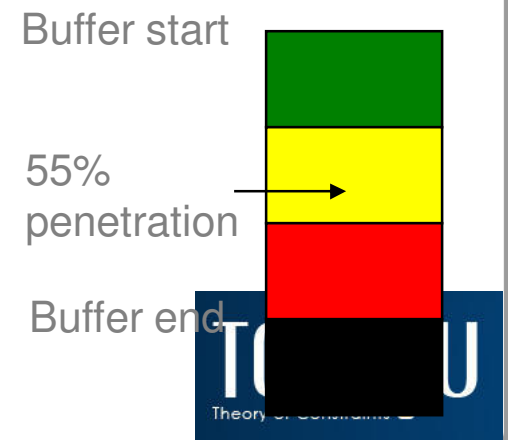
Replenishment prioritization

Buffer Penetration

- Penetration = how much of the buffer has been depleted/used
- Stock buffer: how many product items are missing
- The buffer penetration is calculated as a percentage, meaning:
 - 0% penetration – the buffer is unused (full)
 - 100% penetration – all of the buffer is depleted

Buffer color and buffer penetration

- Logic = most of the time stay in the yellow
 - Green = typically 0% - 33% penetration
 - Yellow = typically 33% - 66% penetration
 - Red = typically 66% - 99% penetration
 - Black = 100% and up



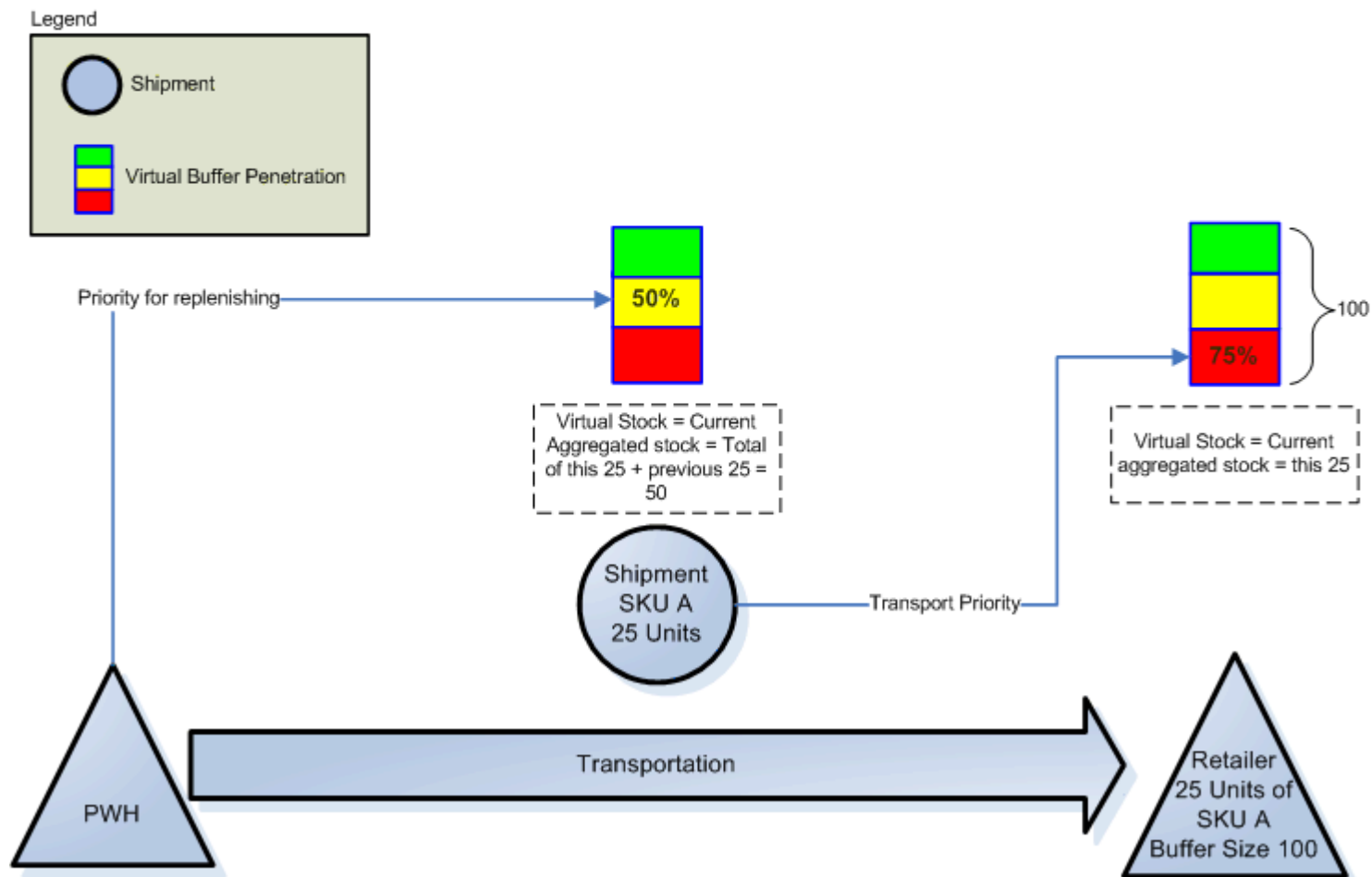
Virtual Buffer Management

- ◉ There are 2 different buffer views of the stock buffer
- ◉ Each view takes into account the total quantity at downstream phases
- ◉ For the plant warehouse:
 - “At the WH”, meaning the quantity at the Plant WH relative to the full buffer
 - “From production”: Firmed work orders plus “At the WH”
- ◉ For the clients/Regional WHs:
 - “At the Site/WH”, meaning the quantity at the Client site/Regional WH relative to the full buffer
 - “From Transport”: In transport including “At the Site/WH”

Example – client site / Central WH

Priority for an SKU held at a stock location

- The Current aggregated stock (virtual stock) is calculated for all downstream links for the same SKU and the appropriate Virtual Buffer Penetration is calculated based on what is missing for the full buffer against the buffer size.
- The priority is determined by the virtual buffer penetration of the next link



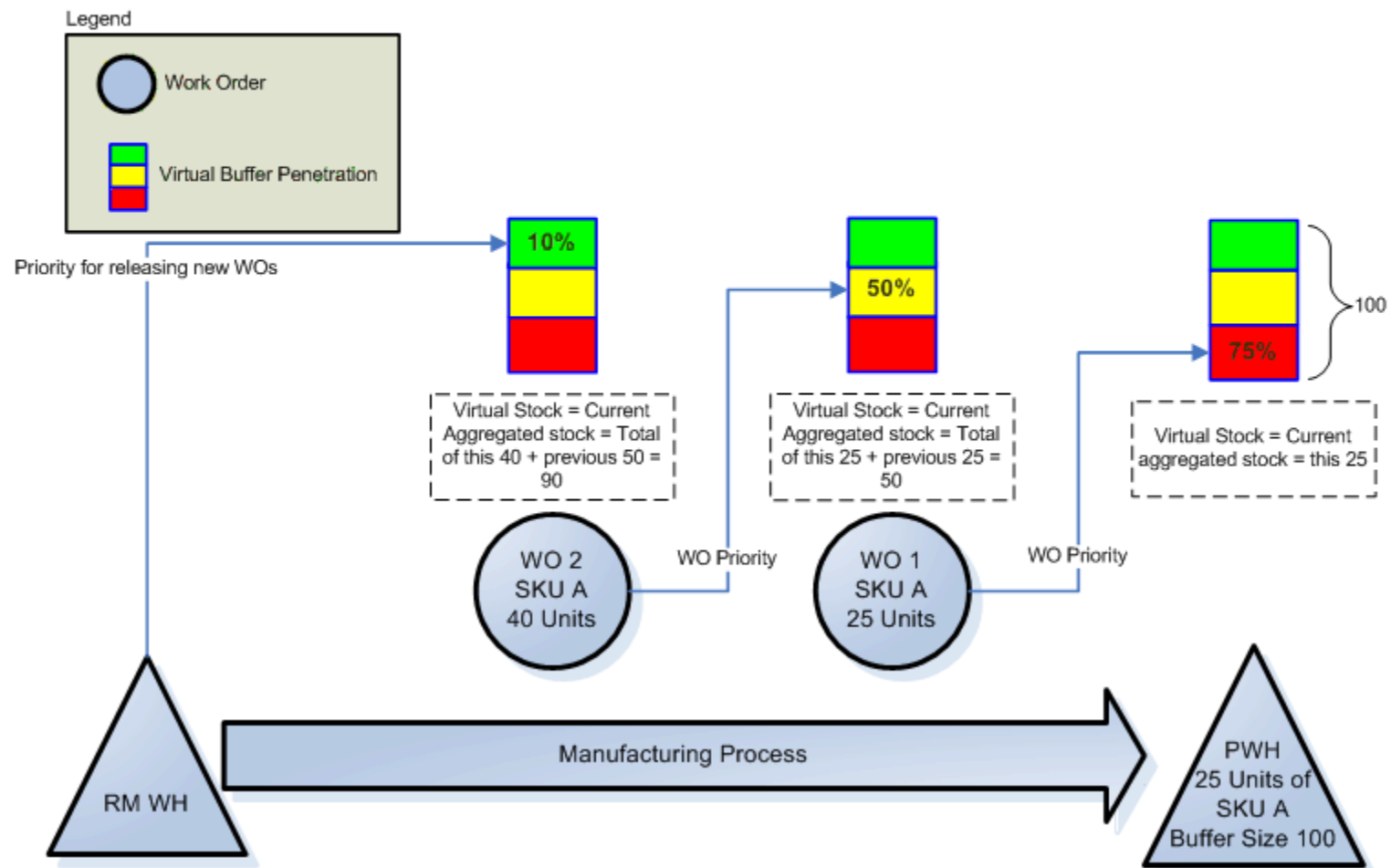
Using the virtual buffer

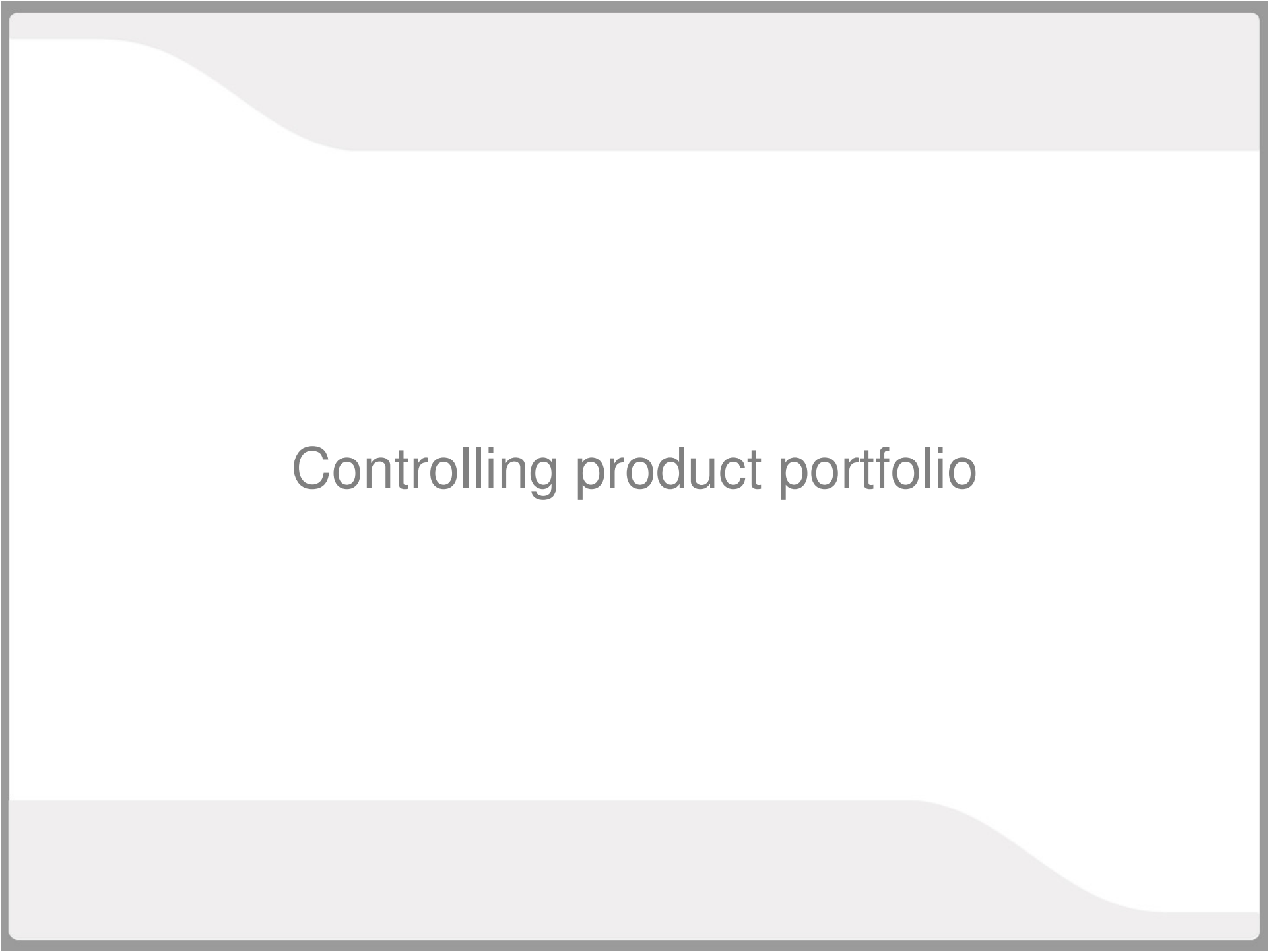
In transport + site	site	meaning
		No material anywhere in the pipeline – replenish ASAP
		expediting transportation will solve urgency replenish if possible
		Expediting transportation will solve urgency

Synchronizing the shop floor with MTS

Priority for an SKU held at the PWH

- The Current aggregated stock (virtual stock) is calculated for all downstream links for the same SKU and the appropriate Virtual Buffer Penetration is calculated based on what is missing for the full buffer against the buffer size.
- The priority is determined by the virtual buffer penetration of the next link





Controlling product portfolio

Consumption Speed classification

- **Cheetah** items – these items are sold very fast, enabling the retailer to reach high inventory turns
- **Elephant** items – these items are items the retailer just can't get rid of – items which are running very slowly with low inventory turns
- **Regular running** items – the items which do not fit the above categories

Cheetah effect

- ◉ Most items that are missing are cheetahs
- ◉ When replenishment is long it is difficult to get the cheetah back in place
- ◉ The effects of out of stock is more than the records show
- ◉ Yet, people are proud to put the “Sold out” sign

Elephant effect

- ⦿ These are the non-sold items
- ⦿ They block space
- ⦿ They consume sales attention
- ⦿ They are discounted “end of season sale” and erode margins

Identification of speed

- ◉ The inventory turn (rotating of inventory) determine the cheetah, regular elephants
- ◉ A shop should get rid of the elephants and move in more cheetahs
- ◉ But, is speed the only consideration?
- ◉ if an airplane moves slower than a laptop does it mean we should stop selling airplanes?

Return on Investment (ROI)

- ⦿ How much are we making
- ⦿ How much money we invest

- ⦿ The money we are making is Throughput
- ⦿ The investment we are putting in place is the average buffer

ROI classification

- ◉ **Star** items – these items represent a very quick ROI – meaning keeping them is very good for business – and for the manufacturer/distributor this is a kind of product he would like to keep at all the stock locations he services
- ◉ **Black Hole** items – these items take a very long period in order to return the investment done in them. For the manufacturer/distributor and item in this group signals a possible item to stop producing/purchasing. However, this is not conclusive, as some items (usually referred to as **Strategic**) are a must to have even though their margin is so low that it puts them in this group
- ◉ **Regular ROI** items - these items are not in either category

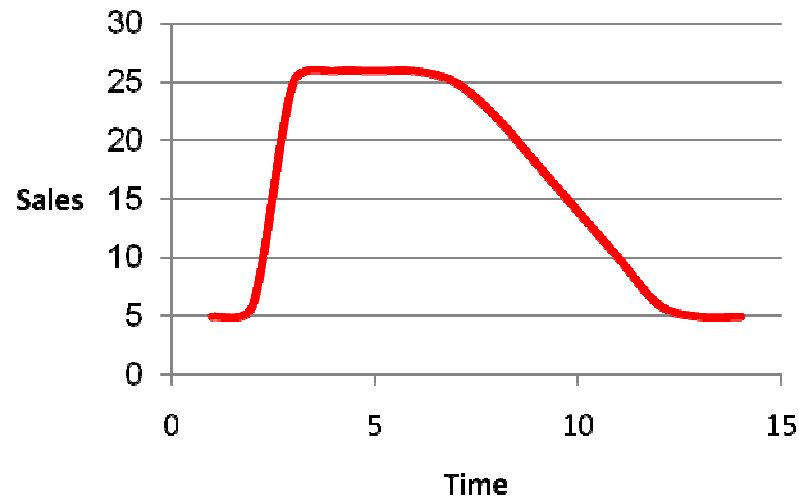
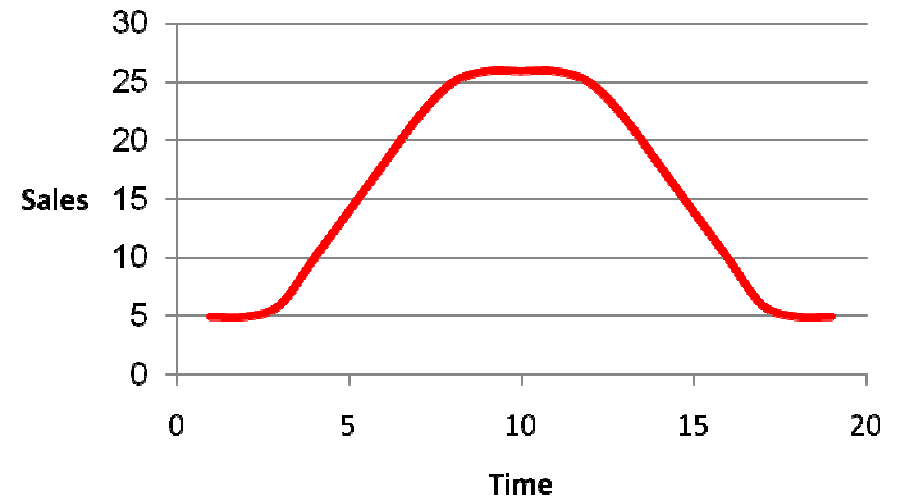
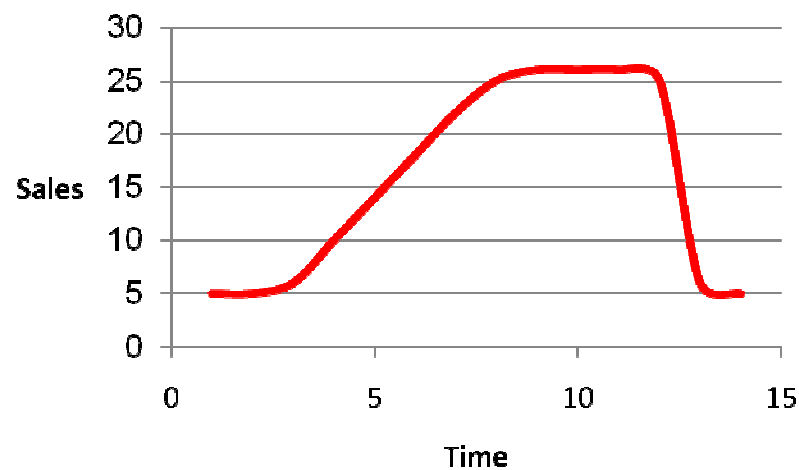
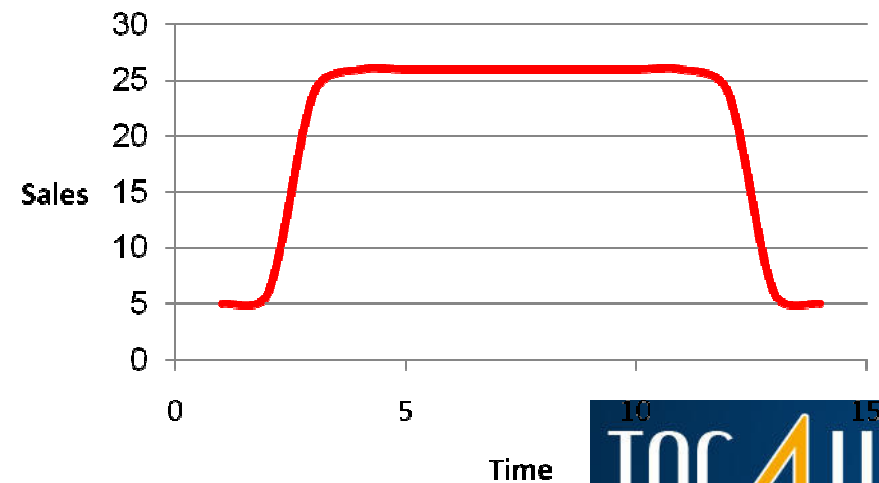
Analysis of ROI and Inventory Turns

- ◉ When you identify a cheetah or star try to populate it to other places to capitalize on success
- ◉ When you identify an elephant or Black hole
 - Compare to other regions and check the reason
 - if this item indeed does not move replace
 - If not check why the other can sell it and you can't

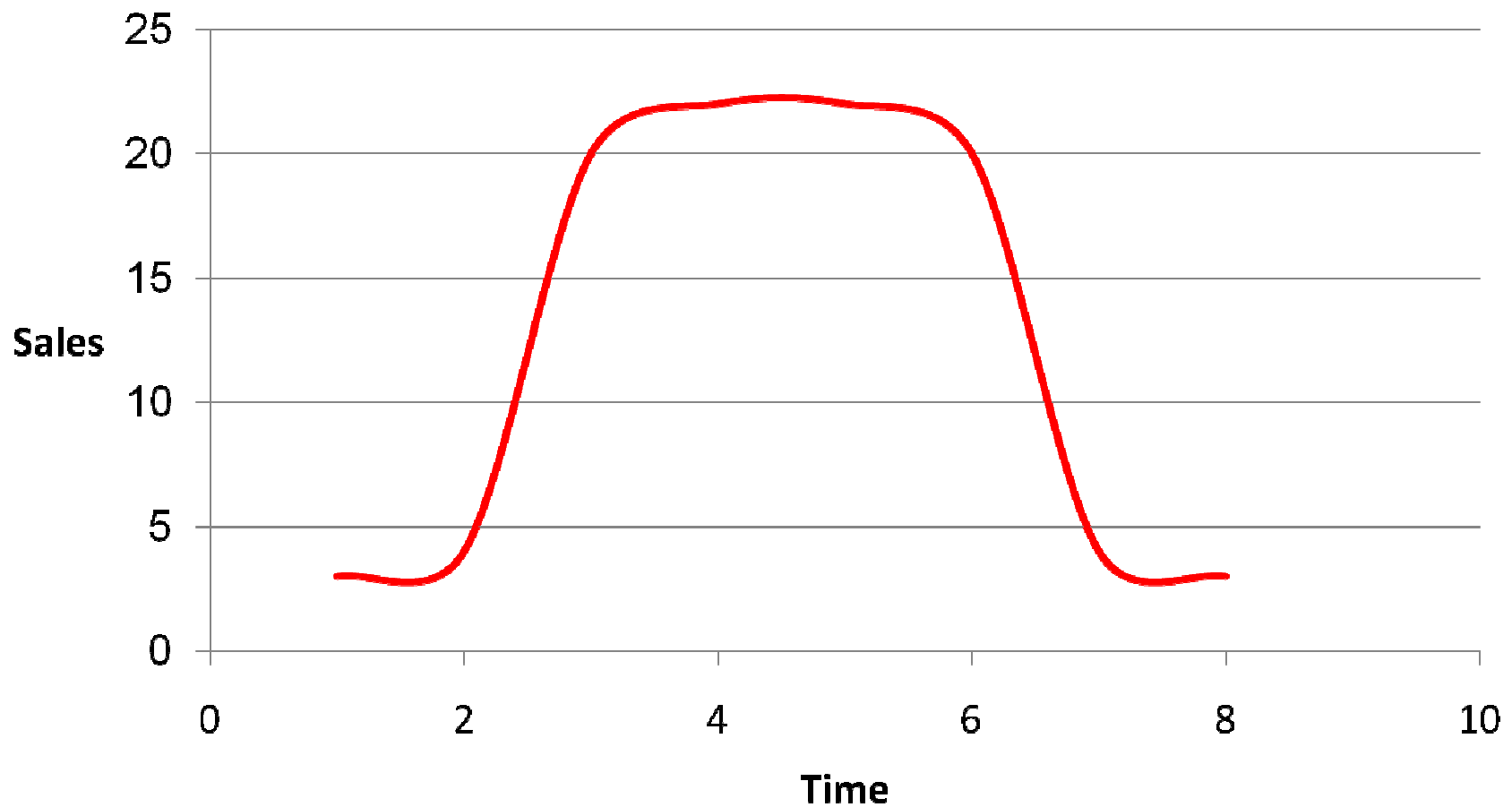
Seasonality

- How do we deal with seasonality patterns when we still want to maintain the benefits coming from implementing DBM?

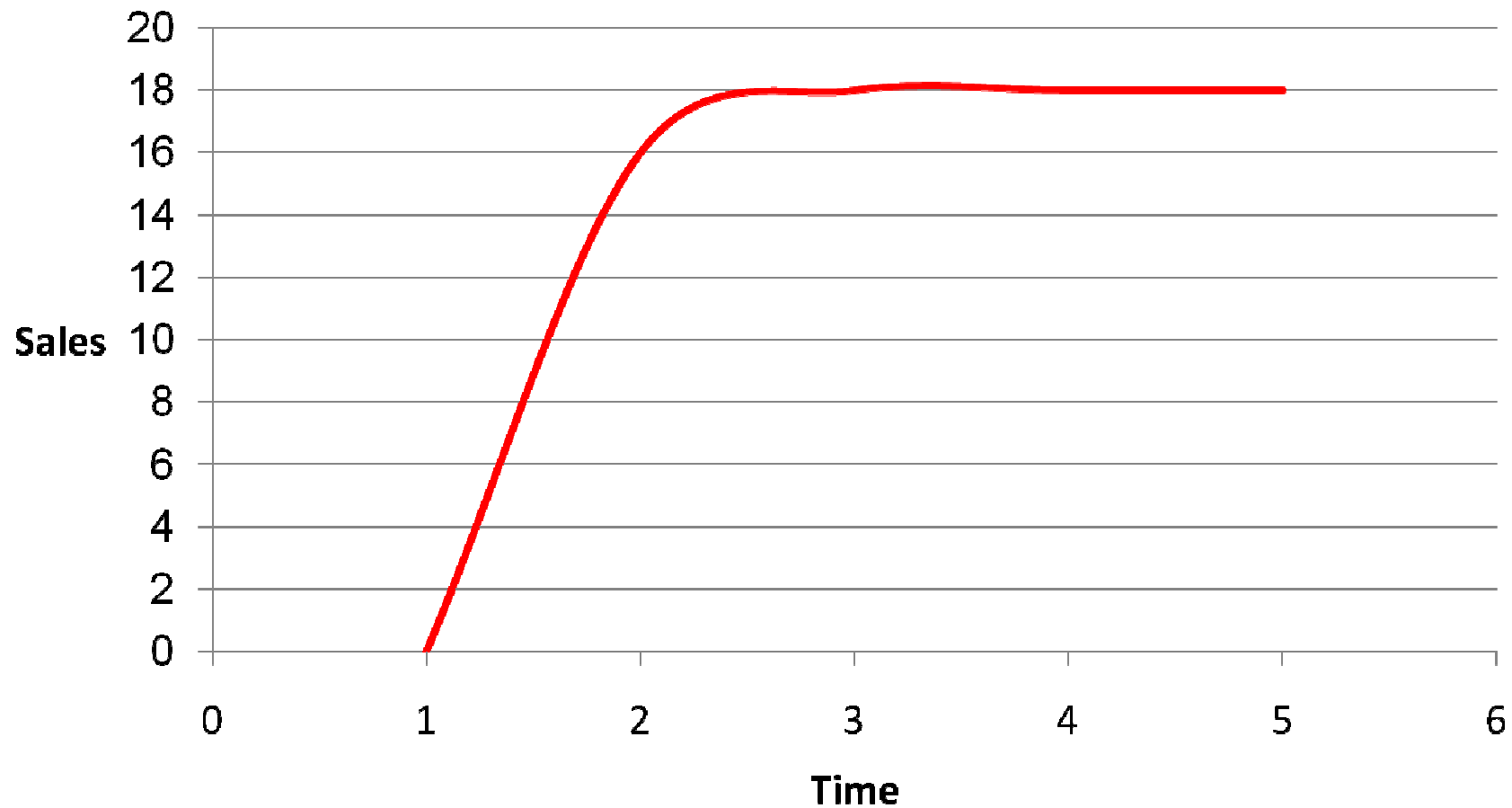
Different Season Patterns



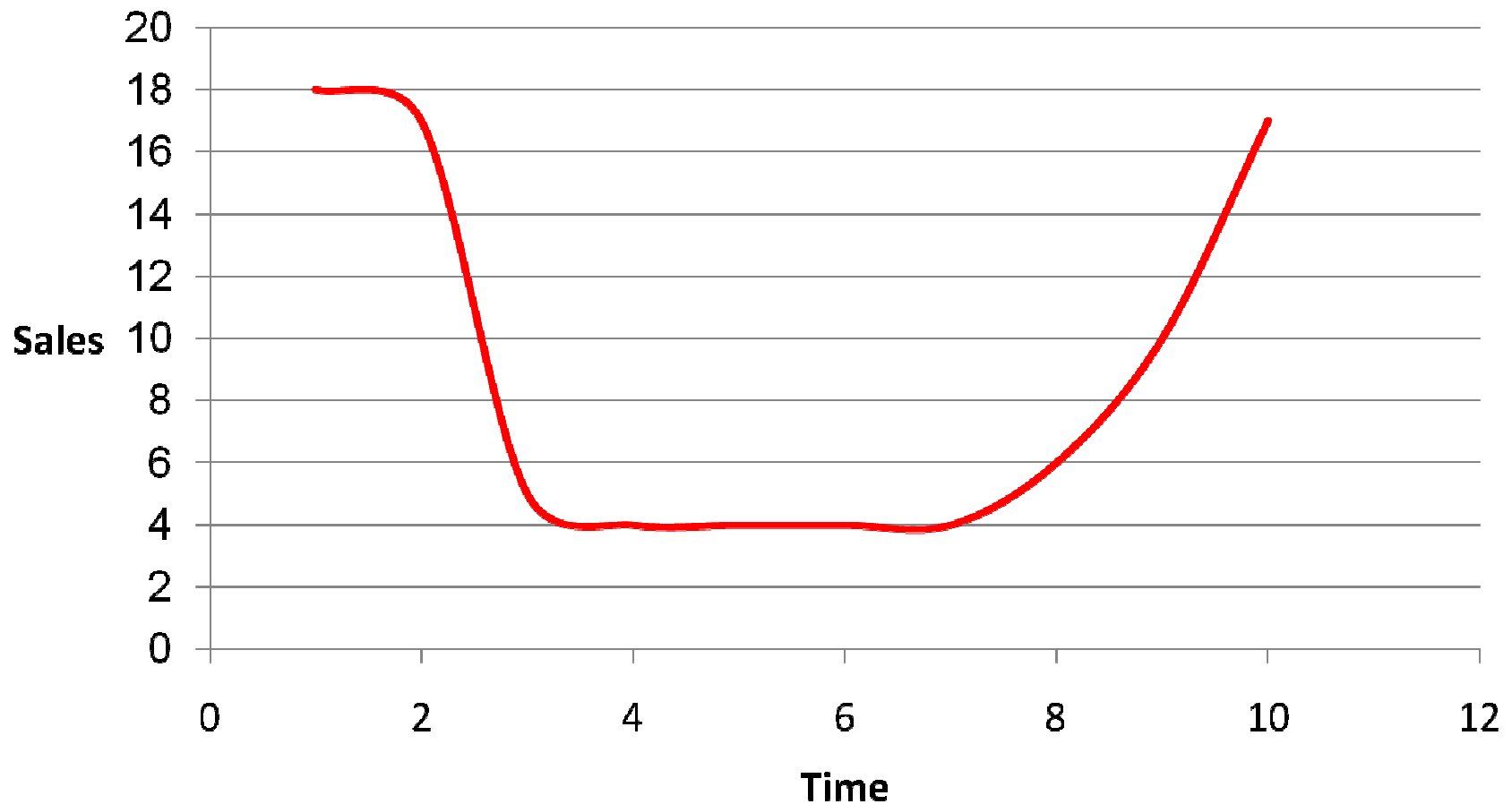
Holiday/Promotion



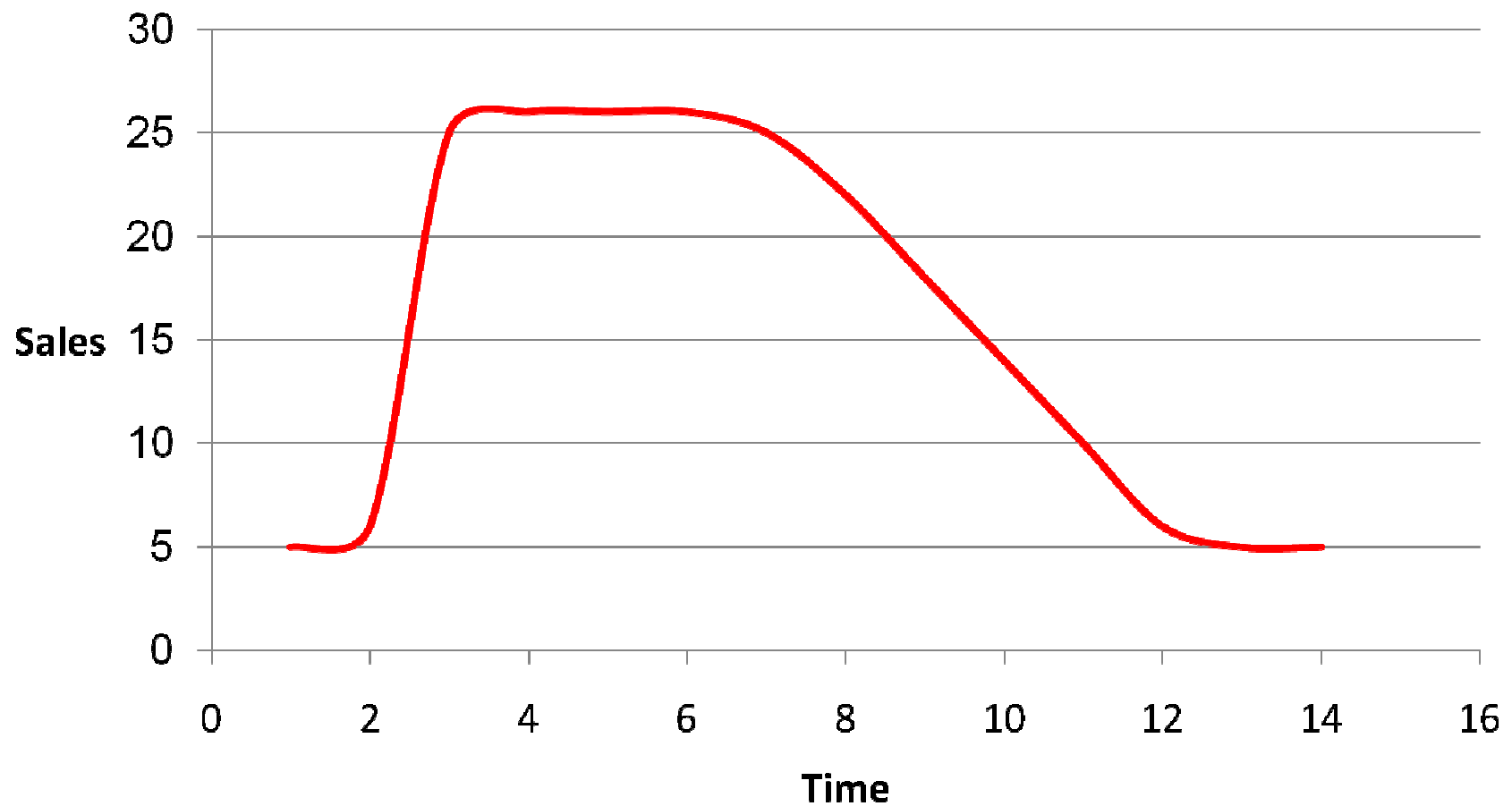
New Product Introduction



“Reverse” seasonality



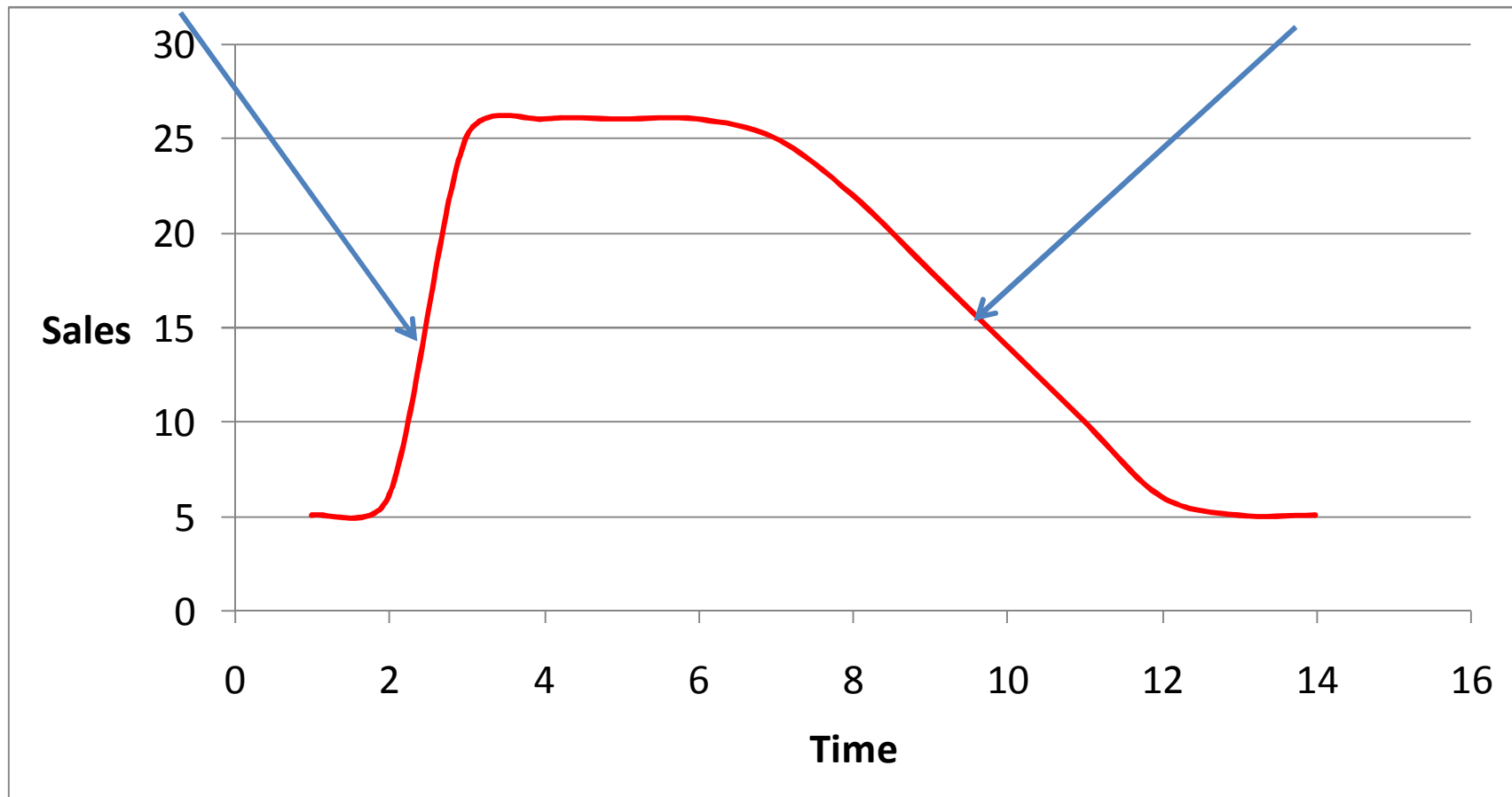
Our focus



Sharp Demand Changes

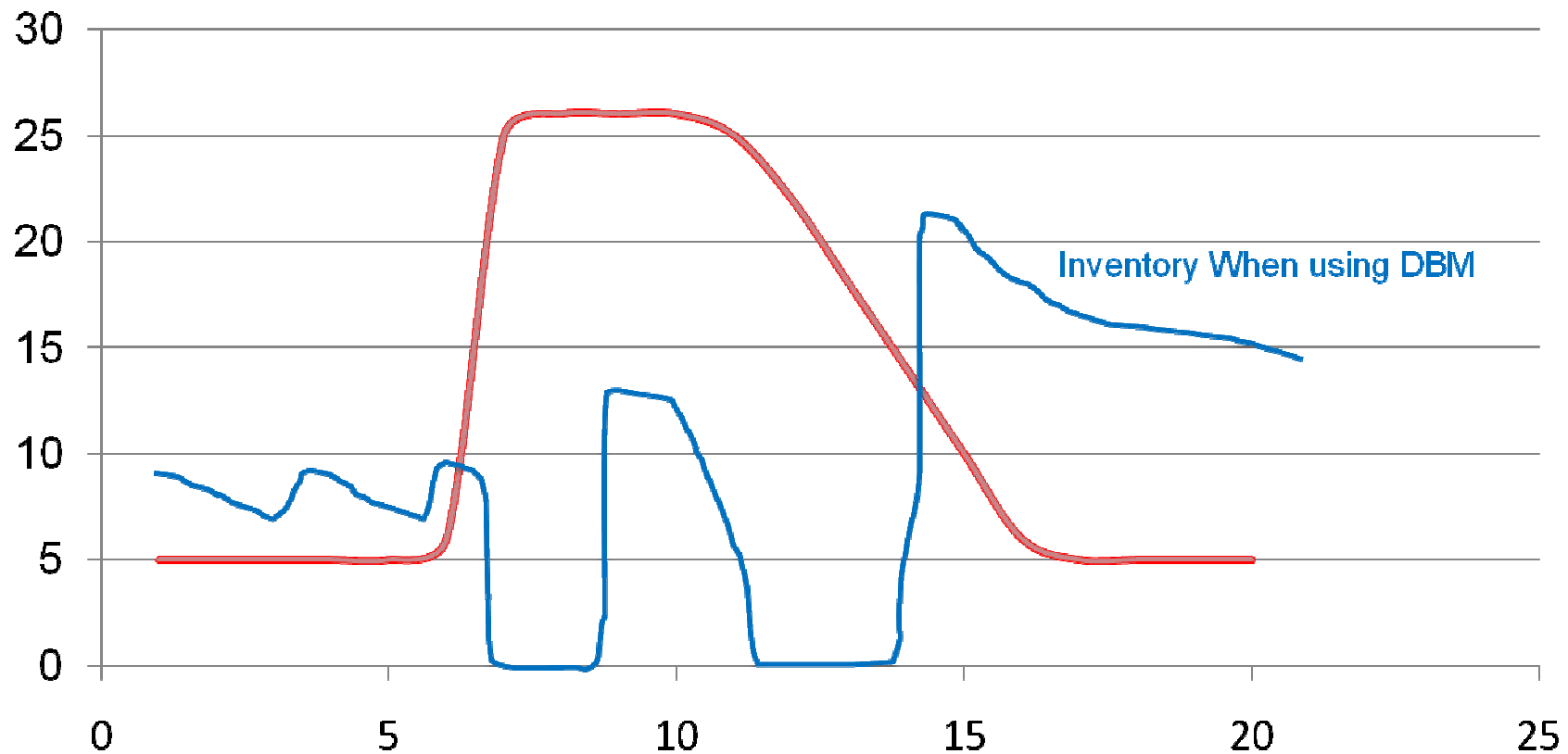
Sharp Demand Increase

Sharp Demand Decrease



How will DBM cope?

DBM and seasonality



- ⊙ Assumptions
 - Demand is continuous
- ⊙ Benefits
 - Highly reactive
 - Pushes for a short replenishment time
 - Logic is simple to explain
 - Stable (doesn't change every day)
- ⊙ Shortcomings
 - Disregards knowledge of future
 - Adjusts slowly to sudden changes
 - Disregards long history

Traditional forecast

- ⦿ Assumptions
 - Everything can be predicted
 - People will trust the output
- ⦿ Benefits
 - Can take into account knowledge about the future
 - Takes into account long history
 - Provides the best theoretical result if all data is accurate, and if done frequently enough on all SKUs
- ⦿ Shortcomings
 - Usually predicts only the average sales and does not include any estimation of the forecasting error
 - Hard to understand for many people – causing overriding of results
 - Subjective and unstable – different user inputs would provide different results
 - Every recalculation of the forecast tends to be disruptive

Comparison for different scenarios

Demand Pattern	Forecast	DBM
Continuous Demand	Would give different daily results – resulting in an unstable system and noise	Would give the best results – a stable system that changes and adjusts periodically only when needed
Sharp Demand Changes	Would give a fair estimation of the needed stocks at each location	Would provide good results only when the replenishment time is short relative to the degree of change

When to use each

- Use DBM whenever expectations are for fairly continuous demand
- When a sharp demand change is expected – plan the CWH/RWH stocks according to forecast
- Revert back to DBM as quickly as possible to adjust to reality

The Inherent Simplicity steps

- 1) Stock Buildup
 - o Order the needed stock at least a replenishment time in advance – see whether you need to order in small batches
- 2) Waiting for stock
 - o Waiting for stocks to arrive using the forecasted buffer size – replenishing within the period, but freezing DBM
- 3) Inside the high demand
 - o Act according to DBM

The Inherent Simplicity steps

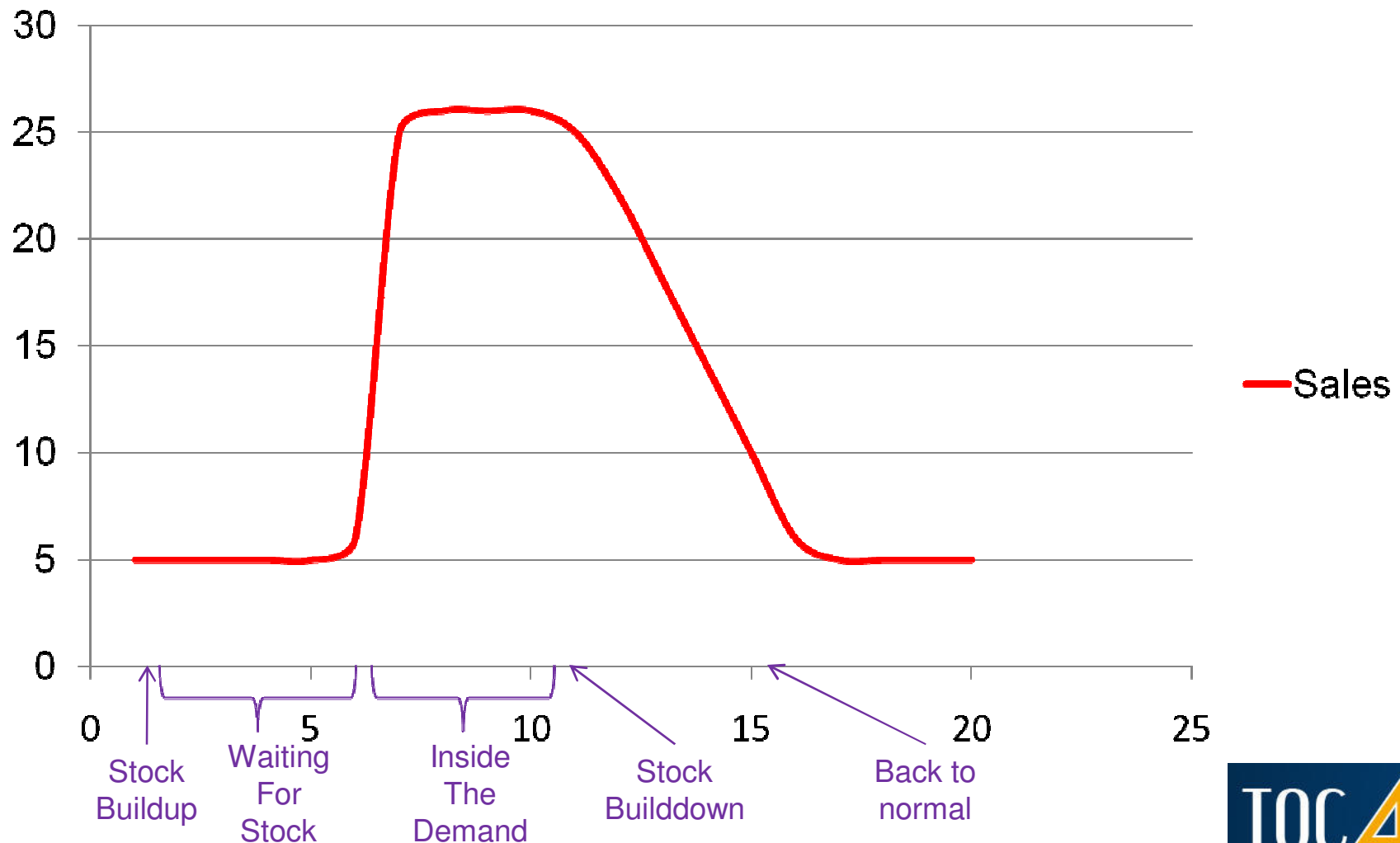
4) Stock Builddown

- o Plan to reduce the buffer size enough time in advance to not stay with too much inventory
- o Thus canceling the replenishment process from the point this was activated until the stock in the system is below the new lower level

5) Back to normal

- o Return to normal behavior – replenishing and acting according to DBM

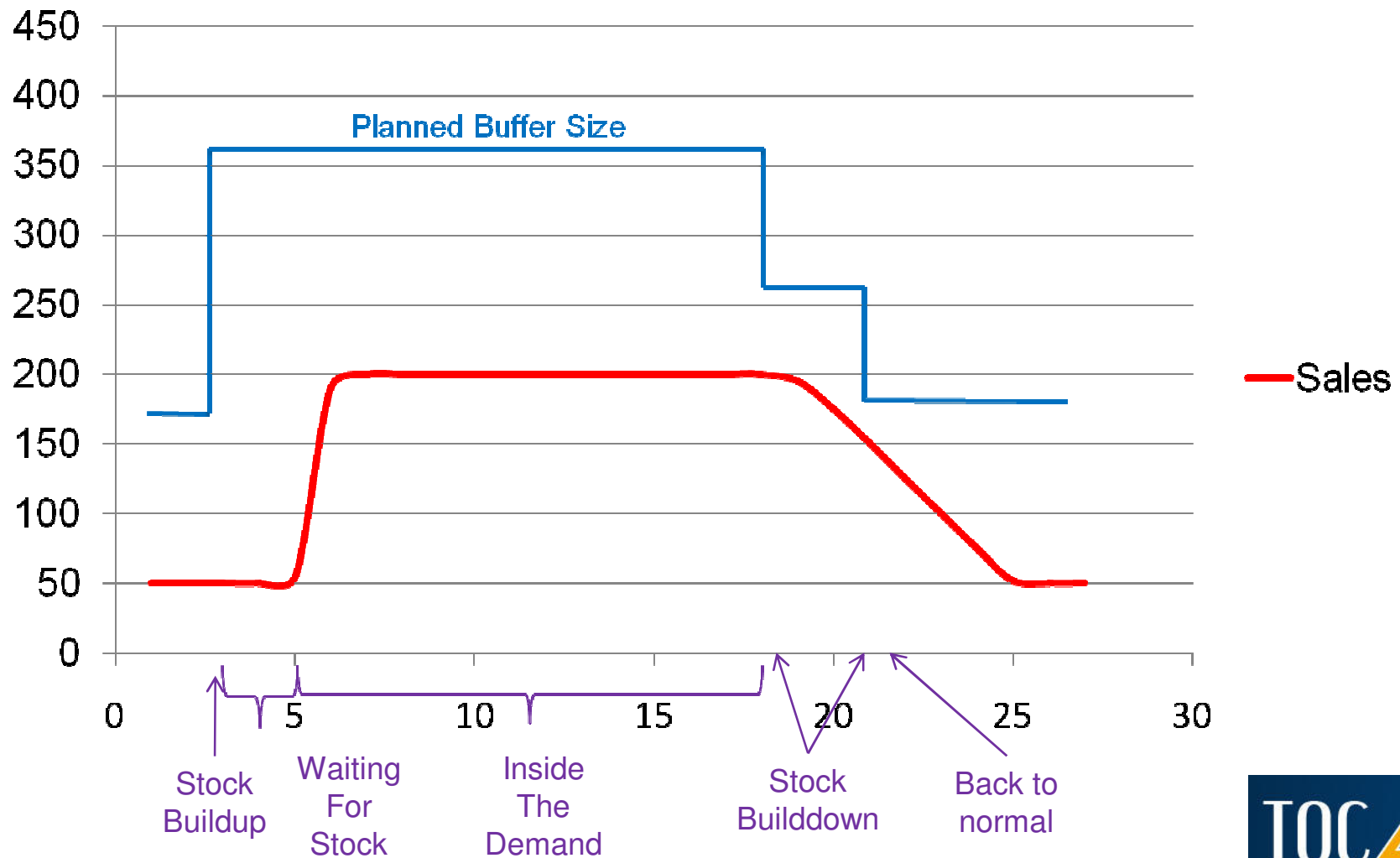
Sharp Demand Changes



Example

- ⦿ A short-sleeve shirt is sold throughout the year at a rate of 10 shirts/day
- ⦿ From May, it's sold at a rate of 40 shirts/day
- ⦿ During September it's sold at a decreasing rate of 5 shirts less each week, until mid-October
- ⦿ The replenishment time is 10 working days

Example



Alternative transportation

- Shortening replenishment time is important in regular supply chain environments
- When seasonality is active, it's absolutely a must if possible – enabling minimum forecasting and using the power of DBM
- The cost of the upgraded method per unit should be considered against the T of the unit and against obsolescence at the end of the season

Alternative transportation

- ◎ In most cases there will be a clear cut between the methods
 - Keeping high inventories
 - Using the upgraded transportation
 - Losing the sales

- ◎ If not – some financial calculations can reveal the direction of the solution

How to proceed

◉ Info:

- www.inherentsimplicity.com
- Amir_sr@inherentsimplicity.com