Operation Management (OM) Introduction

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Coordinates – <small>již bylo prezentováno</small>

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- **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 (pouze MKH-RIOP)** : will assigned after some theory will be presented. Accepted seminar work is the second condition to be admitted to exam)
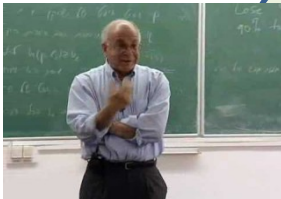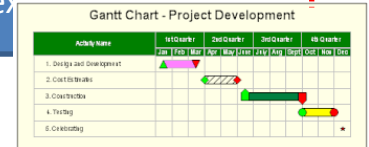- **Tuition plan :** at the **end** of this slide show

What is going on ?
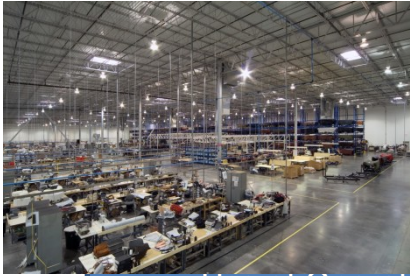
Use of Operations Management (OM) in external environment **(main target)**

⟷

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

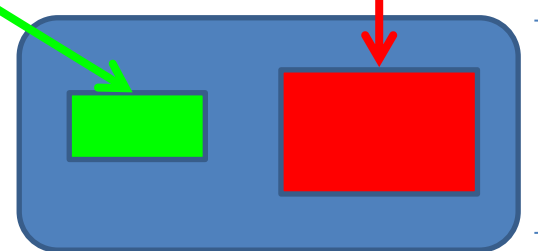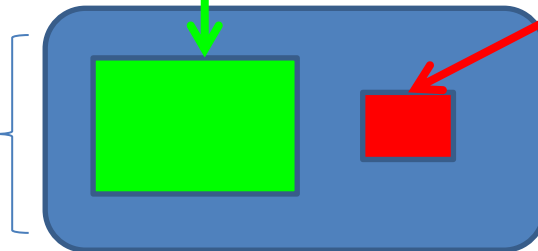Knowledge of methods and experience from research and the literature - **teachers**

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)

Some tools (ERP)

Some basic processes controlled by ERP –I.

80103-T 19" M009 Monitor - Items by Location

Options

Show Items in Transit . . ☐
Show Column Name . . . ☐

No.	Description	BLUE	GREEN	RED	SILVER	WHITE	YELLOW
1908-S	LONDON Swivel Chair, blue	237	57	14	0	0	0
1920-S	ANTWERP Conference Table	31	65	10	0	7	0
1924-W	CHAMONIX Base Storage Unit	1	8	2	0	0	15
1928-S	AMSTERDAM Lamp	149	-19	55	0	0	97
1928-W	ST.MORITZ Storage Unit/Drawers	4	23	-1	0	0	41
1936-S	BERLIN Guest Chair, yellow	46	46	50	0	0	0
1952-W	OSLO Storage Unit/Shelf	9	-1	7	0	0	0
1960-S	ROME Guest Chair, green	145	0	24	0	0	0
1964-S	TOKYO Guest Chair, blue	58	60	29	0	0	0
1964-W	INNSBRUCK Storage Unit/G.Door	14	27	-2	0	0	8
1968-S	MEXICO Swivel Chair, black	233	14	17	0	0	0
1968-W	GRENOBLE Whiteboard, red	10	4	4	0	0	10
1972-S	MUNICH Swivel Chair, yellow	35	-1	-4	0	0	90
1972-W	SAPPORO Whiteboard, black	3	2	5	0	0	0
1976-W	INNSBRUCK Storage Unit/W.Door	3	-2	-3	0	0	3
1980-S	MOSCOW Swivel Chair, red	53	14	21	0	0	0
1984-W	SARAJEVO Whiteboard, blue	3	3	4	0	0	0
1988-S	SEOUL Guest Chair, red	41	83	0	0	0	43
1988-W	CALGARY Whiteboard, yellow	0	8	5	0	0	13
1992-W	ALBERTVILLE Whiteboard, green	6	5	-1	0	0	0
1996-S	ATLANTA Whiteboard, base	44	-1	22	0	0	116
2000-S	SYDNEY Swivel Chair, green	134	17	12	0	0	0
766BC-A	CONTOSO Conference System	0	0	0	0	0	0
766BC-B	CONTOSO Office System	3	0	1	0	0	1
766BC-C	CONTOSO Storage System	2	-1	1	0	0	0
80102-T	17" M780 Monitor	5	0	0	0	0	0
▶ 80103-T	19" M009 Monitor	0	0	0	0	0	0

Item ▼   Help

Used abbreviations: **EOQ** – Economic Order Quantity; **ROP** – Reorder Point; **MRP** –Material Requirement Planning; **COGS** – Cost of Good Sold

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
	Contibution 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

Used abbreviations: BS–Balanced Sheet ->Rozvaha

Some basic processes controlled by ERP –III.

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	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

BOM=Bill Of Material->Kusovník

Used abbreviations: **MRP-II –** Manufacturing Resource Planning = MRP+Resource Planning ; **JIT** – Just In Time; **DBR**-Drum-Buffer-Rope; **QM**-Quality Management

Some basic processes controlled by ERP –IV.

Used abbreviations: **CRM –** Customer Relationship Management

Some basic processes controlled by ERP –V.

Controlling processes in Supply Chain Management (SCM)

	Supply	Production	Orders (Demands)	
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	

Planning levels

Information flow

Reverse product flow

Supplier — Producer — Customer

Primary product flow

Primary product flow

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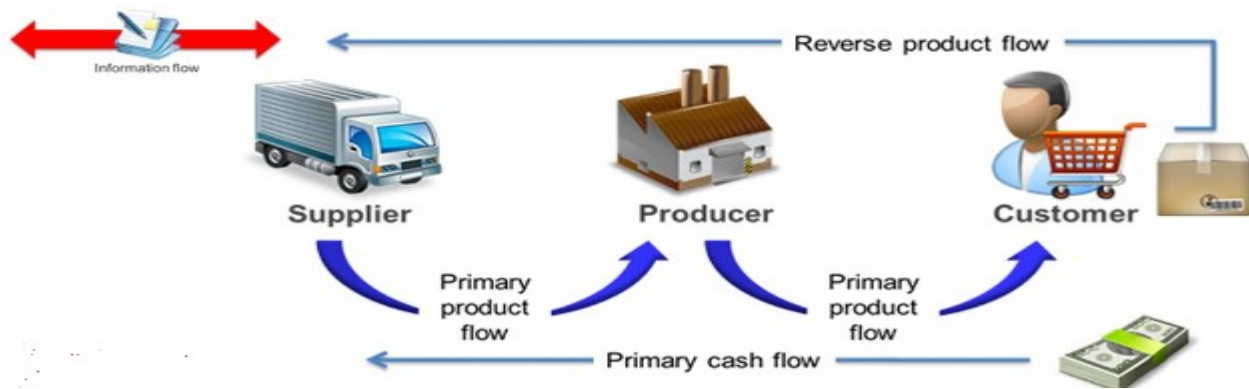
Used abbreviations : **R&D** –Research and Development; **TQM**-Total Quality Management; **JIT**- Just –In-Time; **MRP_II**-Manufacturing and Resource Planning

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

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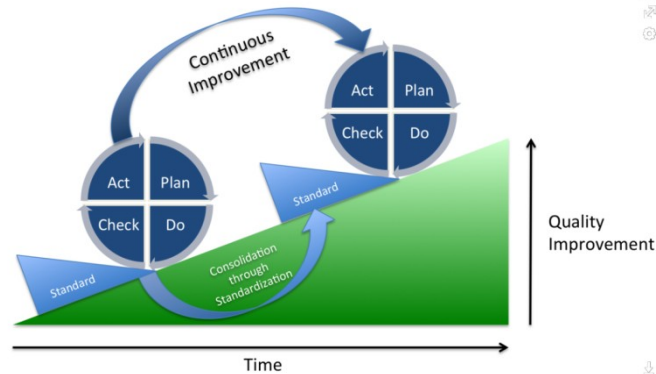
Plan*:* Define the problem to be addressed, collect relevant data, and ascertain the **problem's root cause** (**e.g. by use of TOC=Theory of Constraints**)

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.

Used abbreviations   : **TOC** – Theory of Constraints

Simple example of Deming cycle (home study)

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 later)

Do: Implement algorithm controlling stock replenishment based on MRP principle and ROP and **Safety Stock** level setup. Metrix for effectiveness will be I**nventory Dollar Days (IDD)** - which is one of TOC metrics (will be mentioned during the course)

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);

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

1litr 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€= 3*0,15 €
H=(4/365)x 1.5≈0.0055 -> H≈0.0055 . So p=98,5%

Resource: https://www.lokad.com/service-level-definition-and-formula
Lead time = Průběžný čas (bude mnohokrát v kurzu použito)

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

1952-W OSLO Storage Unit/Shelf - Item Card

| General | Invoicing | Replenishment | Planning | Foreign Trade | Item Tracking | E-Commerce | Warehouse |

Reordering Policy	Fixed Reorde... ▼		Reorder Cycle.	
Include Inventory . . .	✓		Safety Lead Time	
Reserve	Optional ▼		Safety Stock Quantity . .	10
Order Tracking Policy . .	None ▼		Reorder Point.	30
Stockkeeping Unit Exists .	☐		Reorder Quantity	20
Critical	☐		Maximum Inventory . . .	0
			Minimum Order Quantity .	5
			Maximum Order Quantity .	0
			Order Multiple.	0

| Item ▼ | Sales ▼ | Purchases ▼ | Functions ▼ | Help |

Used abbreviations : **EOQ** – Economic Order Quantity – will be explained during this course in ERP section

Another point of view I.

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

Project management	Theory of constraints		Production	Linear programming	Total quality management	Product postitioning	Business Intelligence

Workflow	Critical chain	Drum –Buffer-Rope	MRP-MRP-II,JIT,APS	Cutting, blending	Pareto, ishikawa	Boston Matrix	Gartner QM	Decision Making

| SCRUM | CONWIP | Logistics | Pareto, Ishikawa | Product Life Cycle | Kepner-Tregoe |

| EOQ | Six Sigma | Yield management | Hurwitz |

| ABC | | | Prospect Theory |

| LEAN |

| Little´s law |

Function block Logistic more in detail will be presented later in this show

Used abbreviations : QM– Quadrant Matrix; **CONWIP –** Constant Work in Progress; **EOQ** – Economic Order Quantity ; **MRP -** Material Requirement Planning

Operations

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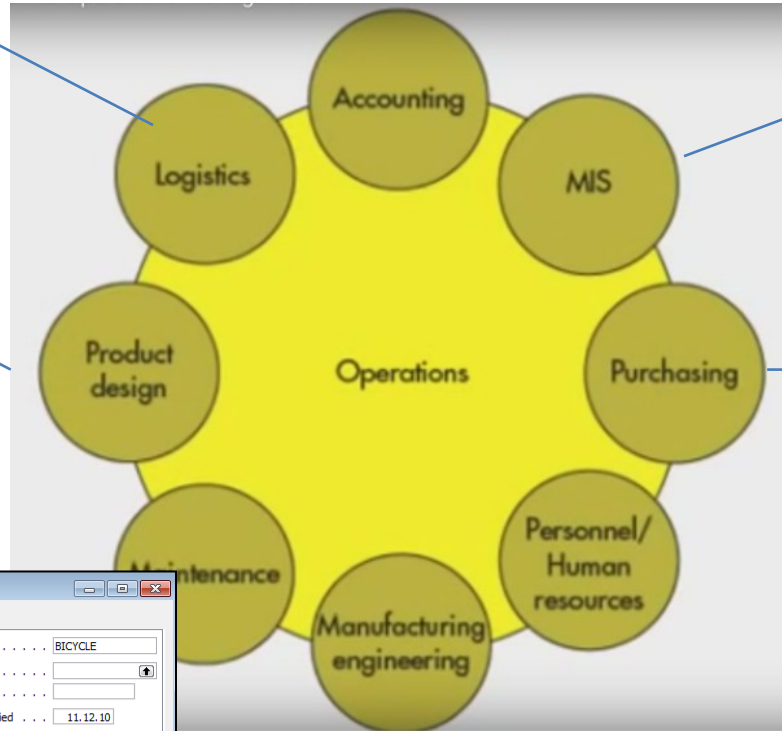
Manufacturing
- Product Design
  - Items
  - Production BOM
  - Routings
  - Families
  - Exchange Production BOM Item
  - Delete Expired Components
  - Calculate Low-Level Code
  - Reports
- Capacities
- Planning
- Execution
- Costing

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

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	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

Bill of material

Function block Logistic-simplified
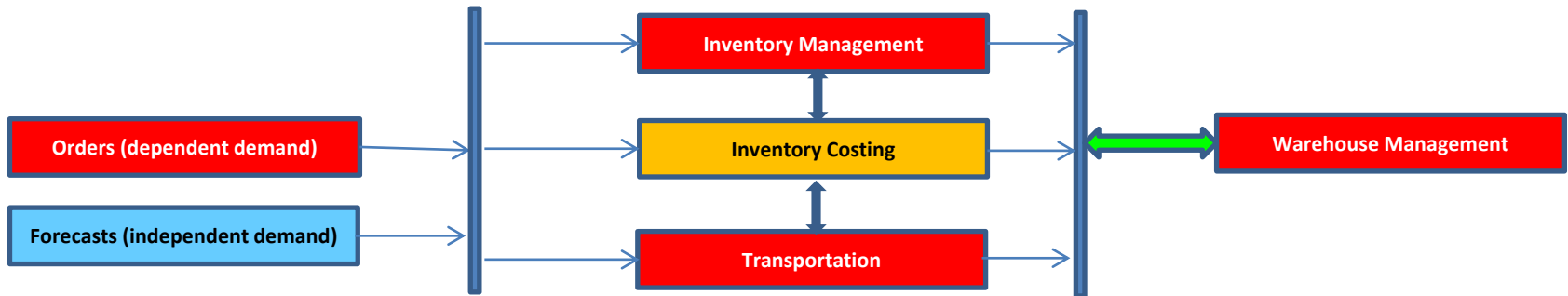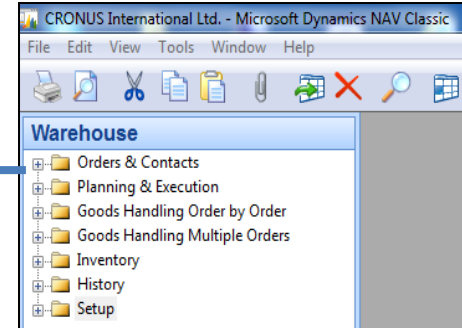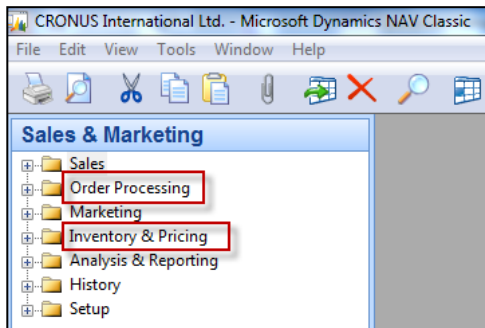
Procedures-simplified (feedback)

Input

Transformation

Output

Color agenda used later

Inputs
Building
Labour
Machines
Materials
Customers
Information

Transformation/
conversion
processes

Outputs
Goods
Services

Feedback

Control

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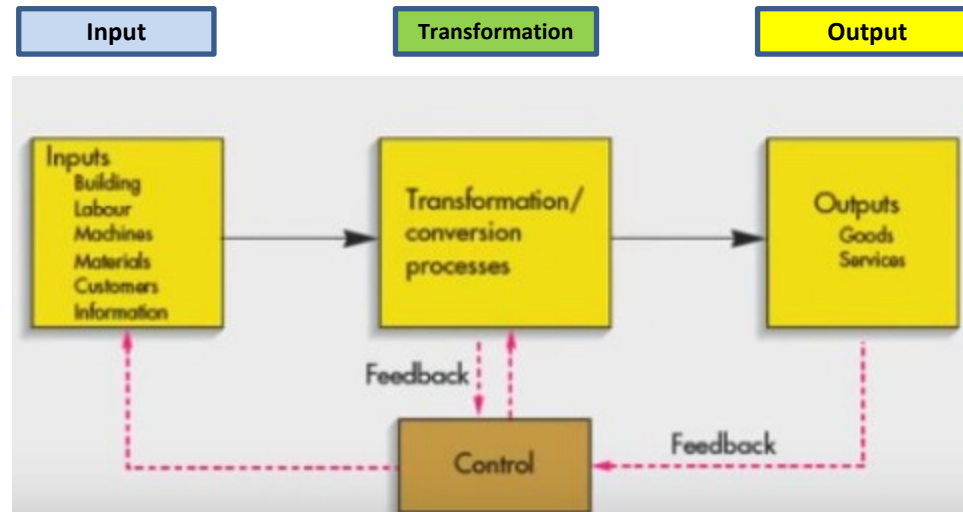
Processing (not organised set of processes, will be presented also as a introduction to project management PWP presentation later)

Load-despatch	Purchase Order	Reporting	Statistics
Consumption registration	Production Output registration	Inventory value calculation	Output check (Quality control)
Delivery	Production Planning	Sales Order	Component replenishment
Transfer to Production	Put-away	Cross-docking	Input check
Finished goods to Inventory	Picking from Inventory	Invoicing	Payment

Your main task (to organize processes based on business logic)
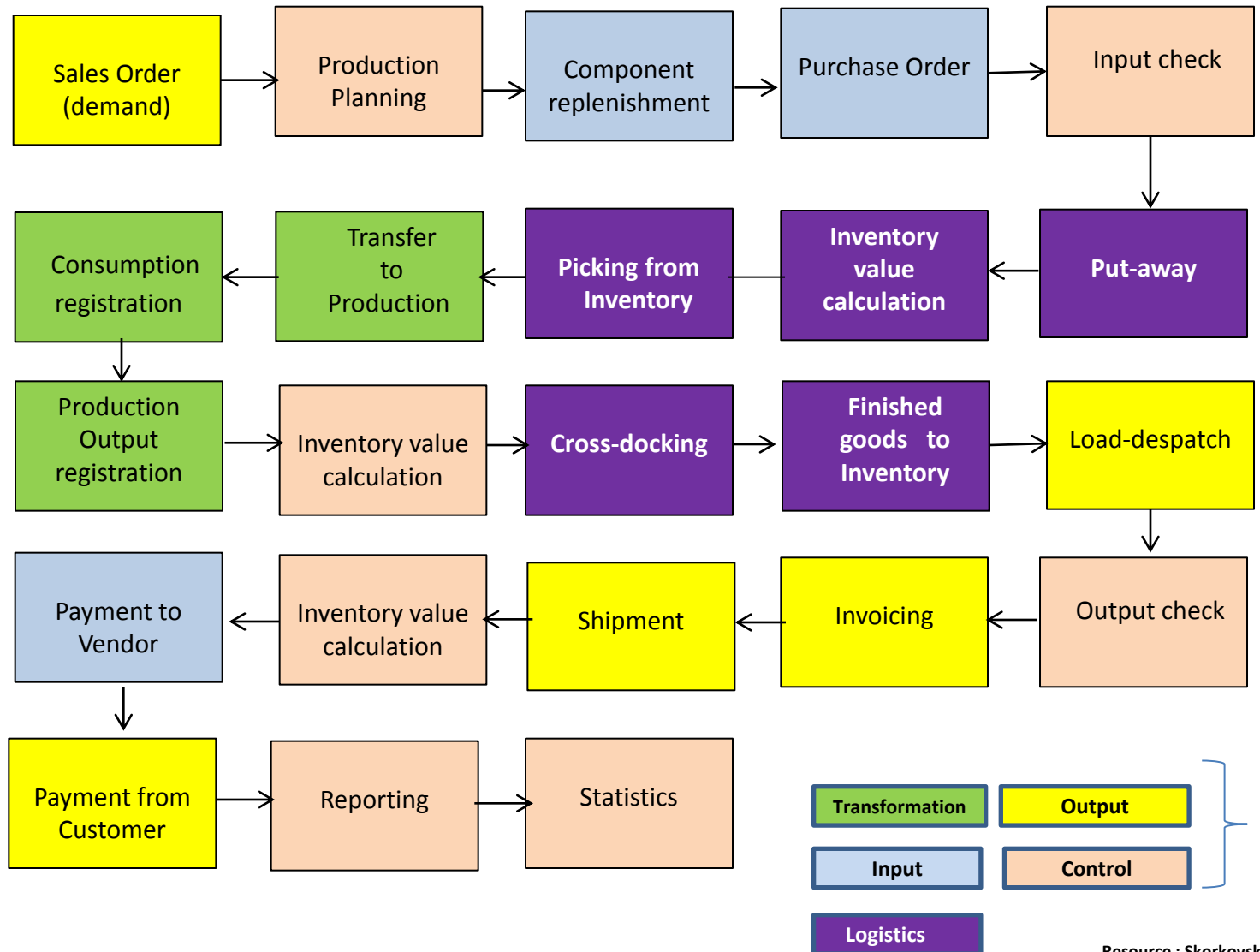
Your main task (possible problems, bottlenecks, undesirable effects..)
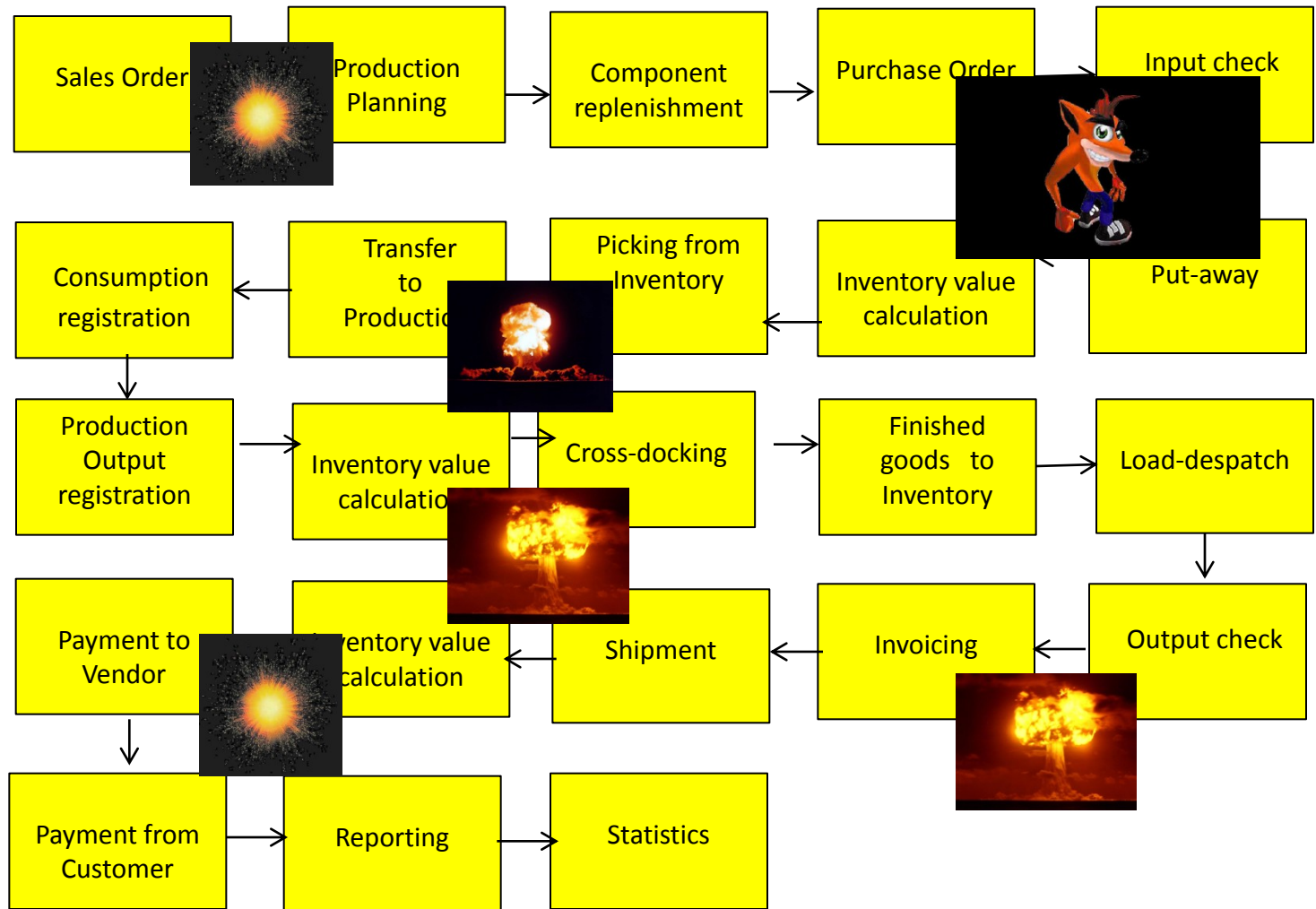
Application of TOC ->thinking tools->Current Reality Tree – first stage

Your main task

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

Cause-Effect relation

Cause-Effect relation

Cause-Effect relations

Cause-Effect relation

Cause-Effect relation

Root Problem
(e.g.low profit or lack of component)
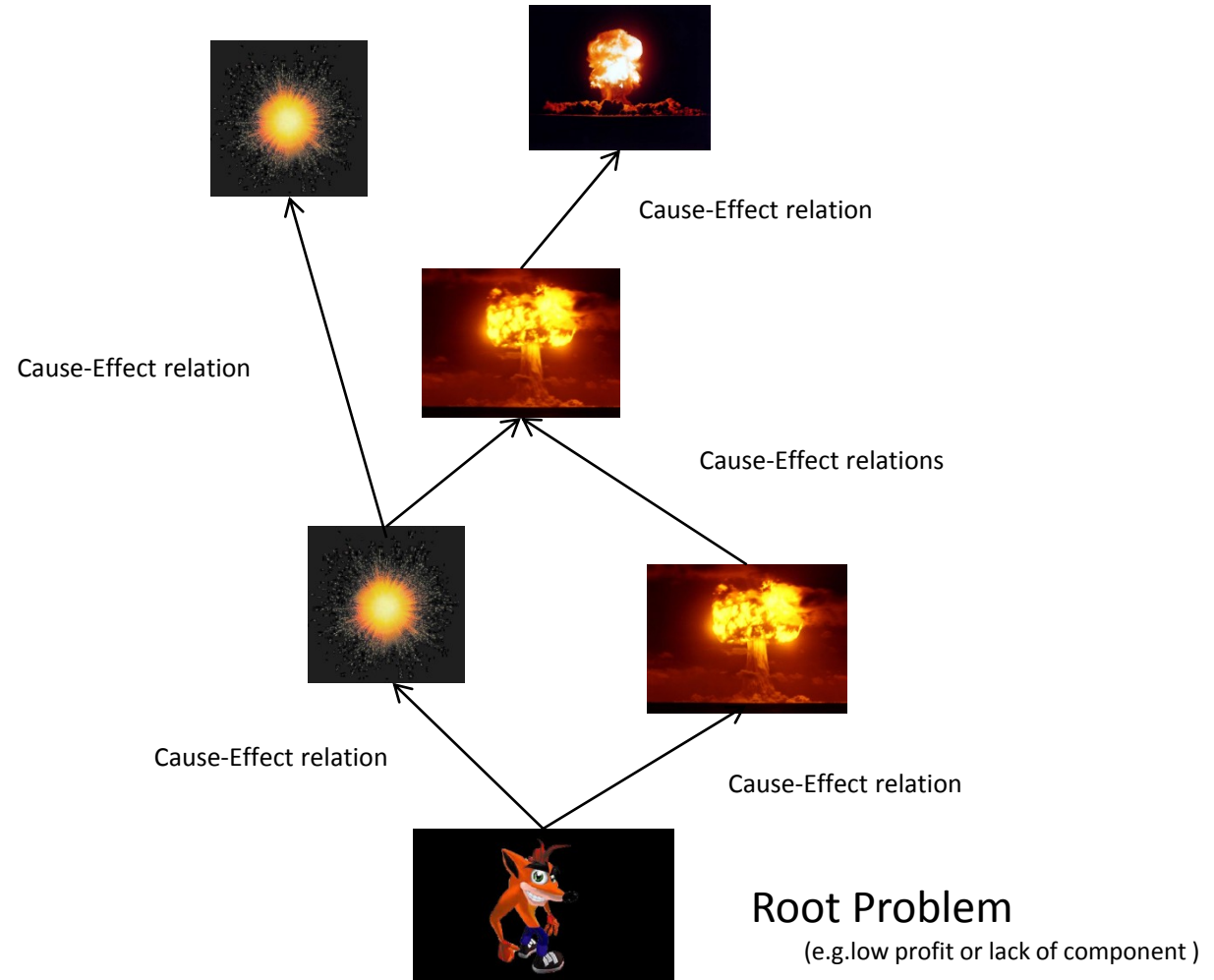
Basic problem I. (availability of components solved by product PlannerOne application)

APS result ->18.8.->23.8. a 27.8.->10.9

Basic problem II-I. (over budget or **under budget in our case**)

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	

*Basic problem II-II. (over budget) – nákup služeb

1015 London Postmaster - Purchase Invoice

General | Invoicing | Shipping | Foreign Trade | E-Commerce

No. 1015
Buy-from Vendor No. . . 10000
Buy-from Contact No. . . CT000066
Buy-from Vendor Name . . London Postmaster
Buy-from Address . . . . 10 North Lake Avenue
Buy-from Address 2 . . .
Buy-from Post Code/City N12 5XY   London
Buy-from Contact . . . . Mrs. Carol Philips

Posting Date 26.03.12
Document Date 26.03.12
Vendor Invoice No. . . . Miki-0983
Order Address Code. . .
Purchaser Code . . . . . RL
Campaign No. . . . . . .
Responsibility Center . . LONDON
Assigned User ID . . . .
Status . . . . Open

Type	No.	Description	Location Code	Quantity	Unit of Measure ...	Direct Unit Cost Excl...	Line Amount Excl. VAT	Line Disco...	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 II-III. (over budget)

No.	Name	I...	Debit Amount	Credit Amount	Balance/Budget (%)	Budgeted Debit Amount	Budge... Credit Amount	Budgeted Amount
8100	**Building Maintenance Expenses**	I...						
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**	I...	**14 000,00**		466,7	**3 000,00**		**3 000,00**
8200	**Administrative Expenses**	I...						
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**	I...	**14 000,00**		560,0	**2 500,00**		**2 500,00**
8300	**Computer Expenses**	I...						
8310	Software	I...				1 000,00		1 000,00

Purchases

Other problems. Examples, which could be solved are mentioned
in PWP Project activities (Činnosti spojené s projektem)

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
- 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
- Decision trees

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