

Operation Management (OM)

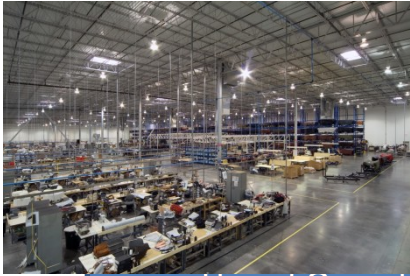
Introduction

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Czech Republic

Coordinates

- **Lecturer** : Ing.Jaromír Skorkovský, CSc.
 - Department of Corporate Economy (5th floor)
 - miki@econ.muni.cz
 - +420 731113517
- **Study material** : will be updated regularly (is.muni.cz)
- **Attendance** : seminar and lectures are obligatory – see subject specification (is.muni.cz) – first important condition to be admitted to exam)
- **Excuses** : if serious reason emerges- only written from is accepted
- **Seminar work** : will assigned after some theory will be presented. Accepted seminar work is the second condition to be admitted to exam)
- **Tuition plan** : at the **end** of this slide show

What is going on ?

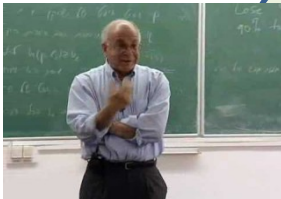
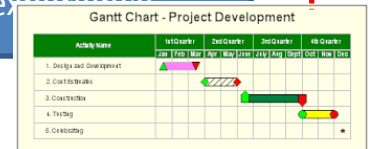


Use of Operations Management (OM) in external environment
(main target)



General knowledge of OM methods acquired at university and long-standing experiences

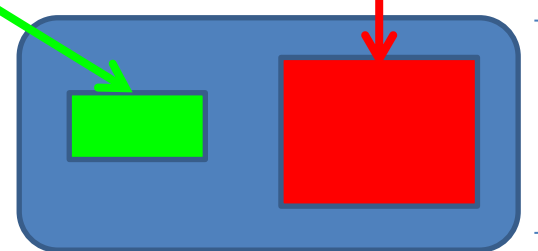
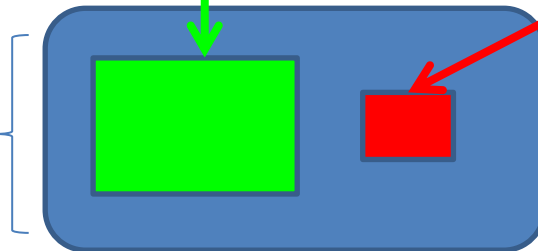
$$= \frac{\sum_{x_1} f_1(x_1) f_2(x_2, x_1)}{\sum_{x_1} f_1(x_1) \sum_{x_2} f_2(x_2, x_1)}$$



Knowledge of methods and experience from research and literature - **teachers**



Knowledge of methods and experience from outside world – **consultants, managers, ...**



Extent of knowledge

Extent of knowledge



Synergy and put OM into practice

OM all around us

OM is the management of all processes used to design, supply, produce, and deliver valuable goods and services to customers



IN

Processing-transformation

Out

TQM = Total Quality Management

ERP: Logistics, Transportation

MRP, JIT, APS, Lean Manufacturing, Little's law

ERP: Marketing, Selling, Invoicing, Payment,....

Some OM methods

- Theory of Constraints
- Balanced Scorecard
- Project Management methods (Critical Chain, SCRUM,...)
- Material Requirement Planning and Just-in-Time
- Advanced Planning and Scheduling
- Six Sigma – quality management
- Boston, SWOT and Magic Quadrant Matrices
- Little ´s Law (relations between WIP, Throughput and Cycle time)
- Linear programming (cutting, blending,..)
- Yield Management
- Kepner-Tregoe (support of decision making)
- Decision trees

Some tools (ERP=Enterprise Resource Planning System)

CRONUS International Ltd. ?

ACTIONS **REPORT**

Sales Quote Sales Invoice Sales Order Sales Return Order Sales Credit Memo
 New Document

Sales Journal Sales Line Discounts Sales Price Worksheet Sales Prices Price List Navigate
 General Price History

Inventory - Sales Back Orders Customer - Order Summary Refresh
 Reports Page

Role Center Sales Orders

Sales Order Processor

Sales Orders, Sales Orders - Open ▾

10000 Sell-to Customer No. ▾

Filter: Order • Open Limit totals: "...31.03.19

No.	Sell-to Custom...	Sell-to Customer Name	External Docume...	Location Code	Assigned User ID	Status	Salespers... Code	Campaign No.	Curr Cod
104001	10000	The Cannon Group PLC		BLUE		Open	PS		
104006	10000	The Cannon Group PLC		BLUE		Open	PS		

Customer Statistics

Customer No.: 10000
 Balance (LCY): 173 794,54

Sales

Outstanding Ord... 1 612,50
 Shipped Not Inv... 525,50
 Outstanding Inv... 0,00

Service

Outstanding Ser... 6,63
 Serv Shipped No... 0,00
 Outstanding Ser... 49,27
 Total (LCY): 175 988,...

Credit Limit (LCY): 0,00
Overdue Amount... 173 794,54
 Total Sales (LCY): 21 707,86
 Invoiced Prepay... 0,00

My Customers

Manage List Open New Find

Name	Phone No.	Balance (LCY)
014... Progressive Ho...		1 499,02
014... New Concepts ...		222 241,32
10000 The Cannon Gr...		173 794,54

My Notifications

From	Created Date	Note	Page

Report Inbox

Show Unread Reports All Reports Delete

Created Date-Time	Description	Output Type
There is nothing to show in this view.		

Home Posted Documents Departments

Some basic processes controlled by ERP –I (where Do we have our items)

BYT-KOMPLET s.r.o.
Milos Silhan
V.Nezvala 5
CZ-687 01 Bojkovice
Czech Republic

Sales - Shipment

Page 1 of 1

CRONUS International Ltd.
5 The Ring
Westminster
W2 8HG London

Sell-to Customer No. 42147258
Document Date 11. leden 2019
Shipment No. 102018
Shipment Date 11.01.19

Phone No. 0666-666-6666
Home Page
E-Mail
VAT Reg. No. GB77777777
Giro No. 888-9999
Bank World Wide Bank
Account No. 99-99-888
Salesperson John Roberts

No.	Description	Quantity	Unit of Measure
1972-S	MUNICH Swivel Chair, yellow	6	Piece
1968-S	MEXICO Swivel Chair, black	4	Piece
1980-S	MOSCOW Swivel Chair, red	3	Piece

Some basic processes controlled by ERP –II.

CONTRIB - DEFAULT - Acc. Schedule Overview

General | Dimension Filters | Options

Account Schedule Name : CONTRIB Date Filter 01.01.15..31.12.15
 Column Layout Name DEFAULT Budget Filter

Row No.	Description	Net Change Debit	Net Change Credit	Balance at Date Debit	Balance at Date Credit
	Contribution margin analysis				
RM	Raw Materials		13,44	577 719,32	
RC	Direct Cost Applied, Cap.		1 824,00		2 846,80
OVC	Overhead Applied, Cap.		380,00		491,10
R	Sales, Retail - Dom.		2 700,00		1 132 035,33
TC	Total direct costs		1 837,44	574 872,52	
▶ KP	Contribution margin	862,56		1 706 907,85	
AM	Margin	482,56		1 706 416,75	
AM%	Margin in %	68,05			50,78

1 7 31 3 12 Functions Help

Some basic processes controlled by ERP –III.

1000 Bicycle - Production BOM Bill of material

General

No. 1000 Search Name BICYCLE

Description Bicycle Version Nos.

Unit of Measure Code . . . PCS Active Version.

Status Certified Last Date Modified . . . 11.12.10

Type	No.	Description	Quantity ...	Unit of Measu...	Scrap...	Routing Li...
▶ Item	1100	Front Wheel	1	PCS	0	
Item	1200	Back Wheel	1	PCS	0	
Item	1300	Chain Assy	1	PCS	0	
Item	1400	Mudguard front	1	PCS	0	
Item	1450	Mudguard back	1	PCS	0	
Item	1500	Lamp	1	PCS	0	
Item	1600	Bell	1	PCS	0	
Item	1700	Brake	1	PCS	0	
Item	1800	Handlebars	1	PCS	0	
Item	1850	Saddle	1	PCS	0	
Item	1900	Frame	1	PCS	0	

Prod. BOM ▼ Component ▼ Functions ▼ Help

Some basic processes controlled by ERP –IV.

OP100016 Assembling furniture - Opportunity Card

General

No. OP100016 Campaign No.

Description Assembling furniture Priority Normal

Contact No. CT000002 Sales Cycle Code EX-SMALL

Contact Name. Selangorian Ltd. Status Won

Contact Company Name. Selangorian Ltd. Closed

Salesperson Code. PS Creation Date. 04.01.12

Sales Document Type Date Closed. 21.01.12

Sales Document No.

Active	Action Taken	Sales Cycle Stage	Date of Change	Estimated Close Date	Estimated Value (LCY)	Calcd. Current Value (LCY)	Completed %	Chances of Success %	Probability %
<input checked="" type="checkbox"/>	Won	0	21.01.12	21.01.12	5 500,00	5 500,00	100	100	100
<input type="checkbox"/>	Next	4	17.01.12	21.01.12	5 500,00	5 087,50	95	90	93
<input type="checkbox"/>	Next	3	12.01.12	21.01.12	5 500,00	3 987,50	80	65	73
<input type="checkbox"/>	Next	2	08.01.12	21.01.12	5 500,00	2 337,50	50	35	43
<input type="checkbox"/>		1	06.01.12	21.01.12	5 000,00	550,00	2	20	11
<input type="checkbox"/>									
<input type="checkbox"/>									
<input type="checkbox"/>									
<input type="checkbox"/>									
<input type="checkbox"/>									
<input type="checkbox"/>									
<input type="checkbox"/>									

Opportunity Functions Create Oppo... Help

Some basic processes controlled by ERP –V.

2009 Deerfield Graphics Company - Sales Order

General Invoicing Shipping Foreign Trade E-Commerce Prepayment

No. 2009

Sell-to Customer No. 40000

Sell-to Contact No. CT000004

Sell-to Customer Name Deerfield Graphics Company

Sell-to Address 10 Deerfield Road

Sell-to Address 2

Sell-to Post Code/City GL1 9HM Gloucester

Sell-to Contact Mr. Kevin Wright

No. of Archived Versions.

Posting Date 18.01.12

Order Date 18.01.12

Document Date 18.01.12

Requested Delivery Date

Promised Delivery Date .

Quote No.

External Document No. .

Salesperson Code PS

Campaign No.

Opportunity No.

Responsibility Center . .

Assigned User ID

Status Released

Type	No.	Description	Location Code	Reserved Quantity	Unit of Measu...	S... P... Excl. VAT	Unit Price	Line Amount Excl. VAT	Line Disco...	Appl.-to Item Entry
▶ Item	LS-10PC	Loudspeakers, White for PC	WHITE	12	BOX	59,00	708,00			
Item	LS-150	Loudspeaker, Cherry, 150W	WHITE	8	PCS	129,00	1 032,00			

Customer Information

Sell-to Customer

- Ship-to Addresses (0)
- Contacts (1)
- Sales History

Bill-to Customer

- Avail. Credit 0

Item Information

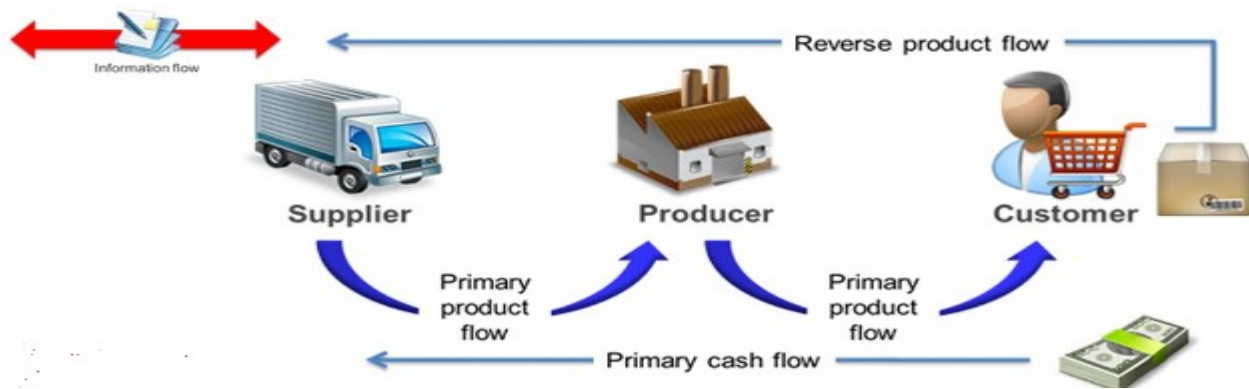
- Item Card
- Availability (-46)
- Substitutions (0)
- Sales Prices (0)
- Sales Line Di... (0)

Order Line Functions Posting Print Help

Used abbreviations : ATP|CTP– Available to Promise | Capable to Promise

Controlling processes in Supply Chain Management (SCM)

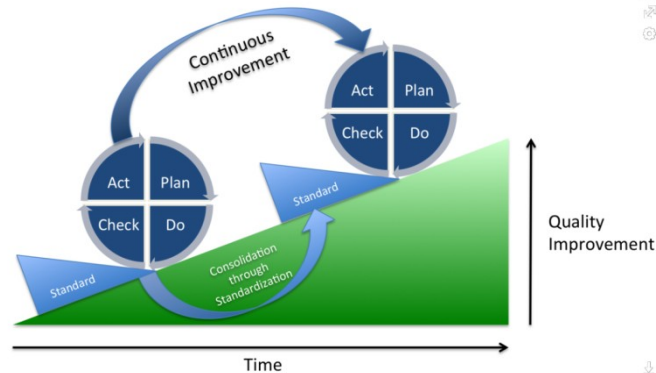
		Supply	Production	Orders (Demands)	
Planning levels {	Strategic	← Operation Strategies and Innovations , R&D →			Demand Planning
	Tactical	Forecasts, Blank Orders	Long term planning	Marketing	
	Operational	Logistic operations	Routing control, TQM	Packaging , Transportation	
	Operational	MRP, Replenishment	MRP_II ; JIT, Capacities	Cash flow	



Used abbreviations : R&D –Research and Development; TQM-Total Quality Management; JIT- Just –In-Time; MRP_II-Manufacturing and Resource Planning

Used abbreviations (slide number 3) : ERP - Enterprise Resource Planning ; APS – Advanced Planning and Scheduling

Deming cycle (based on periodicity)



Plan: Define the problem to be addressed, collect relevant data, and ascertain the **problem's root cause** (e.g. by use of TOC=Theory of Constraints)

Do: Develop and implement a solution; decide upon a measurement to gauge its effectiveness.

Check: Confirm the results through before-and-after data comparison.

Act: Document the results, inform others about process changes, and make recommendations for the problem to be addressed in the next PDCA cycle.

Simple example of Deming cycle

Plan: Excessively high value of the stock, which is one of the reasons of low liquidity of our company (converting assets to cash)= **problem's root cause** detected by use of TOC=Theory of Constraints and Current Reality Tree (will be presented)

Do: Implement algorithm controlling stock replenishment based on MRP principle and ROP and Safety Stock level setup. Metrix for effectiveness will be **inventory dollar days (IDD)** - which is one of TOC metrics

Check: ERP inventory costing routines before and after implementation of stage **Do** application

Act: Document the results, inform others about process changes, and recommend how to continue in inventory management routines (e.g. use of EAN readers or calculation of **inventory service level** in order to speed up inventory procedures such as put-away and pick or optimize inventory level differently) in the next PDCA cycle.

Used abbreviations : **MRP** – Material Requirement Planning – will be presented; **ROP** – Reorder Point –see next slide); **ERP**- see slide number 12

IDD definition : <https://elischragenheim.com/2016/05/23/throughput-dollar-days-tdd-and-inventory-dollar-days-idd-the-value-and-limitations/>

Explanation of some terms used in PDCA Deming Cycle simple example (**home study**) I.

- **Service level** : represents the expected probability of not hitting a **stock-out**. This percentage is required to compute the safety stock.

Intuitively, the service level represents a trade-off (compromise) between the cost of inventory and the cost of stock-outs (which incur missed sales, lost opportunities and client frustration among others).

$$p = \Phi \left(\sqrt{2 \ln \left(\frac{1}{\sqrt{2\pi}} \frac{M}{H} \right)} \right)$$

M - stock-out cost (often 3 time the gross margin)

H - carrying cost per unit for the duration of the lead time

1l milk pack -> 1.50€ selling price, 10% margin -> =0,15 €. Lead time = 4 days.

The annual carrying cost is 1.50€ (the value is high because milk is a highly perishable product).

Stock-out cost ->3 time the gross margin, that is to say->M= 0.45€.

$H=(4/365) \times 1.5 \approx 0.0055$ $H \approx 0.0055$. So $p=98,5\%$

Explanation of some terms used in PDCA Deming Cycle simple example (**home study**) II.

The screenshot shows the SAP Item Card for '1952-W OSLO Storage Unit/Shelf' in the 'Planning' tab. The 'Reorder Point' field is highlighted with a red box and contains the value 30. Other fields include Reorder Cycle, Safety Lead Time, Safety Stock Quantity (10), Reorder Quantity (20), Maximum Inventory (0), Minimum Order Quantity (5), and Order Multiple (0). The 'Include Inventory' checkbox is checked, and 'Reserve' is set to 'Optional'.

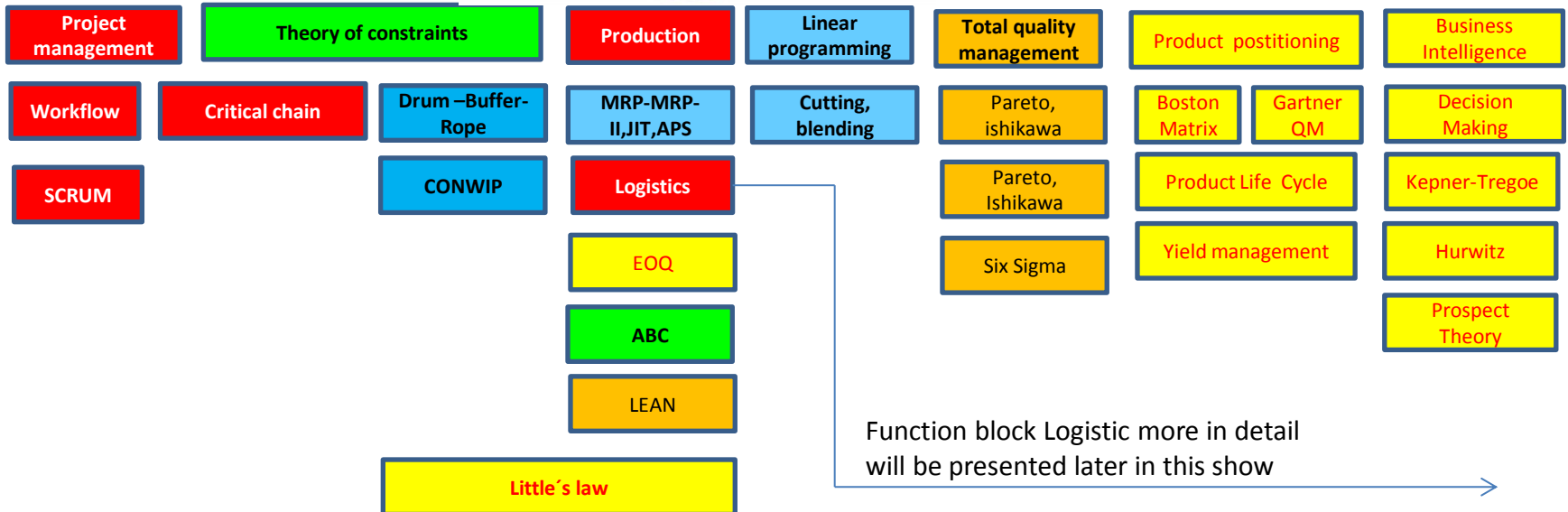
Field	Value
Reordering Policy	Fixed Reorde...
Include Inventory	<input checked="" type="checkbox"/>
Reserve	Optional
Order Tracking Policy	None
Stockkeeping Unit Exists	<input type="checkbox"/>
Critical	<input type="checkbox"/>
Reorder Cycle	
Safety Lead Time	
Safety Stock Quantity	10
Reorder Point	30
Reorder Quantity	20
Maximum Inventory	0
Minimum Order Quantity	5
Maximum Order Quantity	0
Order Multiple	0

Used abbreviations : EOQ – Economic Order Quantity – will be explained during this course

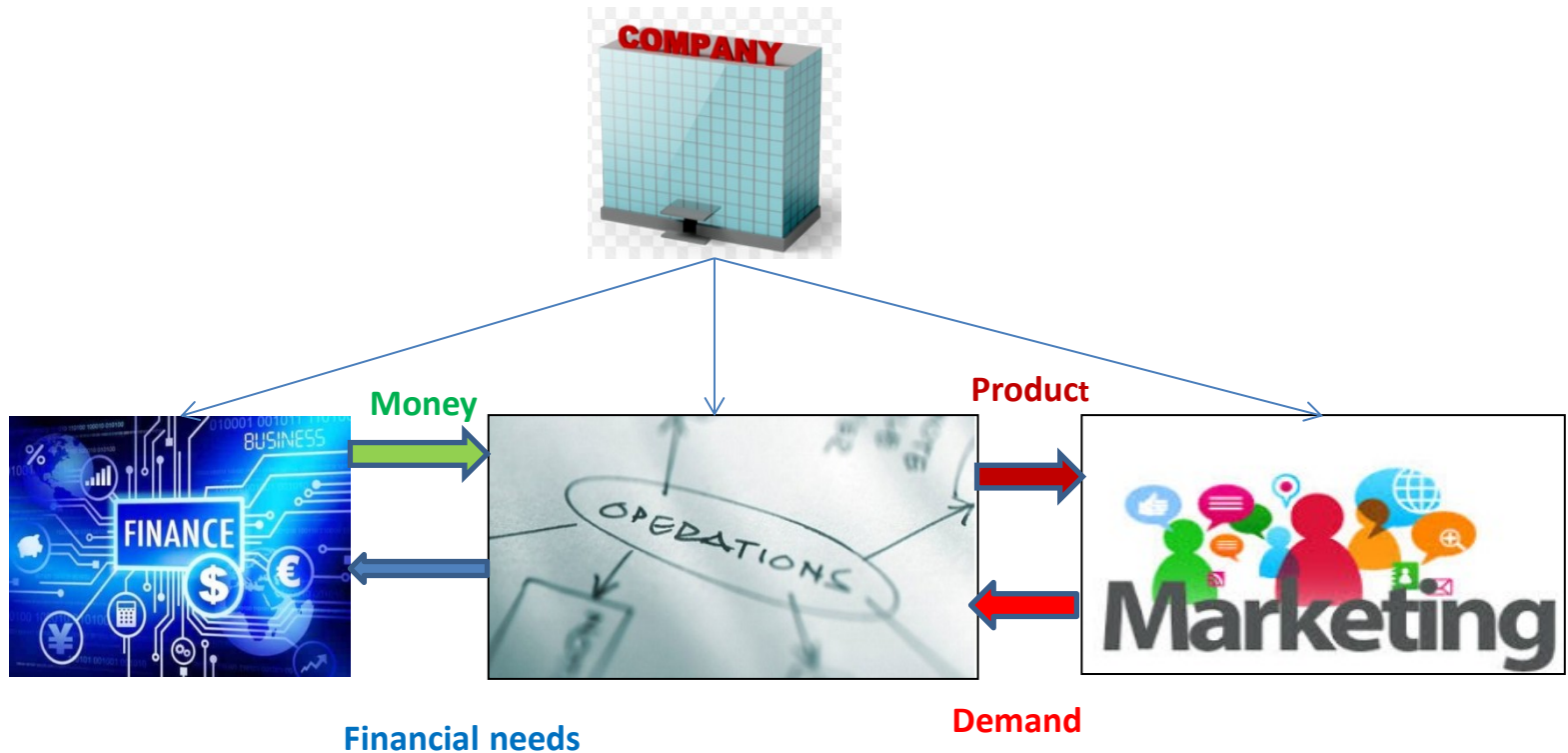
Another point of view



This will be modified in following **South African** project show (example of Balanced Score Card use)

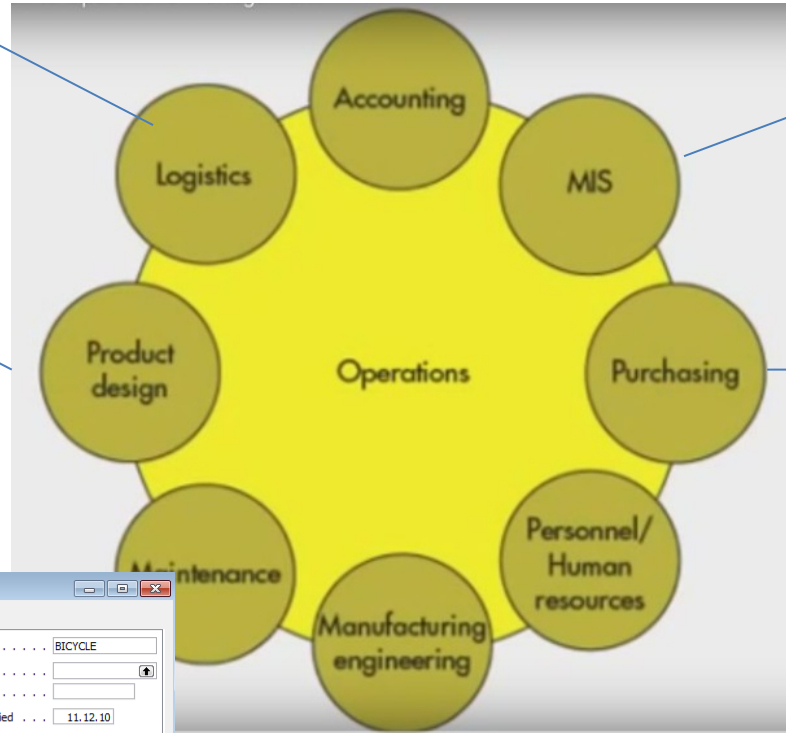


Another point of view



Operations

See next slide



Manufacturing

- Product Design
 - Items
 - Production BOM
 - Routings
 - Families
 - Exchange Production BOM Item
 - Delete Expired Components
 - Calculate Low-Level Code
- Reports
- Capacities
- Planning
- Execution
- Costing

1000 Bicycle - Production BOM

General

No. 1000 Search Name BICYCLE

Description Bicycle Version Nos.

Unit of Measure Code PCS Active Version.

Status Certified Last Date Modified 11.12.10

Type	No.	Description	Quantity	Unit of Measu...	Scrap...	Routing Li...
Item	1000	Front Wheel	1	PCS	0	
Item	1200	Back Wheel	1	PCS	0	
Item	1300	Chain Assy	1	PCS	0	
Item	1400	Mudguard front	1	PCS	0	
Item	1450	Mudguard back	1	PCS	0	
Item	1500	Lamp	1	PCS	0	
Item	1600	Bell	1	PCS	0	
Item	1700	Brake	1	PCS	0	
Item	1800	Handlebars	1	PCS	0	
Item	1850	Saddle	1	PCS	0	
Item	1900	Frame	1	PCS	0	

Prod. BOM Component Functions Help

Bill of material

Microsoft Dynamics NAV 2009 R2

Version W1 6.0 R2 (6.00.32012)

Copyright (C) 2010 Microsoft. All rights reserved.

This product is licensed to:

4805500
NAVERTICA a.s.
Sumavska 15

Brno 602 00

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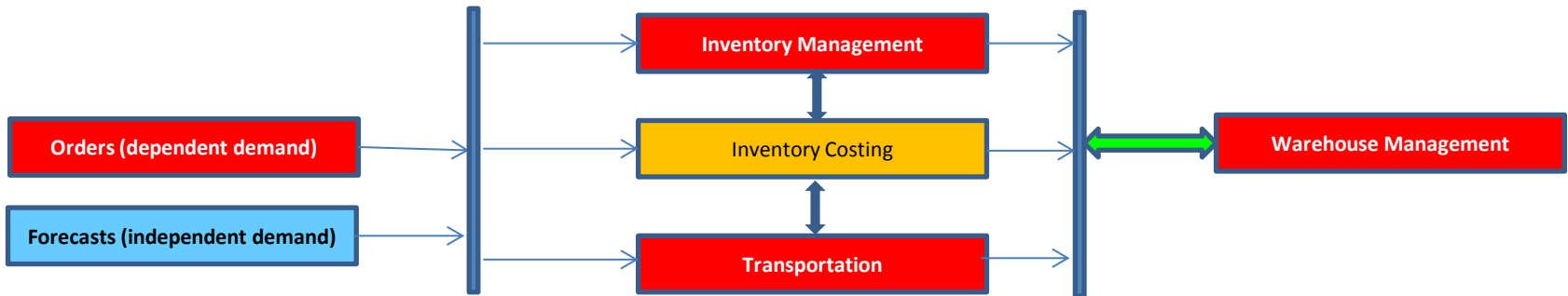
Warning: This computer program is protected by copyright law and international treaties.

Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.

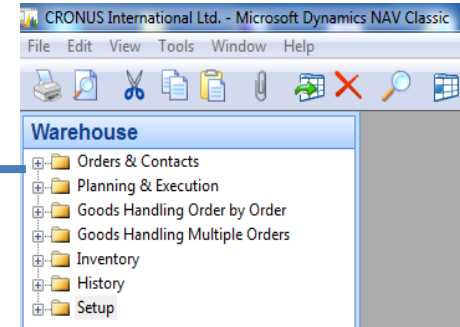
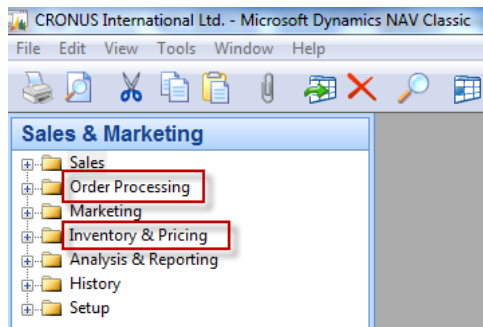
Purchase

- Planning
 - Items
 - Vendors
 - Requisition Worksheets
 - Recurring Req. Worksheet
 - Order Planning
 - Production Forecasts
 - Purchase Orders
 - Sales Orders
 - Blanket Sales Orders
 - Planned Production Orders
 - Firm Planned Prod. Orders
 - Transfer Orders
- Reports
- Documents
- Setup
- Order Processing
- Inventory & Costing
- Analysis & Reporting
- History
- Setup

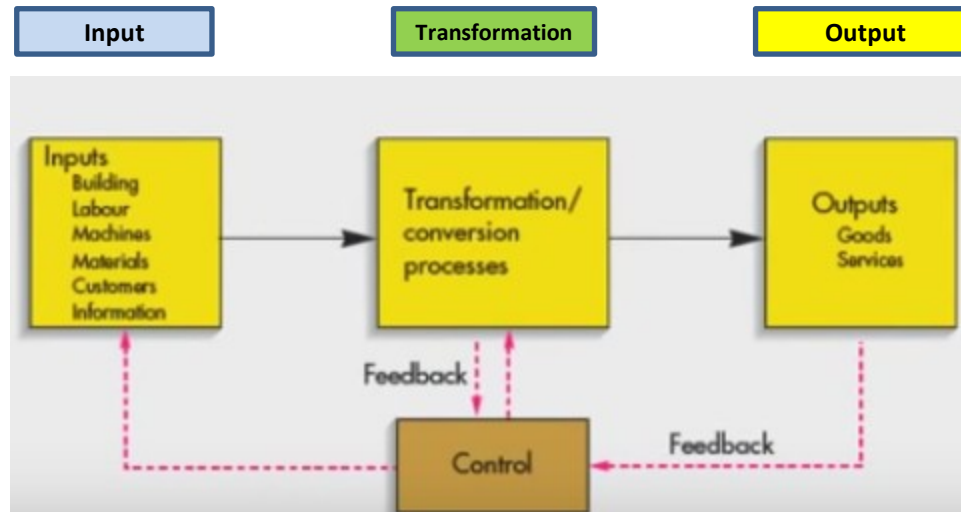
Function block Logistic-simplified



Will be part of our course regarding ERP system MS Dynamics NAV



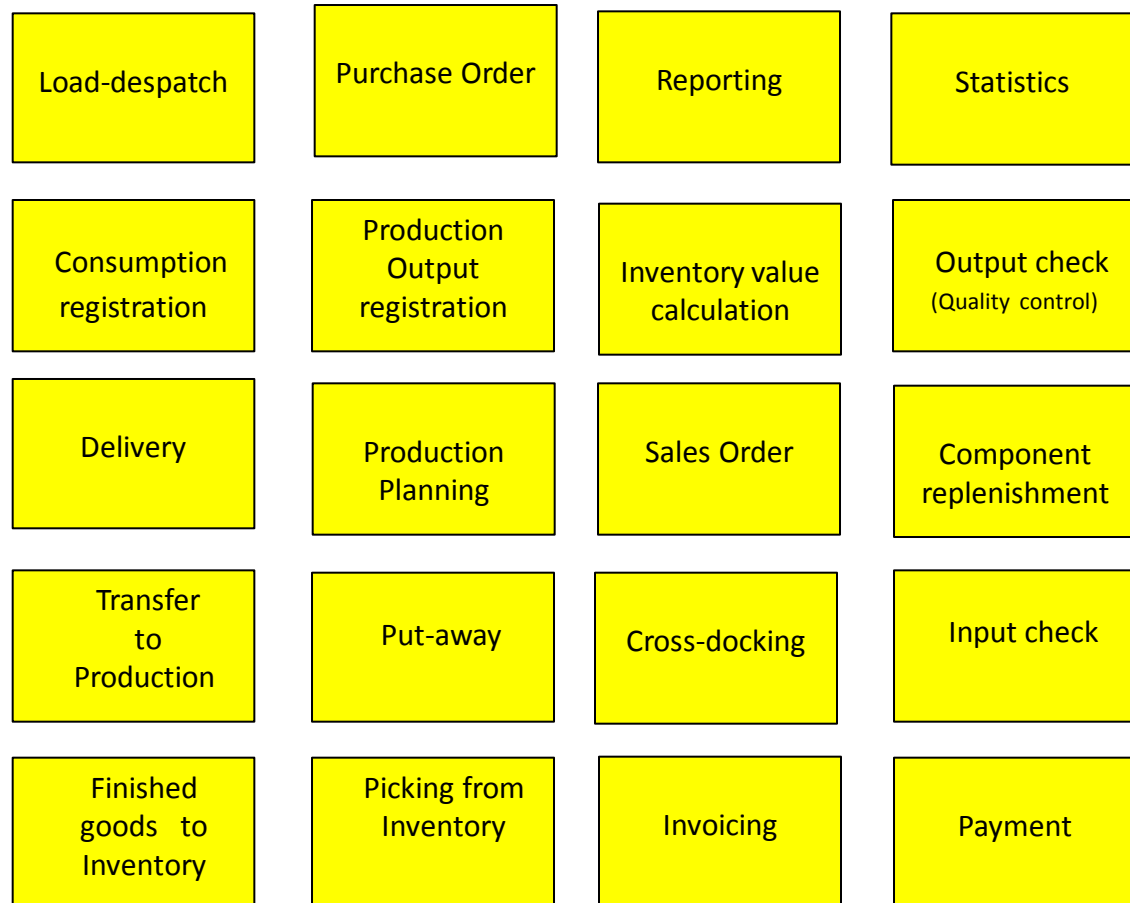
Procedures-simplified



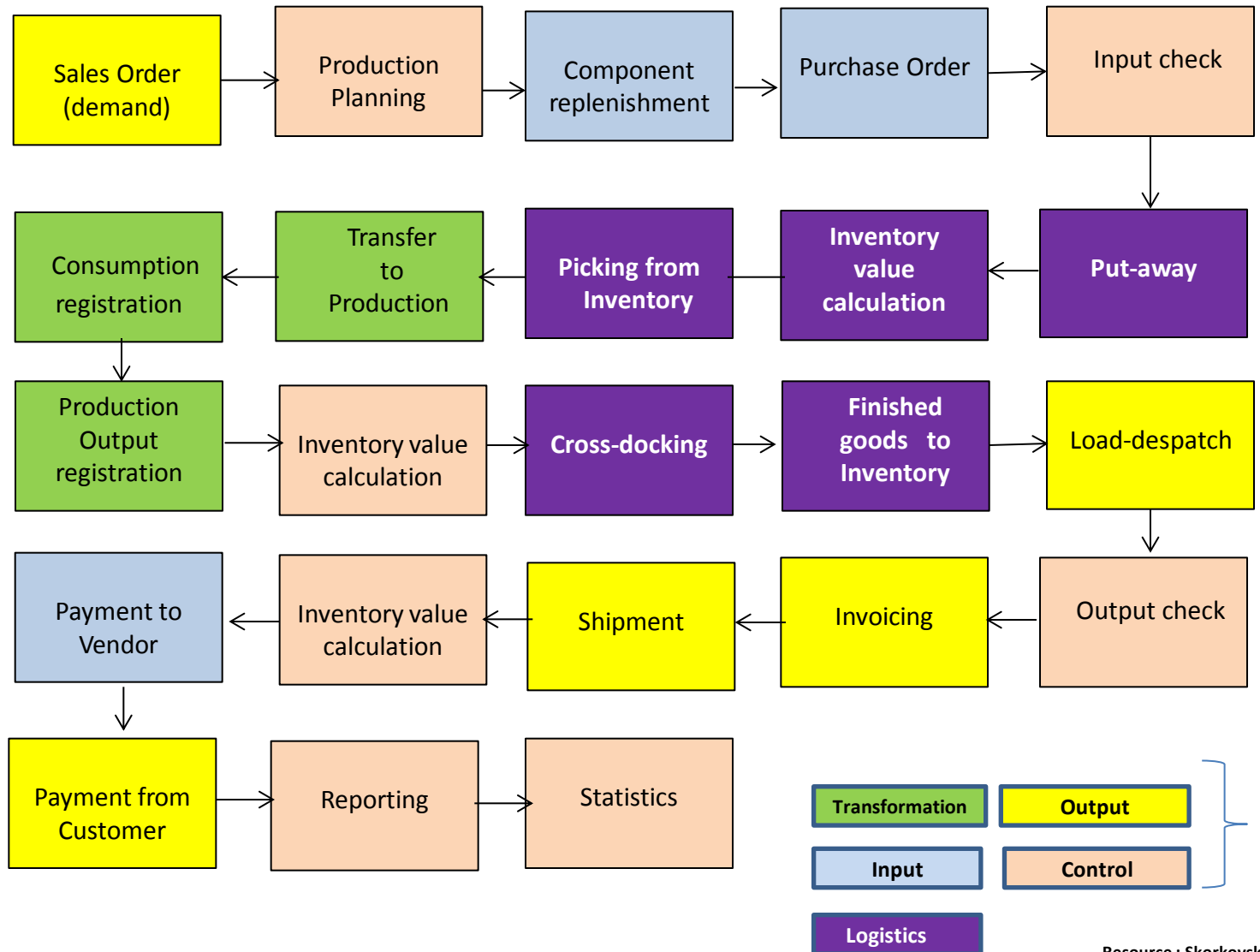
} Color agenda used later

Processing

(not organised set of processes, will be presented also as a introduction to project management PWP presentation later)

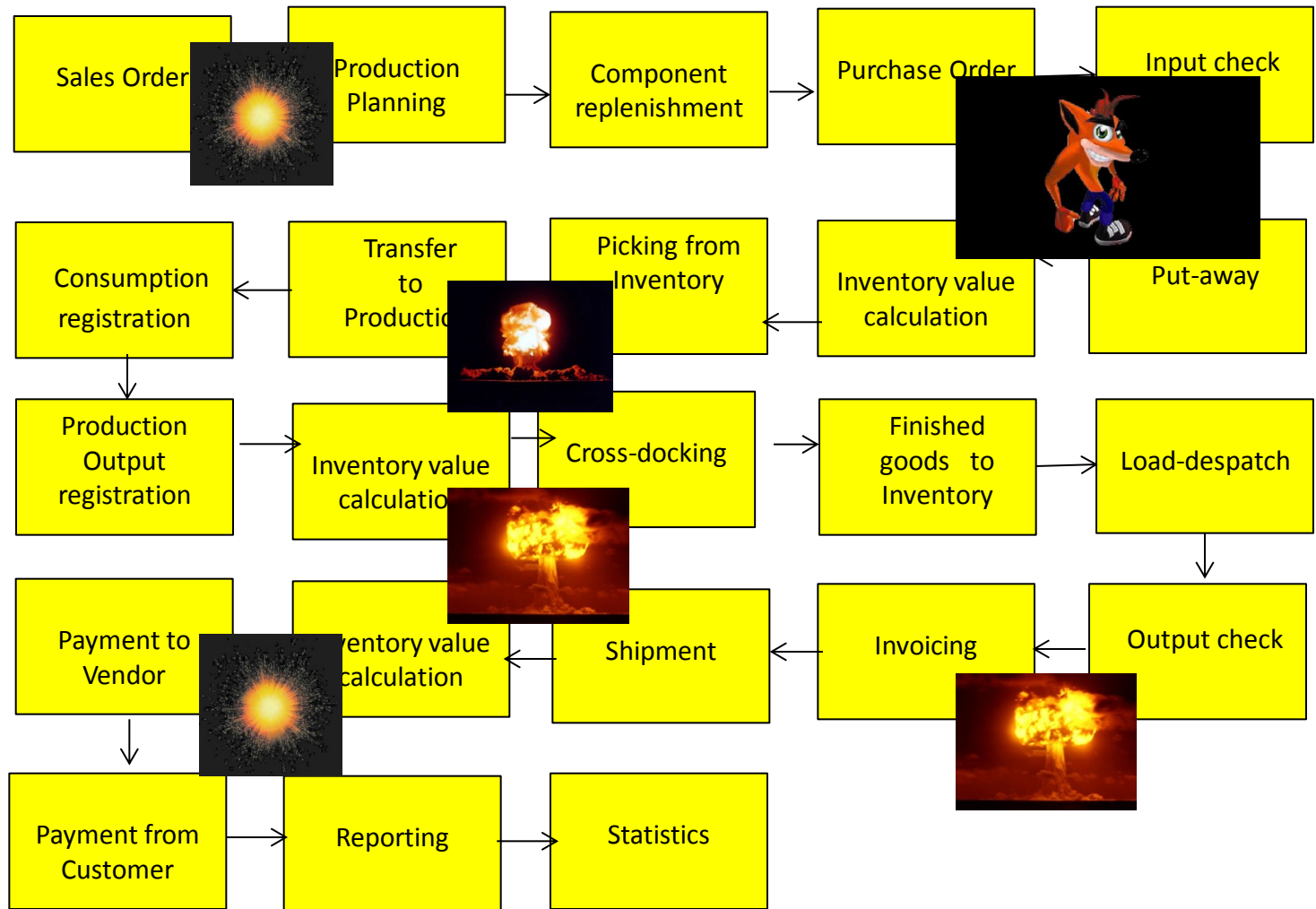


Your main task (to organize processes based on business logic)



Agenda

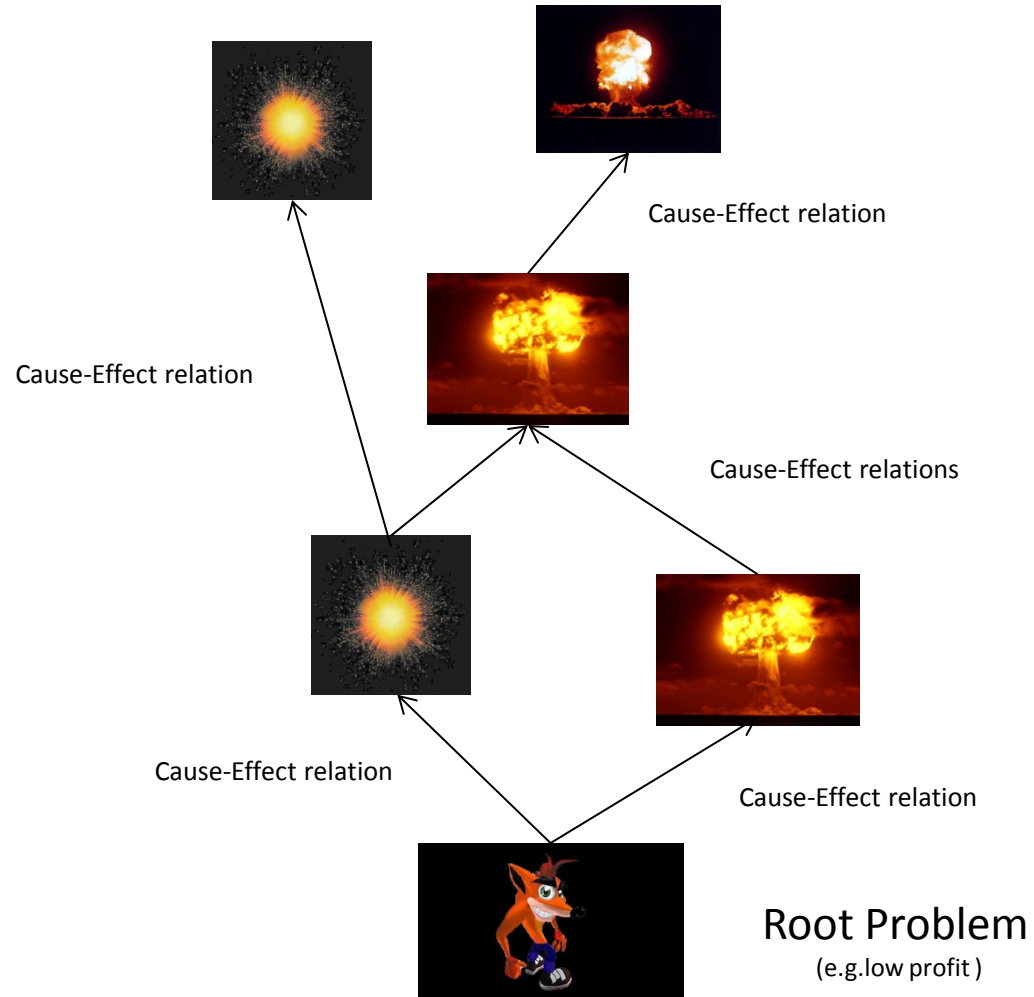
Your main task (possible problems, bottlenecks, undesirable effects..)



Application of TOC ->thinking tools->Current Reality Tree – first stage

Your main task

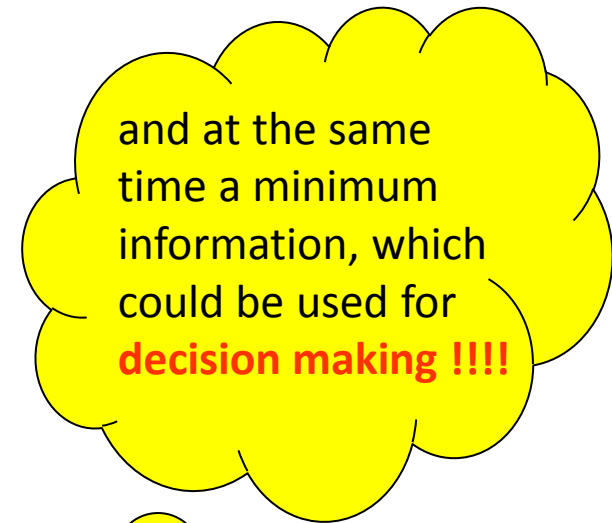
(Search - **HOW** ??? Measure impacts -**HOW** ??? and Destroy - **HOW** ???)



Basic problem I. (one of many)

We cannot solve our problems with the same level of thinking that created them !

Statement by Albert Einstein)

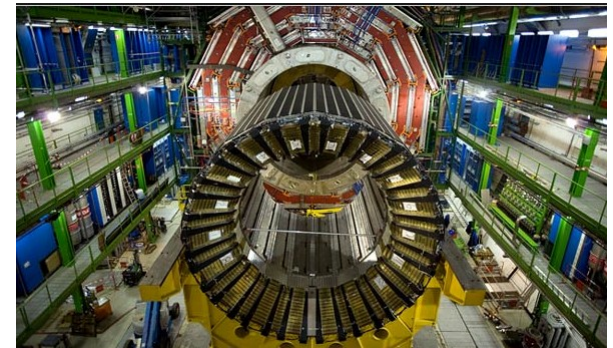


Moore's law is the observation that the number of transistors in a dense integrated circuits doubles approximately every two years – so -> capacity of memory is going up

Big data and analysis problem

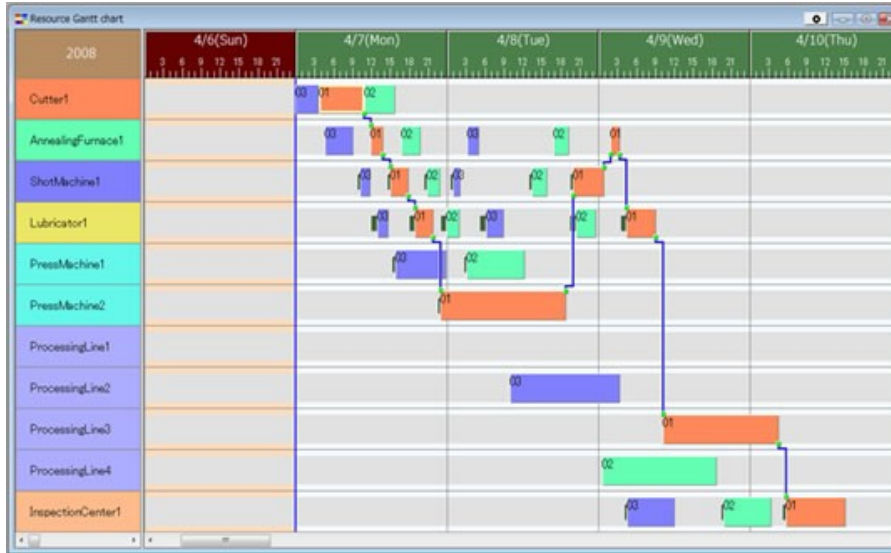
In test and measurement applications, engineers and scientists can collect vast amounts of data every second of every day.

- For **every second** that the Large Hadron Collider at CERN runs an experiment, the instrument can generate 40 terabytes of data.
- For **every 30 minutes** that a Boeing jet engine runs, the system creates 10 terabytes of operations information.
- For a single journey across the Atlantic Ocean, a four-engine jumbo jet can create 640 terabytes of data.
- Multiply that by the more than 25,000 flights flown each day, and you get an understanding of the enormous amount of data that exists (Rogers, 2011). **That's "Big Data."**



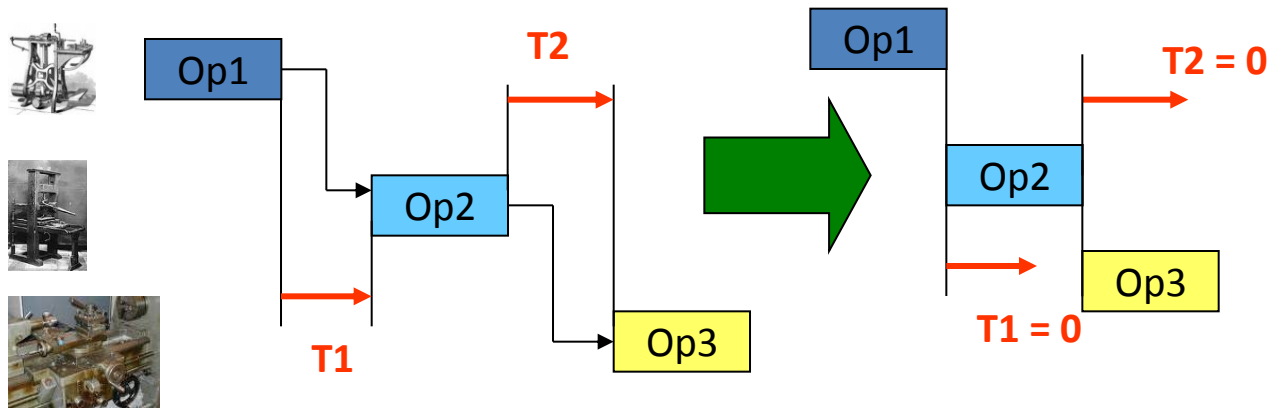
* Basic problem II. (we need reliable data)

To solve it we should use finite capacity scheduling (APS)- will be presented later

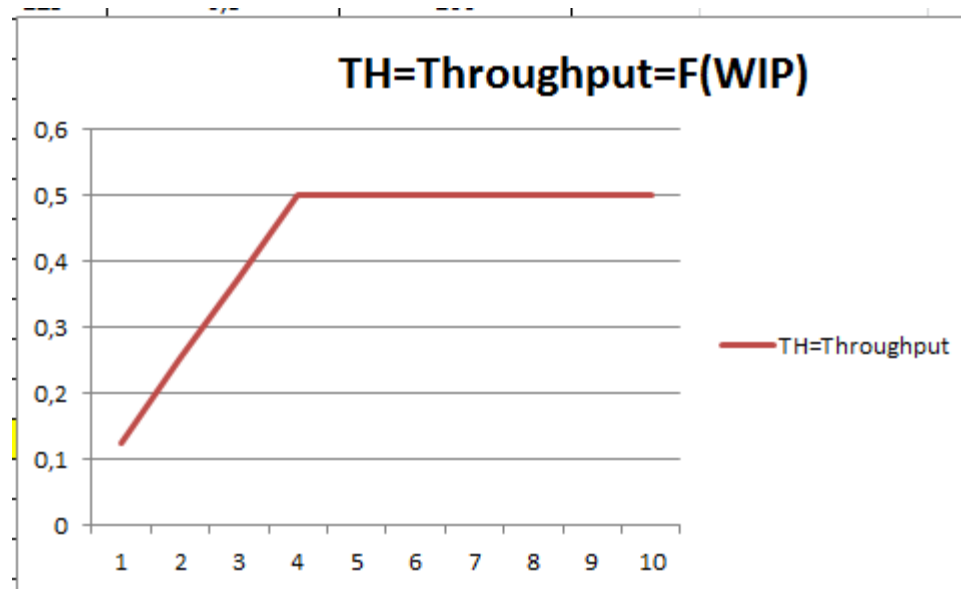


$$T1+T2=X$$

$$Opt=Min(X)$$



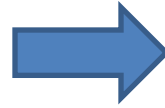
Basic problem III.



Will be explained in **Little's law** presentation

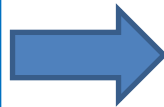
Basic problem (setup times) IV.

Black



White

White

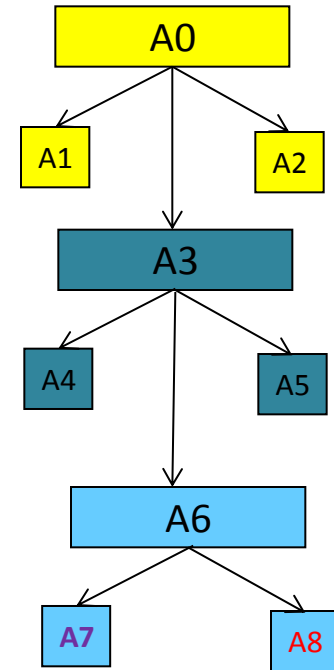
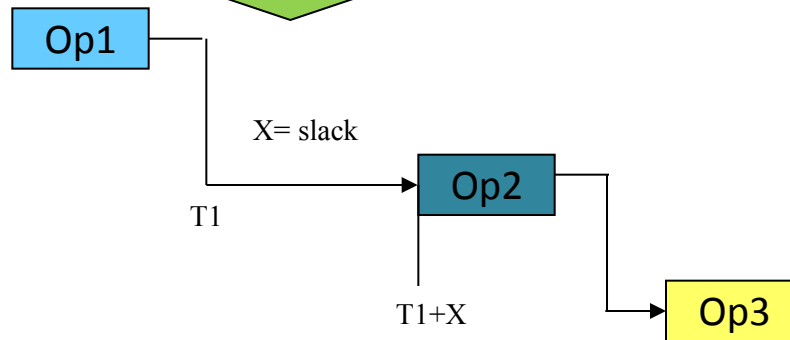
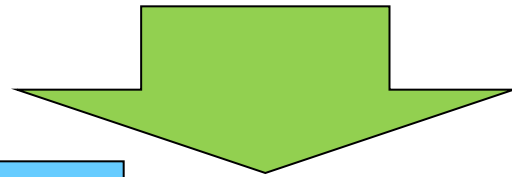
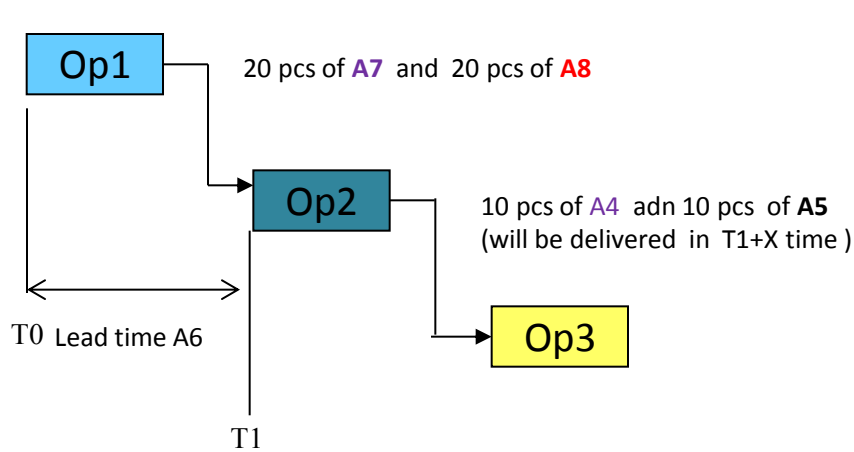


Black

(Black ->White, Setup time=60 minut)

(White->Black, Setup time = 20 minut)

Basic problem V-I. (availability of components, home study !!)



Basic problem VI-I. (over budget)

2012 - Budget

General Filters Options

Budget Name 2012 ↑

Show as Lines G/L Account ↑

Show as Columns Period ↑

Code	Name	Budgeted Amount	26.03.12	02.04.12
8100	Building Maintenance Expenses			
▶ 8110	Cleaning	1 160,00	1 000,00	
8120	Electricity and Heating	1 120,00	1 000,00	
8130	Repairs and Maintenance	1 160,00	1 000,00	
8190	Total Bldg. Maint. Expenses	3 440,00	3 000,00	
8200	Administrative Expenses			
8210	Office Supplies	510,00	500,00	
8230	Phone and Fax	800,00	800,00	
8240	Postage	1 390,00	1 200,00	
8290	Total Administrative Expenses	2 700,00	2 500,00	
8300	Computer Expenses			
8310	Software	1 000,00	1 000,00	

1 7 31 3 12 ⋮ ⏪ ⏩ Balance Functions Help



Basic problem VI-II.

(over budget)

1015 London Postmaster - Purchase Invoice

General Invoicing Shipping Foreign Trade E-Commerce

No. 1015

Posting Date 26.03.12

Buy-from Vendor No. 10000

Document Date 26.03.12

Buy-from Contact No. CT000066

Vendor Invoice No. Miki-0983

Buy-from Vendor Name London Postmaster

Order Address Code.

Buy-from Address 10 North Lake Avenue

Purchaser Code RL

Buy-from Address 2

Campaign No.

Buy-from Post Code/City N12 5XY London

Responsibility Center LONDON

Buy-from Contact Mrs. Carol Philips

Assigned User ID

Status Open

Type	No.	Description	Location Code	Quantity	Unit of Measure ...	Direct Unit Cost Excl...	Line Amount Excl. VAT	Line Qty. to Assign
G/L Ac...	8110	Cleaning		10	HOUR	100,00	1 000,00	
G/L Ac...	8120	Electricity and Heating		20	HOUR	200,00	4 000,00	
G/L Ac...	8130	Repairs and Maintenance		30	HOUR	300,00	9 000,00	
G/L Ac...	8210	Office Supplies		10	HOUR	100,00	1 000,00	
G/L Ac...	8230	Phone and Fax		20	HOUR	200,00	4 000,00	
▶ G/L Ac...	8240	Postage		30	HOUR	300,00	9 000,00	

Invoice Line Functions Posting Help



Basic problem VI-III.

(over budget)

G/L Balance/Budget

Options

Date Filter 01.03.12..31.03.12 Budget Filter 2012

Department Filter Closing Entries Include

Project Filter

No.	Name	I... Debit Amount	Credit Amount	Balance/Budget (%)	Budgeted Debit Amount	Budge... Credit Amount	Budgeted Amount
8100	Building Maintenance Expenses	L...					
▶ 8110	Cleaning	I... 1 000,00		100,0	1 000,00		1 000,00
8120	Electricity and Heating	I... 4 000,00		400,0	1 000,00		1 000,00
8130	Repairs and Maintenance	I... 9 000,00		900,0	1 000,00		1 000,00
8190	Total Bldg. Maint. Expenses	L... 14 000,00		466,7	3 000,00		3 000,00
8200	Administrative Expenses	L...					
8210	Office Supplies	I... 1 000,00		200,0	500,00		500,00
8230	Phone and Fax	I... 4 000,00		500,0	800,00		800,00
8240	Postage	I... 9 000,00		750,0	1 200,00		1 200,00
8290	Total Administrative Expenses	L... 14 000,00		560,0	2 500,00		2 500,00
8300	Computer Expenses	L...					
8310	Software	I...			1 000,00		1 000,00

1 7 31 3 12 Account Functions Help

Tuition –plan-theory

- OM-intro – done (this slide show)
- Real project-South African client (wholesale)
- Theory of constraints
- Critical chain and project management
- Quality management I. (Pareto+ Ishikawa)
- Quality management II. (Six Sigma, Kaizen, Poka Yoke)
- Business metrics (use of matrices – Boston, Gartner MQ)
- Balanced Score Card
- DBR , CONWIP (Constant Work In Progress)
- Decision making (Kepner-Tregoe methodology,..)
- P&Q analysis (mix of products)
- Business Intelligence – intro and concept
- Little's law
- Yield management – intro to concept
- Linear programming – concept and use
- Business Intelligence
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Tuition –plan-ERP used in OM

- ERP basics (principles) and ERP handling and installation
- Purchase – basic parameters and impacts of parameter setting (Stock, General Ledger)
- Sale - basic parameters and impacts of parameter setting (Stock, General Ledger, Discounts)
- Inventory – basics
- Transfers of items
- Banking operations (posting and payments)
- Customer Relationship Management
- Basic tools used for analysis of created transactions