Operation Management (OM) Introduction

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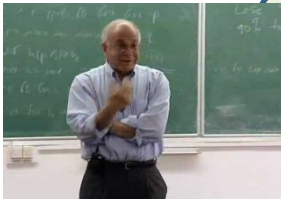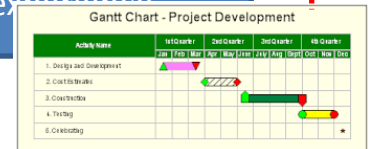- **Tuition plan :** at the **end** of this slide show

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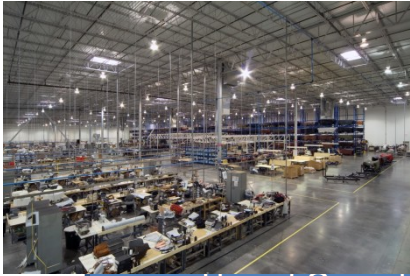
Use of Operations Management (OM) in external environment **(main target)**

⟷

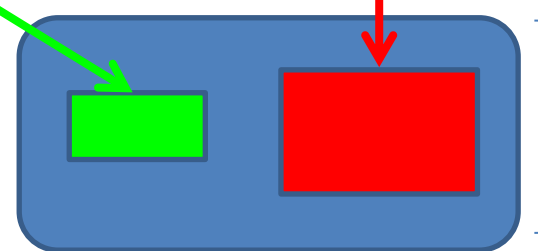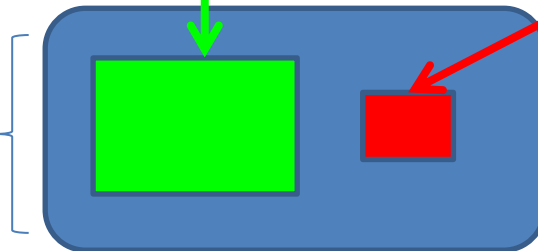General knowledge of OM methods acquired at university and long-standing experience

$$= \frac{\sum_{x_1} f_1(x_1) f_2(x_2}{\sum_{x_1} \sum_{x_3} f_1(x_1) f_2(} \\ \frac{\sum_{x_1} f_1(x_1) f_2(}{(x_1) f_2(x_2, x_1)}$$

Gantt Chart - Project Development

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)

Some tools

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

Some basic processes controlled by ERP –III.

Some basic processes controlled by ERP –IV.

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

Some basic processes controlled by ERP –V.

2009 Deerfield Graphics Company - Sales Order

Tabs: General | Invoicing | Shipping | Foreign Trade | E-Commerce | Prepayment

Field	Value
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.	0

Field	Value
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

Customer Information

- Sell-to Customer
  - Ship-to Addresses (0)
  - Contacts (1)
  - Sales History
- Bill-to Customer
  - Avail. Credit 0

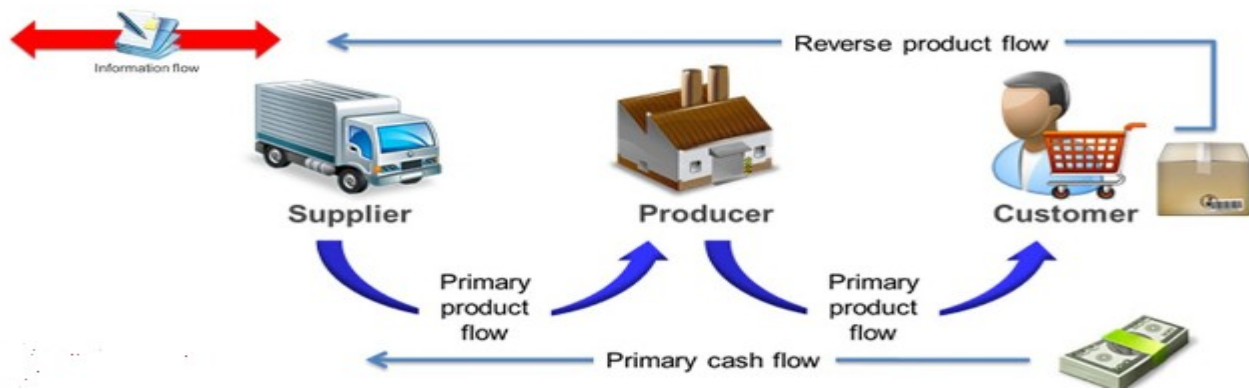| Type	No.	Description	Location Code	Quantity	Reserved Quantity	Unit of Measu...	S... P...	Unit Price Excl. VAT	Line Amount Excl. VAT	Line Disco...	Appl.-to Item Entry
Item	LS-10PC	Loudspeakers, White for PC	WHITE	12		BOX		59,00	708,00		
Item	LS-150	Loudspeaker, Cherry, 150W	WHITE	8		PCS		129,00	1 032,00		

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)

Planning levels		Supply	Production	Orders (Demands)	Demand Planning
	Strategic		Operation Strategies and Innovations , R&D		
	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	

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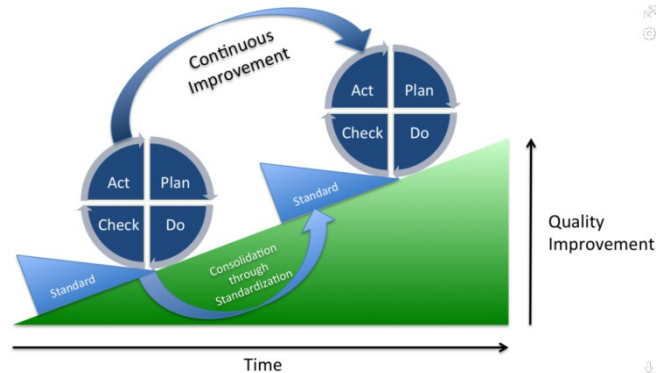
Plan*:* Define the problem to be addressed, collect relevant data, and ascertain the **problem's root cause** (e.g. by use of TOC=Theory of Constraints)

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)

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 (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); **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

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€.
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

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...

   Include Inventory . . . ✓

Reserve . . . . Optional

Order Tracking Policy . . None

Stockkeeping Unit Exists . ☐

Critical . . . . ☐

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

Item ▼   Sales ▼   Purchases ▼   Functions ▼   Help

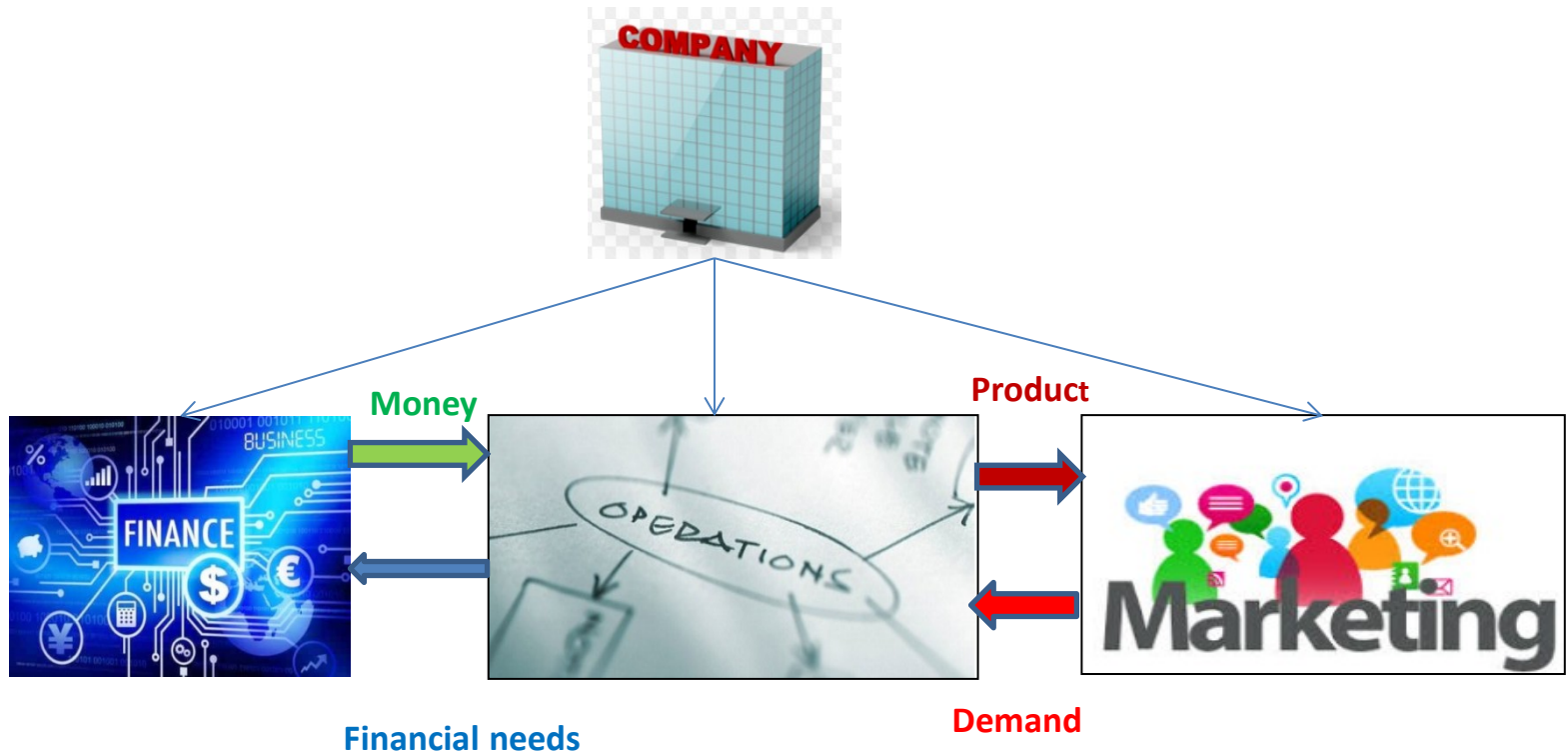**Used abbreviations** : **EOQ** – Economic Order Quantity – will be explained dúrin this course

Another point of view

This will be modified in following **South African** project show (example of Balanced Score Card use)
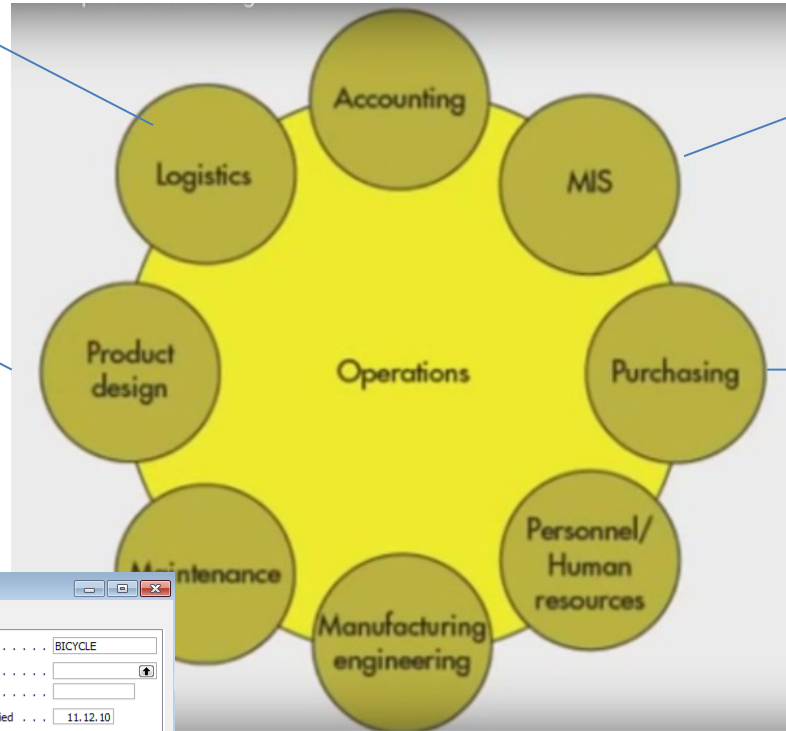
Project management	Theory of constraints	Production	Linear programming	Total quality management	Product postitioning	Business Intelligence
Workflow	Critical chain	Drum –Buffer-Rope	MRP-MRP-II,JIT,APS	Cutting, blending	Pareto, ishikawa	Boston Matrix / Gartner QM	Decision Making
SCRUM		CONWIP	Logistics		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

Another point of view

Operations

See next slide

Function block Logistic-simplified
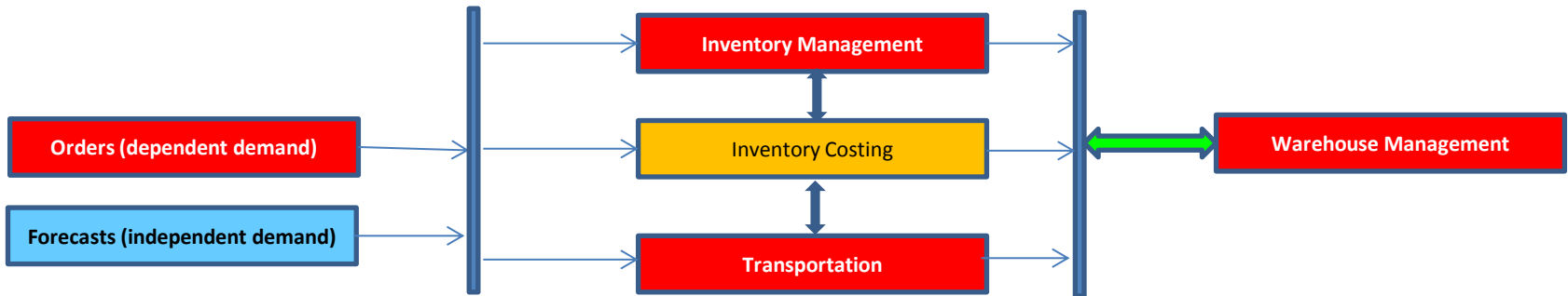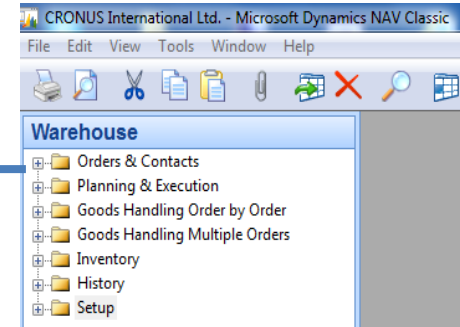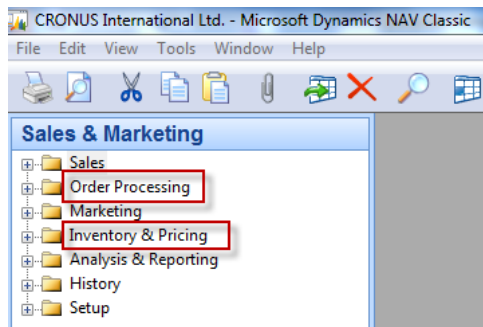
Procedures-simplified (feedback)

Color agenda used later

Input   Transformation   Output

Inputs
- Building
- Labour
- Machines
- Materials
- Customers
- Information

Transformation/conversion processes

Outputs
- Goods
- Services

Feedback

Control

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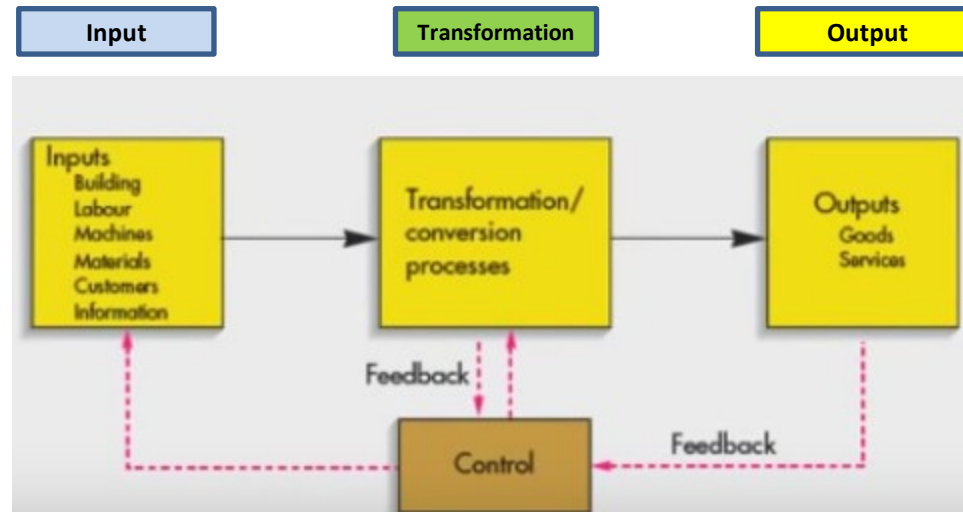
Processing (not organised set of processes, will be presented also as a introduction to project management PWP presentation later)

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

Resource : Skorkovský

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

```
Sales Order        Production        Component         Purchase Order      Input check
(demand)     →     Planning     →    replenishment  →                  →
                                                                             ↓
Consumption        Transfer          Picking from      Inventory           Put-away
registration  ←    to           ←    Inventory    ←    value          ←
                   Production                           calculation
   ↓
Production         Inventory value   Cross-docking     Finished            Load-despatch
Output        →    calculation   →               →     goods   to     →
registration                                            Inventory
                                                                             ↓
Payment to         Inventory value   Shipment          Invoicing           Output check
Vendor       ←     calculation  ←               ←                  ←
   ↓
Payment from       Reporting         Statistics
Customer     →               →
```

Transformation	Output
Input	Control
Logistics	

Agenda

Resource : Skorkovský

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

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

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)
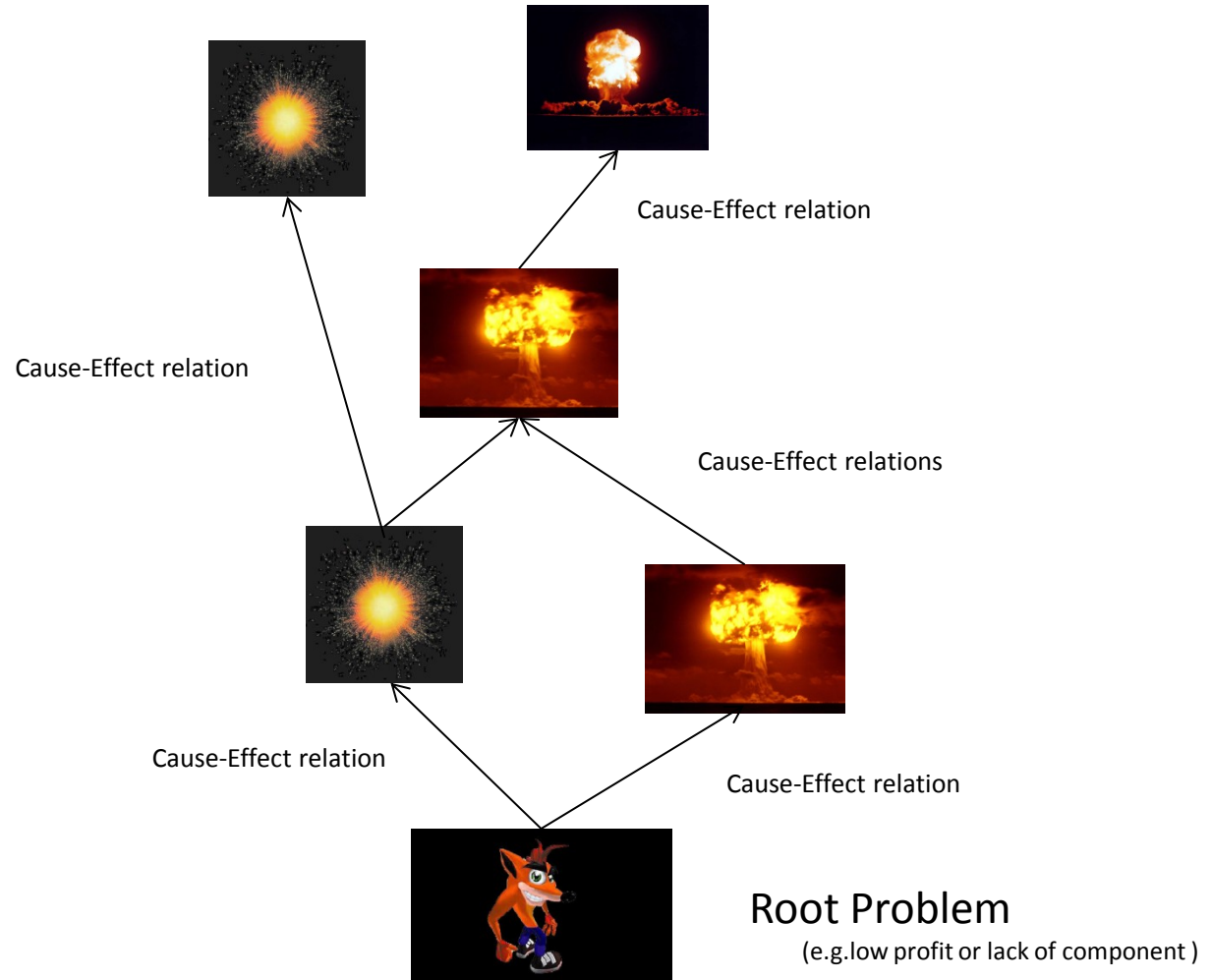
Basic problem I. (availability of components solved by product PlannerOne application)

Kód skupiny	Kód zdroje	Název zdroje	Typ zdroje
STAND-	⊞ STAN	STAND-BY	∞
100	⊞ 110	Mike Seamans	▬
100	⊞ 120	Bryan Walton	▬
100	⊞ 130	Linda Mitchel	▬
200	⊞ 210	Packing table 1	▬
200	⊞ 220	Packing table 2	▬
200	⊞ 230	Packing Machine	▬

Op.- Kód : 101005|10000|20
Zboží - Kód : 1000
Op. - Zbývající množství : 120,00
VZ - Datum dodávky : 11. 10. 2014 1:00:00
VZ - Zpoždění : 118d 10h 33m
Číslo operace pracovního centra : 1,00
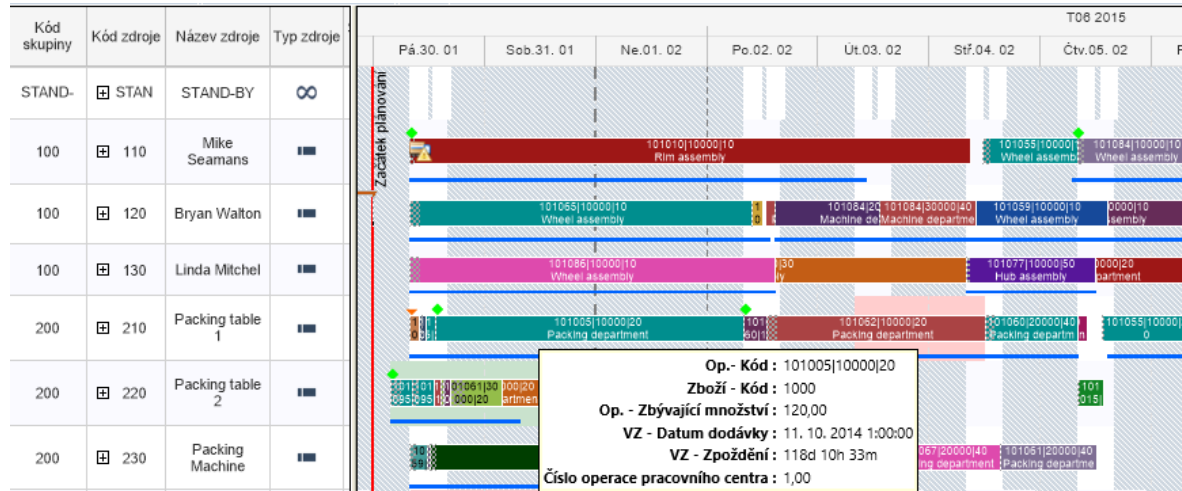
Prod. Order Routing ▾

Type to filter (F3)   Prod. Order No.   ▾

Filter: Firm Planned • 101005 • 10000 • 1(

Operati... No.	Type	No.	Description	Starting Date-Time	Ending Date-Time	Setup Time	Run Time	Material Fixed Date
10	Work Center	100	Wheel assembly	18. 8. 2014 14:41	22. 8. 2014 8:31	110	12	23. 8. 2014 0:00
20	Work Center	200	Packing department	27. 8. 2014 8:31	1. 9. 2014 14:46	15	15	10. 9. 2014 0:00
30	Work Center	300	Painting department	1. 9. 2014 14:46	4. 9. 2014 10:46	10	20	
40	Work Center	400	Machine department	4. 9. 2014 11:11	5. 9. 2014 12:21	10	8	

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

Basic problem II-I. (over budget)

*Basic problem II-II. (over budget)

*Basic problem II-III. (over budget)

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