

Operation Management (OM)

Introduction

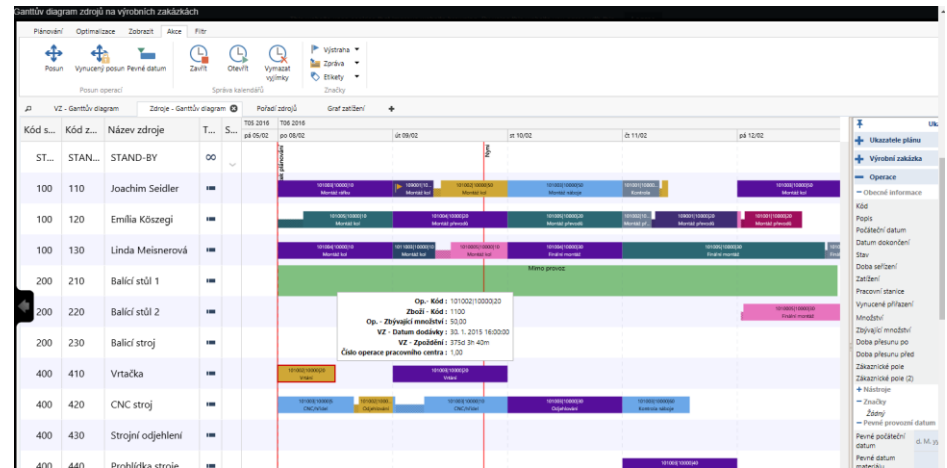
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Department of Business Management
FACULTY OF ECONOMICS AND ADMINISTRATION
Masaryk University Brno
Czech Republic

Coordinates (will be part of OM Introduction as well)

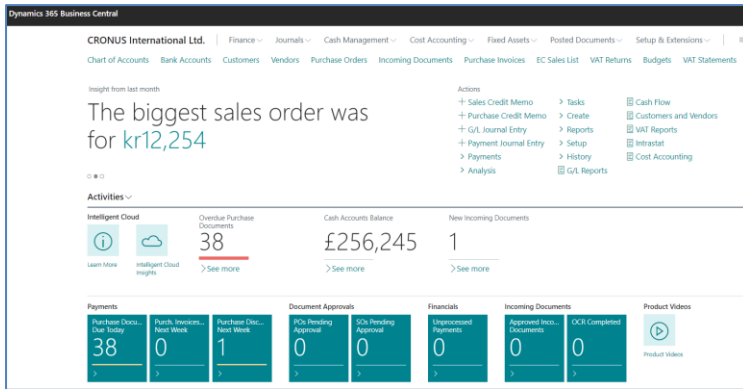
- **Lecturer** : Ing.Jaromír Skorkovský, CSc.
 - Department of Business Management (5th floor)
 - jaromir.skorkovsky@econ.muni.cz
 - +420 731113517
- **Study material** : will be updated regularly after every lesson (is.muni.cz and Interactive Syllabus)
- So far there is a lot of material there but mind you that nearly every part will be slightly or more heavily modified every year. So the correct material will have at the end of its name specification ...20YY mmdd meaning 20YYMMDD if not specified otherwise in advance (e.g. 20230919)
- **Attendance** : seminar and lectures **are obligatory** – see subject specification (is.muni.cz) – first vital condition to be admitted to exam !!!!) – **see letter send after this class.**
- **Excuses** : if serious reason emerges - **only written form is accepted**
- **Seminar work** : will be assigned after some important theory will be presented. Accepted seminar work is the second condition to be admitted to an exam. Assign time: 13.11.2023
- **Tuition plan** : at the **end** of this slide show
- **Name of the tuition plan file** : Tuition plan for AOPR_2023mmdd
- For the case of normal contact teaching : AOPR: P312 (308)- every Monday on 16:00 and VT206 and every Wednesday on 12:00
- In case of online teaching during an unexpected events : MS TEAMS

Tutor experiences from latest projects

- ITEC Johannesburg
- Peter Paper Johannesburg (<https://www.peterspapers.co.za/>)
- Training of personel for Navertica South Africa (120 hours in 2023)
- SW localisations
 - Boltrics (Warehouse Management)
 - Planner One (Ortems)
 - Implementation of BC (ESF)



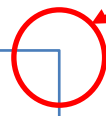
Principles



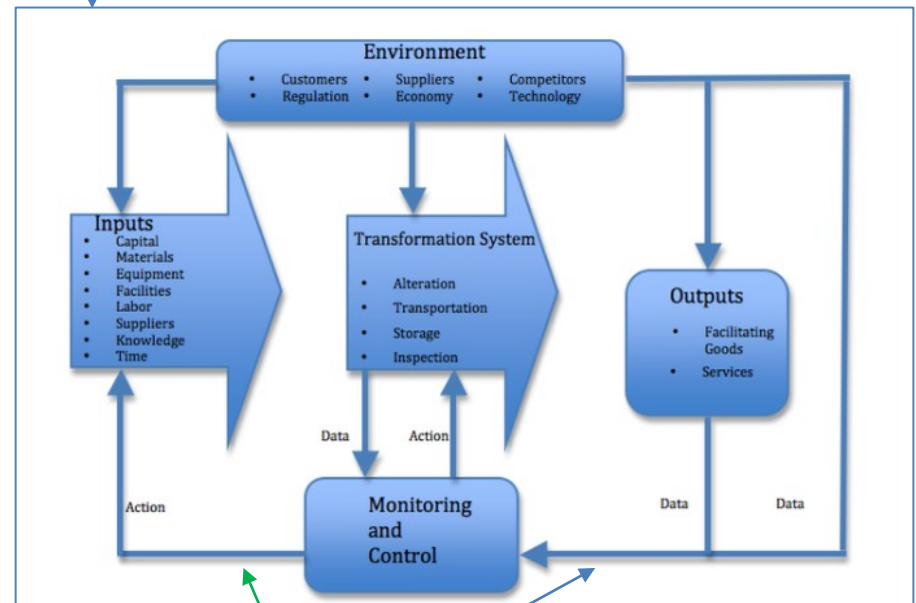
Information technology
MS Dynamics 365 Business Central



Data

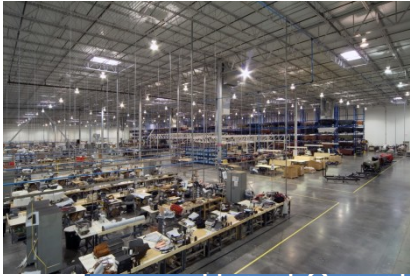


Management philosophy (processes)



Feedbacks

What is going on ?

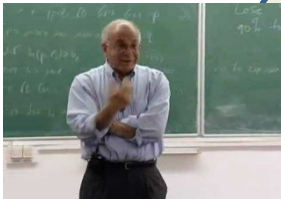
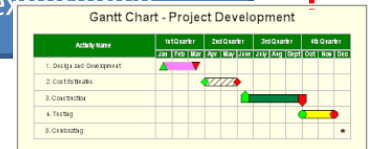


Use of Operations Management (OM) in external environment
(main target)



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

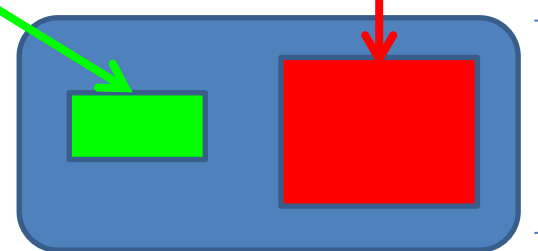
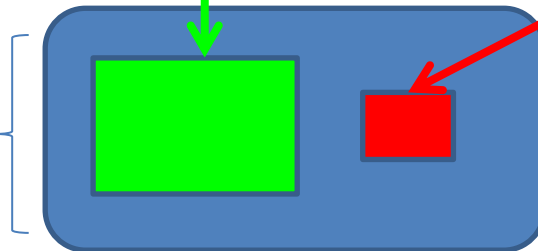
$$= \frac{\sum_{x_1} f_1(x_1) f_2(x_2, x_1)}{\sum_{x_1} f_1(x_1) \sum_{x_2} f_2(x_2, x_1)}$$



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



INBOUND

Processing-transformation

OUTBOUND

TQM = Total Quality Management, Six Sigma, ...

ERP: Logistics, Transportation

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

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

Selected OM methods, which will be kicked around as time will move on

- Theory of Constraints (TOC) -(AOPR)
- Balanced Scorecard -(AOPR)
- Project Management methods (Critical Chain) -(AOPR)
- Material Requirement Planning (MRP) and Just-in-Time principles
- (more in detail live in ERP MS Dynamics 365 Business Central)
- Six Sigma – quality management -(AOPR- reason -> JIT introduction)
- Boston matrix and PLC, SWOT and Magic Quadrant Matrices -(AOPR)
- Little´s Law (relations between WIP, Throughput and Cycle time) -(AOPR)
- Linear programming – optimization principles- (AOPR)
- Yield Management - (AOPR)
- Kepner-Tregoe (support of decision making) - (AOPR)
- Decision trees -(AOPR)

WIP=Work in Progress, PLC=Product Life Cycle

Some tools which have to be used

- **ERP-Enterprise Resource Planning : MS Dynamics 365 Business Central)**
 - Necessary installation, handling, and system setup-principles
 - Inventory – Items – Transports –Availability of Components (Items)
 - Purchase –dealing with Suppliers (**SCM**)- > Payables
 - Selling – dealing with Customers -> Reveivables
 - Payment – Bank operations
 - Accounting basics
 - **CRM- Customer Relationship Management**
 - Manufacturing Basics– Planning and Shop Floor Control->WIP, COGS,...
 - Budgets
 - Reporting

SCM=Supply Chain Management, **COGS**=Cost of Good Sold

ERP serves as the magnifying glass to processes...



Business Central

Dynamics 365 Business Central

CRONUS International Ltd. | Finance | Journals | Cash Management | Fixed Assets | Posted Documents | Cost Accounting

Chart of Accounts | Bank Accounts | Customers | Vendors | Purchase Orders | Incoming Documents | Purchase Invoices | EC Sales List | VAT Returns | Budgets | VAT Statements | Intrastat | Customer - Sales

Headline: Hi, navertica!

Actions:

- + Sales Credit Memo
- + Purchase Credit Memo
- + G/L Journal Entry
- + Payment Journal Entry
- > Payments
- > Analysis
- > Tasks
- > Create
- > Reports
- > History
- G/L Reports
- Cash Flow
- Customers and Vendor
- VAT Reports
- Intrastat
- Cost Accounting

Insights

My Accounts

Account No. ↑	Name	Balance
2910	Cash	9 369,80
2920	Bank, LCY	36 235,65
2930	Bank Currencies	
2940	Giro Account	
5310	Revolving Credit	
5410	Vendors, Domestic	
6110	Sales, Retail - Dom.	

Business Performance

Top Five Customers by Sales Value

Activities

Overdue Purchase Documents

94

> See more

Payments

Purchase Docu... Due Today

94

>

Purch. Invoices... Next Week

23

>

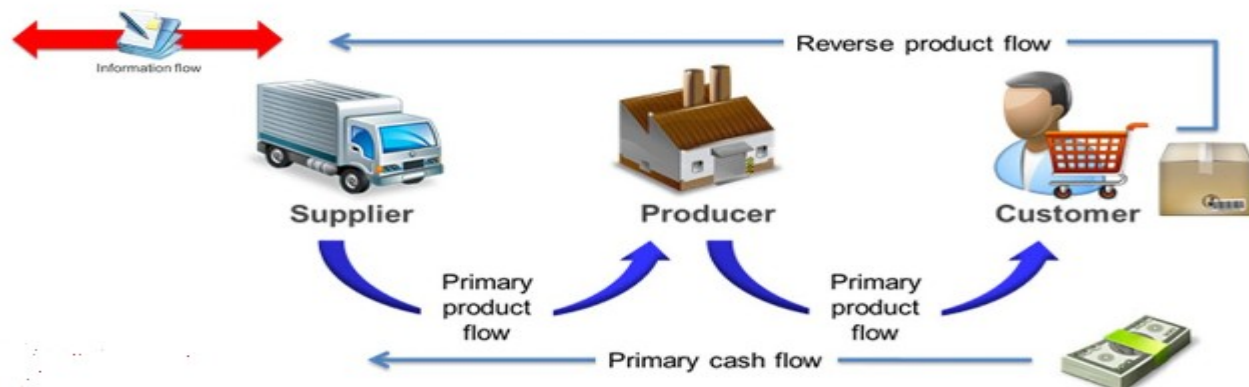
Cash Flow Forecast

CF100001 | Combined | Working Date | Week | Source Type (Updated: 12:36:07)

● Receivables ● Payables ● Cash Flow Manual Expense ● Cash Flow Manual Revenue ● Sales Orders ● Total

Controlling processes in Supply Chain Management (SCM)

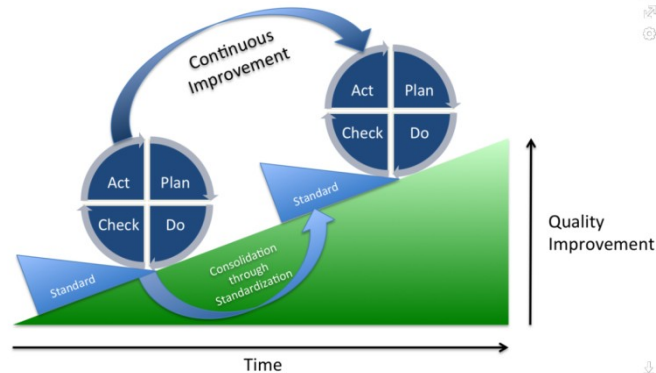
		Supply	Production	Orders	
Planning levels	Strategic	← Operation Strategies and Innovations , R&D →			Demand Planning
	Tactical	Forecasts, Blank Orders	Long term planning	Marketing	
	Operational	Logistic operations	Routing control, TQM	Packaging , Transportation	
	Operational	MRP, Replenishment	MRP_II ; 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 , **MRP**-Material Requirement Planning

Deming cycle PDCA (based on process periodicity)



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

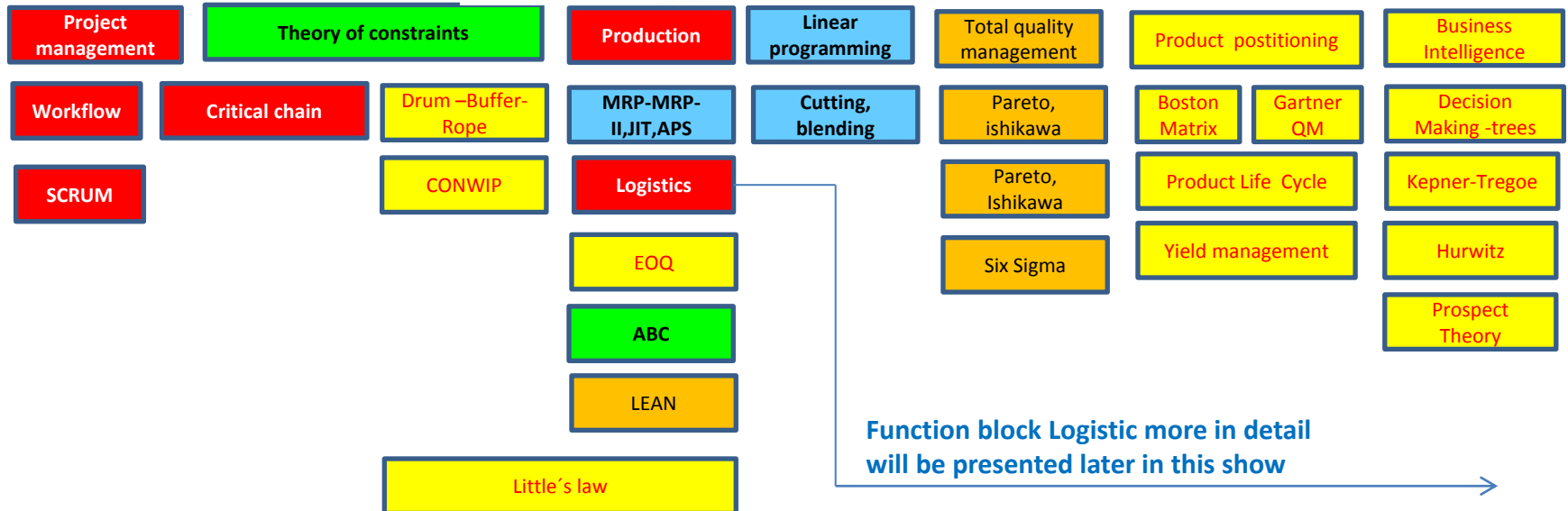
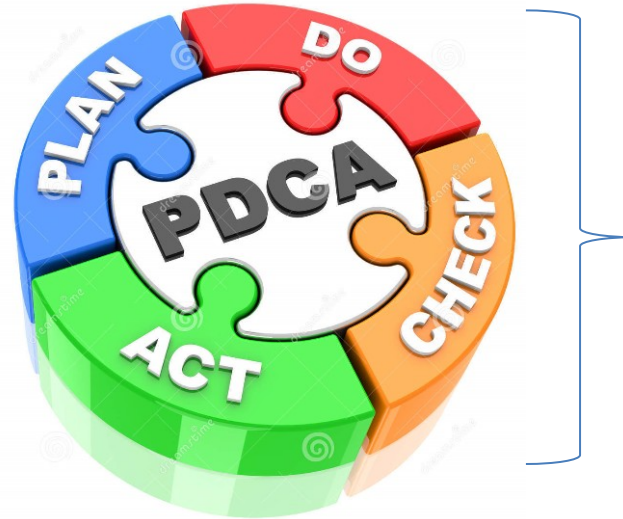
Do: Develop and implement a solution; decide upon a measurement to assess its effectiveness.

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

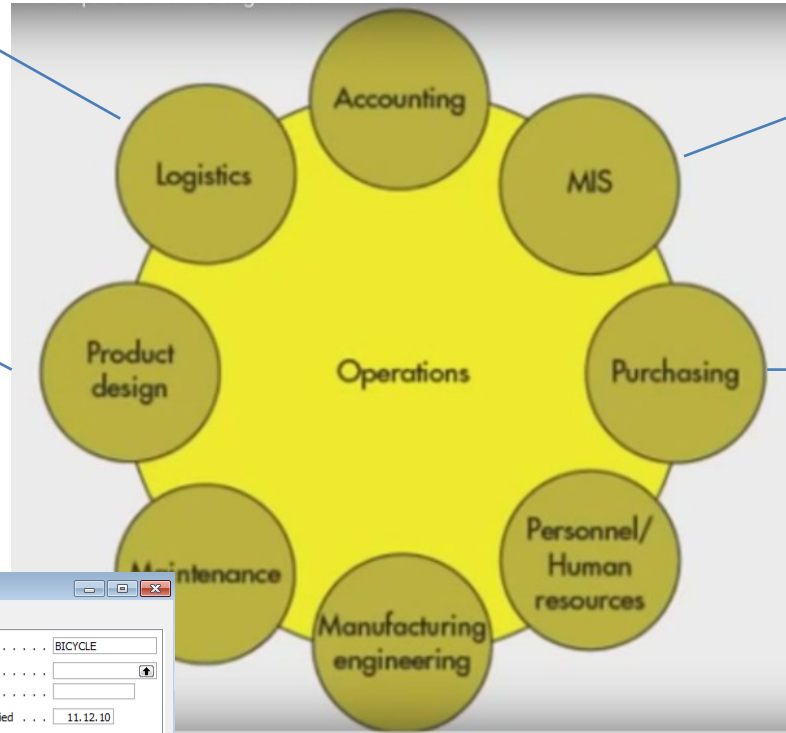
Another PDCA angle of view



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

A subset of ERP-driven 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	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

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

Bill of Material

MS Dynamics 365 Business Central

CRONUS International Ltd. | Finance | Journals | Cash Management | Cost Accounting | Fixed Assets | Posted Documents | Setup & Extensions

Chart of Accounts | Bank Accounts | Customers | Vendors | Purchase Orders | Incoming Documents | Purchase Invoices | EC Sales List | VAT Returns | Budgets | VAT Statements | Intrastat

Account No.	Name	Balance
2910	Cash	199.01
2920	Bank, LCY	2,846.54
2930	Bank Currencies	3,958.03
2940	Giro Account	249,241.29
5310	Revolving Credit	-1,383,297.64

Cash Flow Forecast

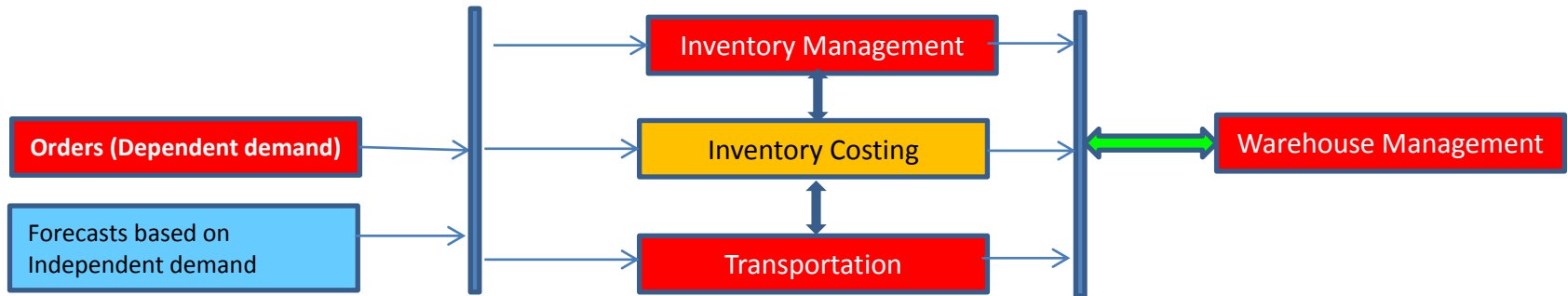
CF100001 | Combined | Working Date | Month | Source Type (Updated: 3:18:32 PM)

- Payables
- Cash Flow Manual Revenue
- Liquid Funds
- Sales Orders
- Cash Flow Manual Expense
- Tax
- Total

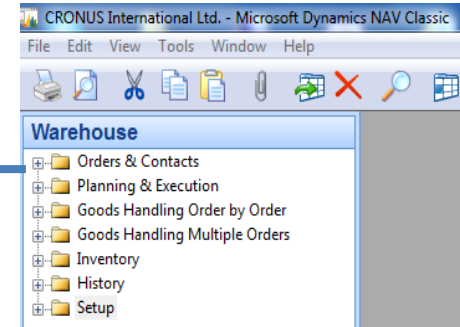
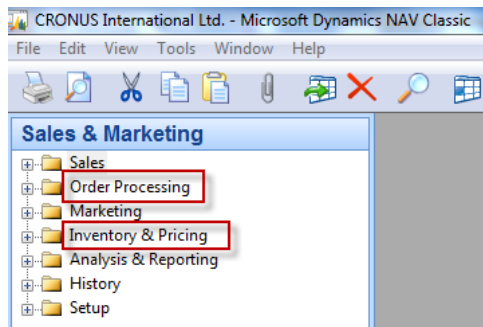
Report Inbox

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

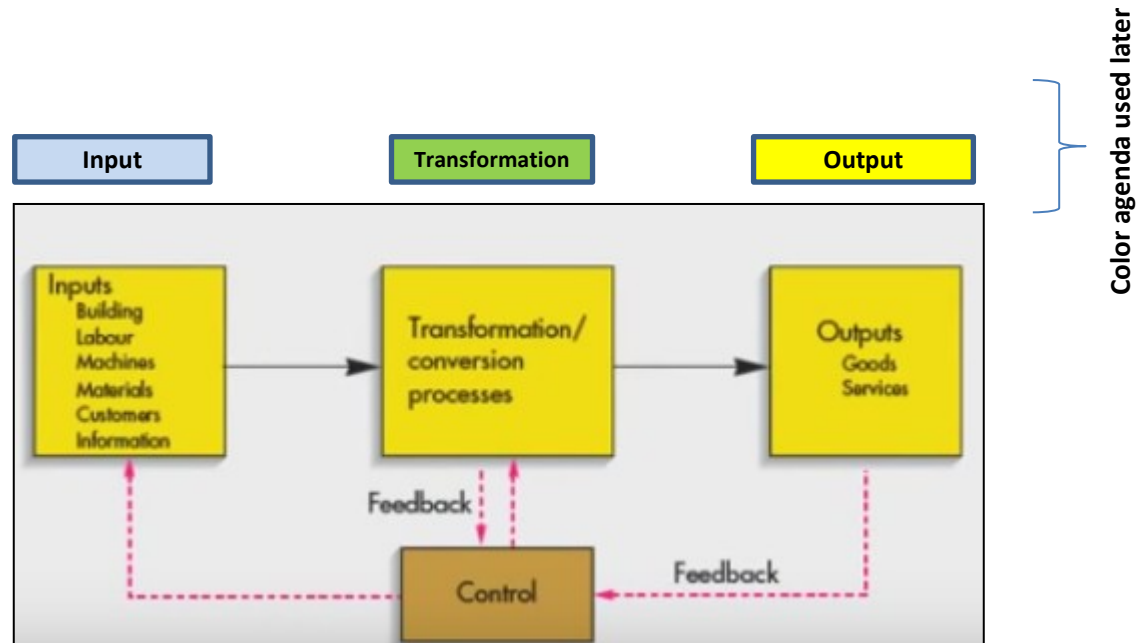
Function block Logistic- very simplified



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



Procedures-simplified (feedback control)



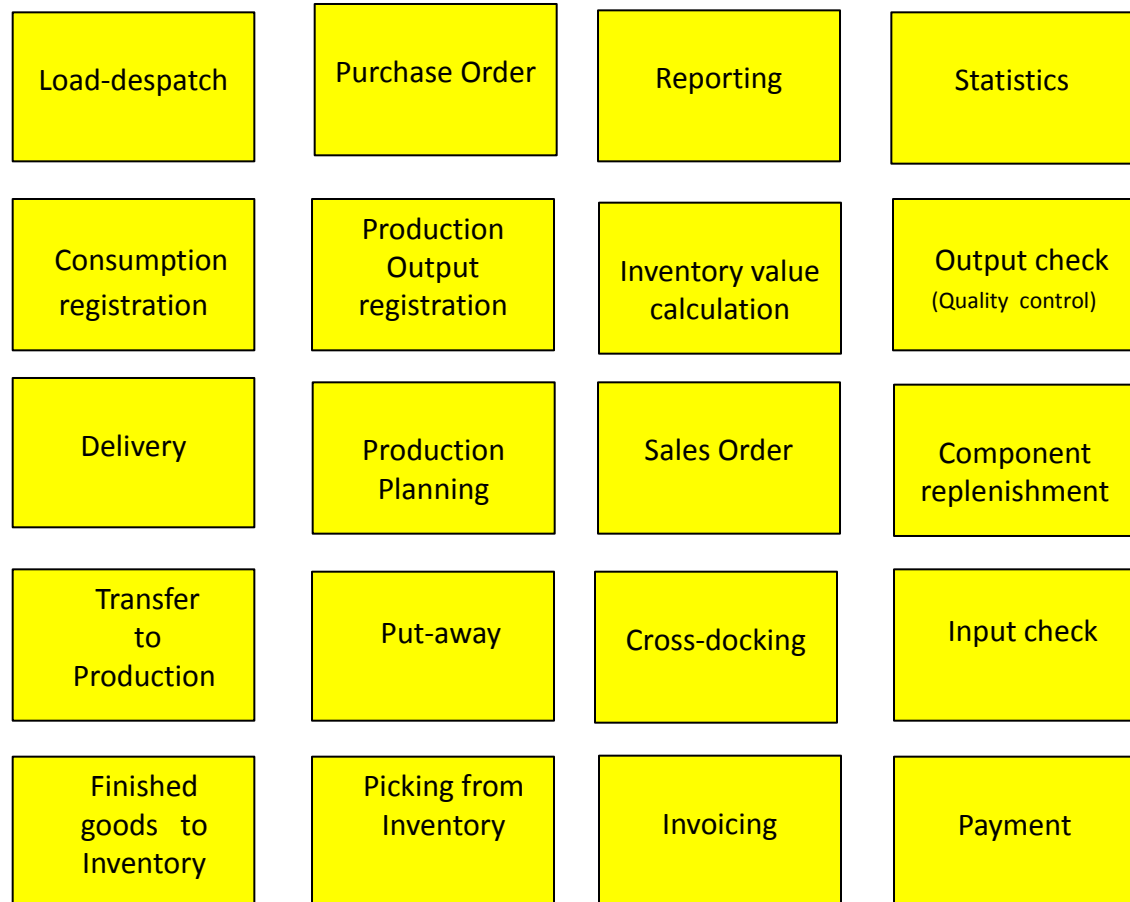
When managing the processes, you will not be able to do without the use of feedback.

Processing

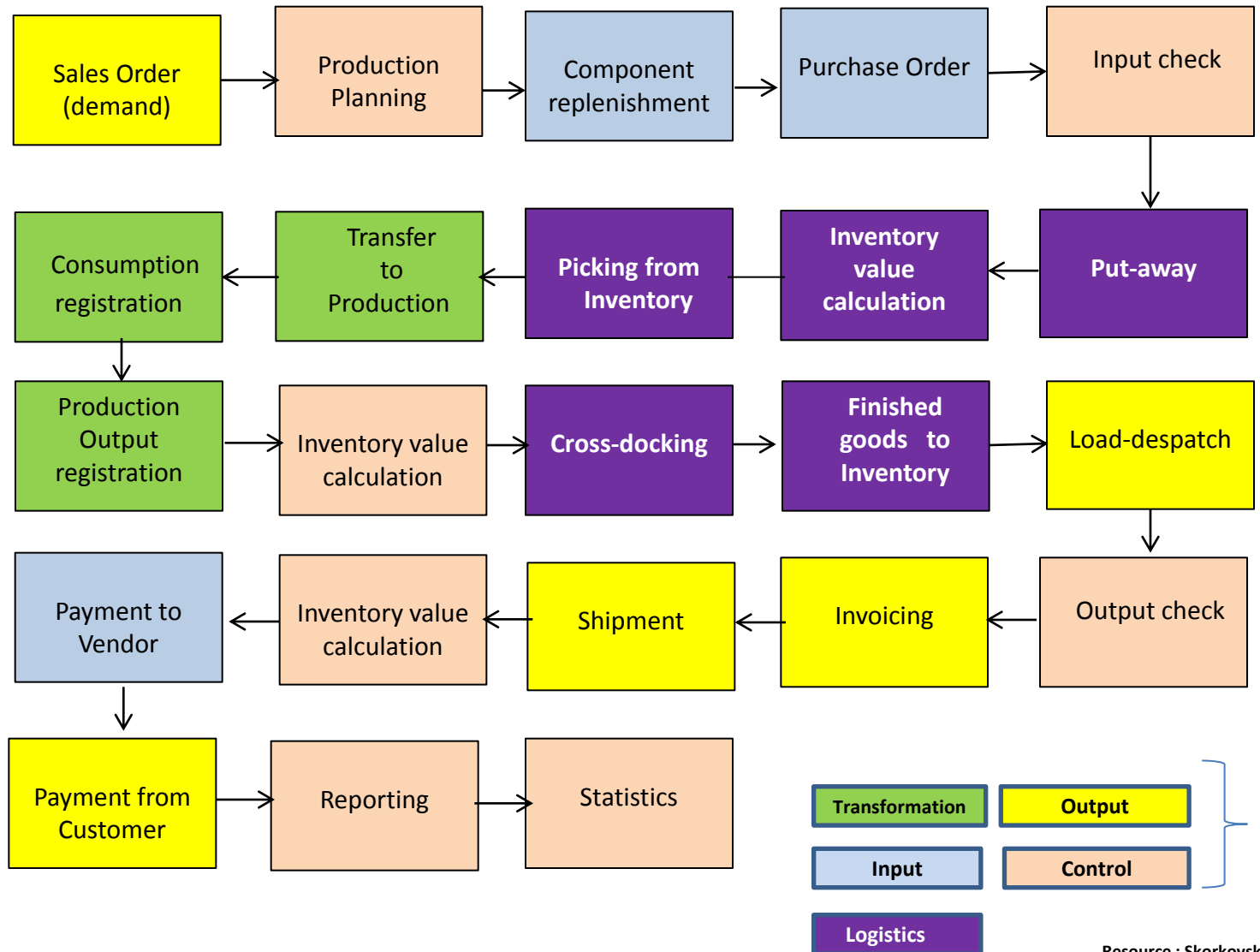
(not organised set of processes, will be presented also as a introduction to project management PWP presentation later)



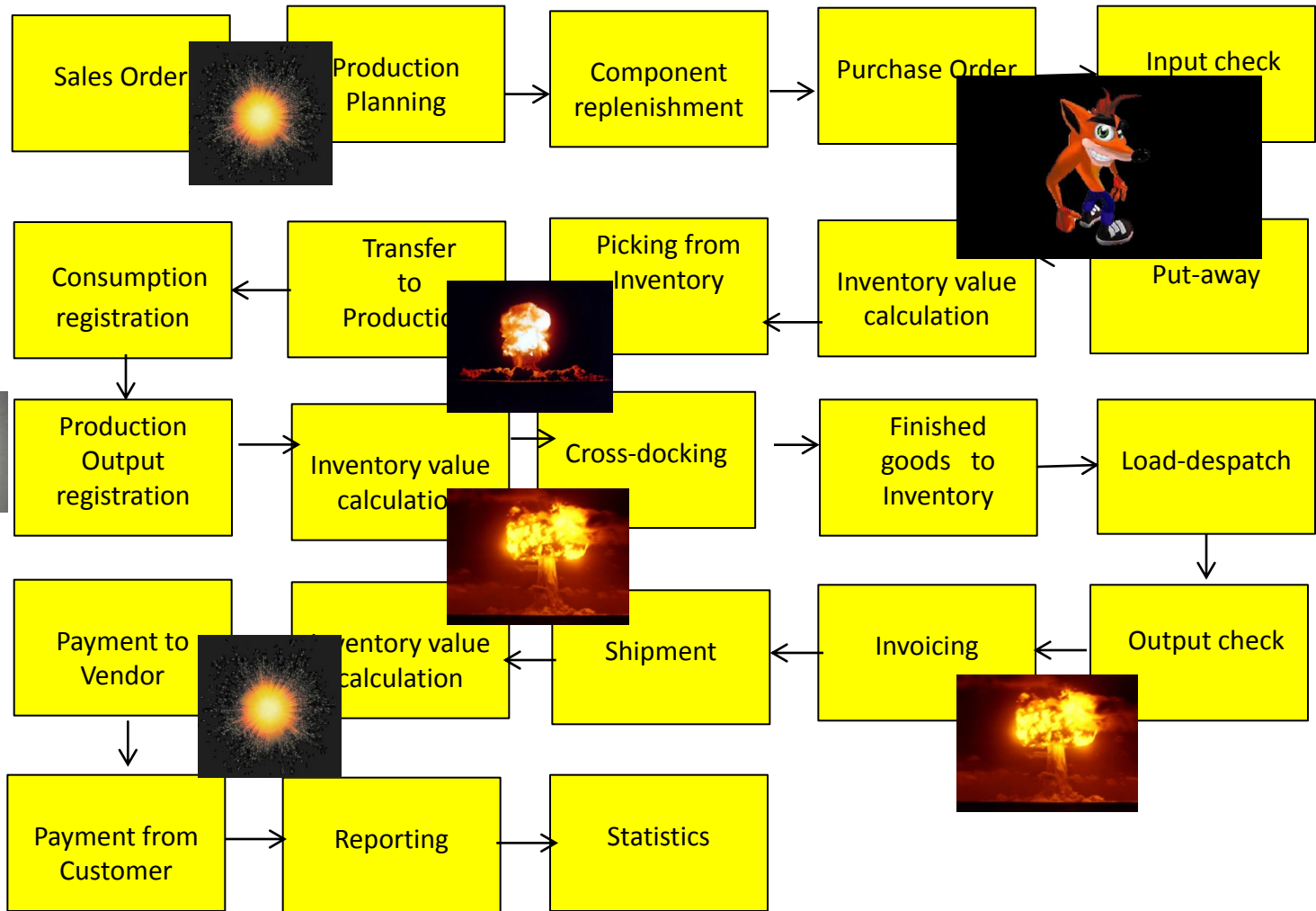
Process flow ?



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



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

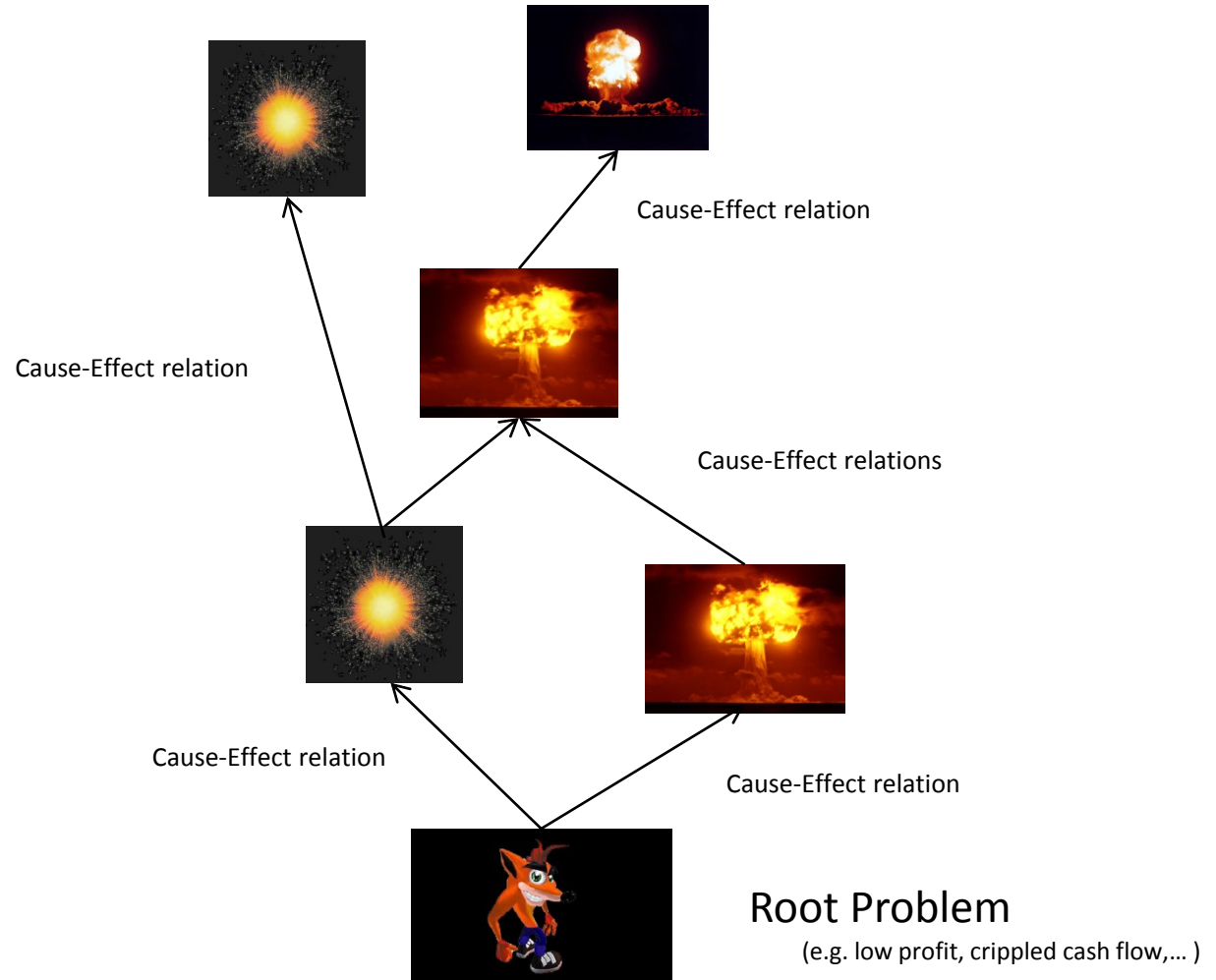


Priorities ?

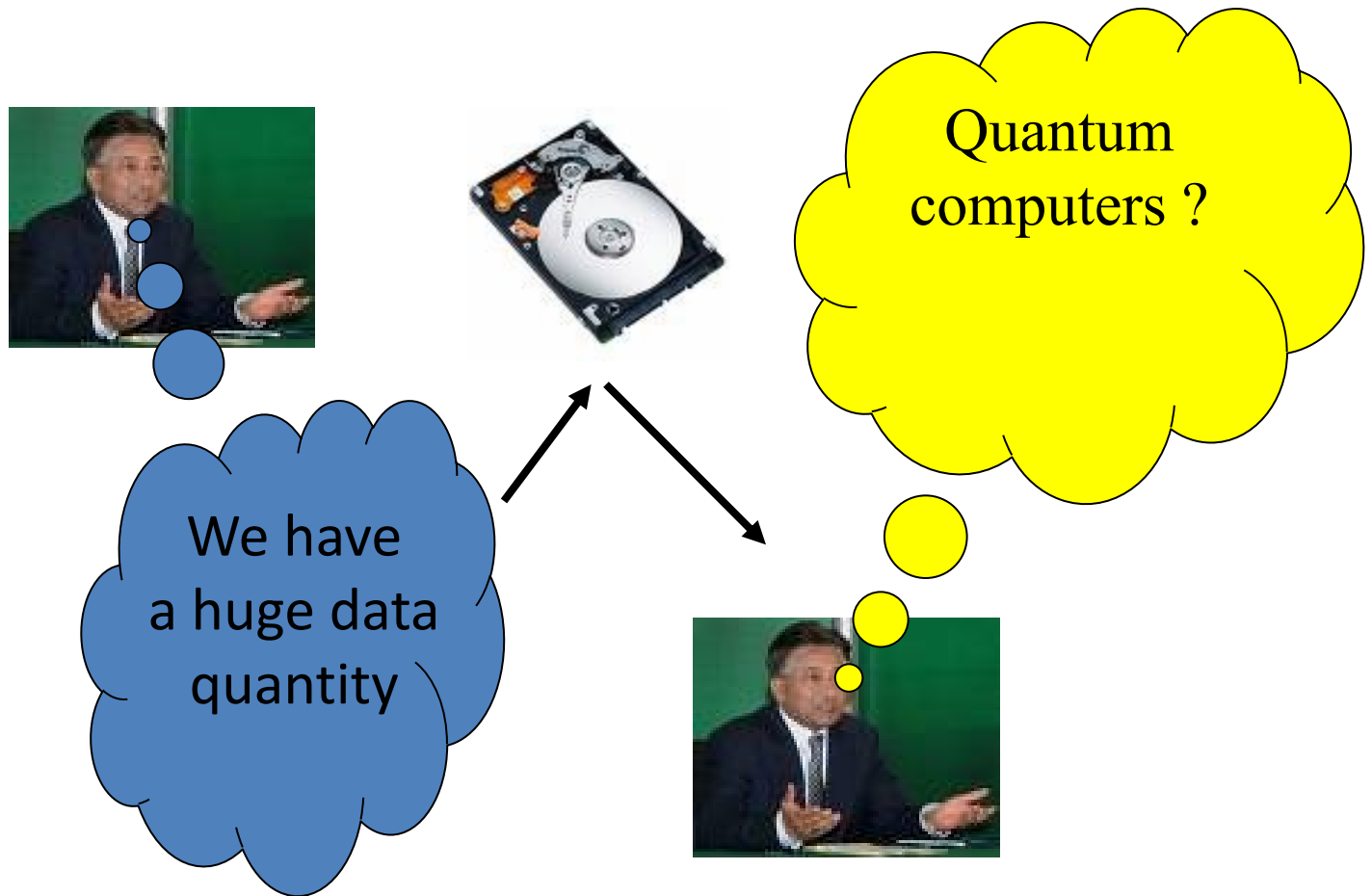
Application of TOC ->thinking tools->Current Reality Tree – first stage

Your main task

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

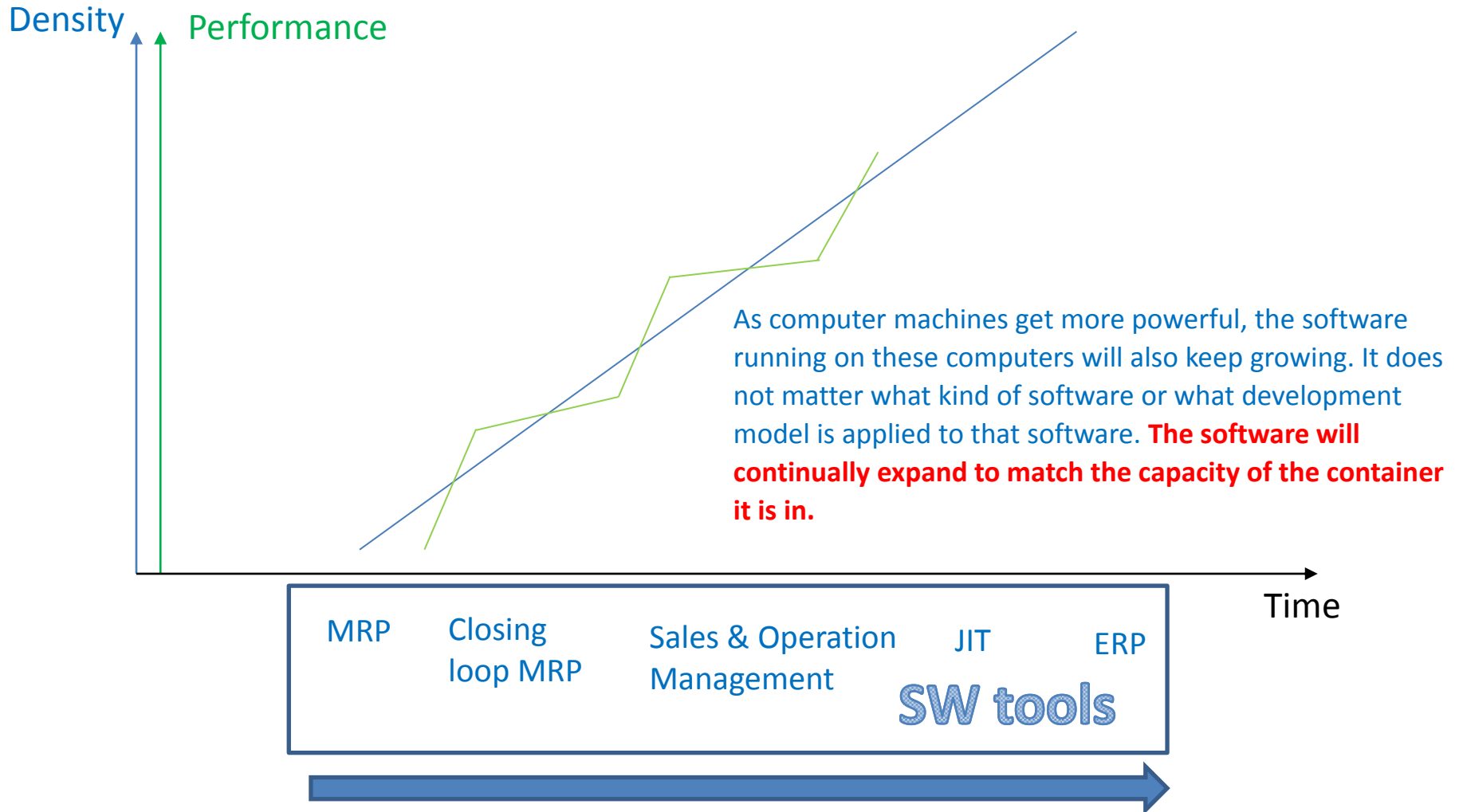


Basic problem I. (one of many)



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 -> applications (SW) temporarily solve such a constraint and it is still valid after more than 50 Years !!!

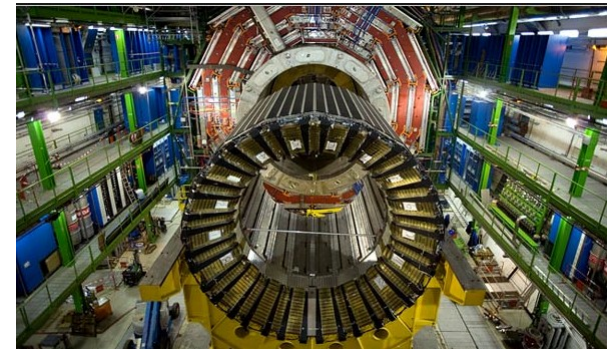
Transistor density in chips and computer performance – home study



Big data and analysis problém –home study

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

- 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.”**

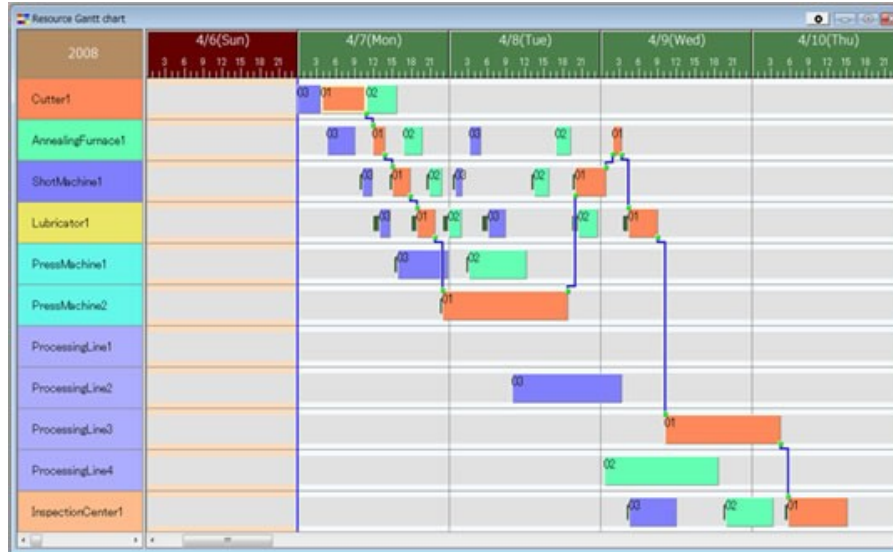


Hardon Collider-accelerator

* Basic problem II. (we need reliable data to control processes)

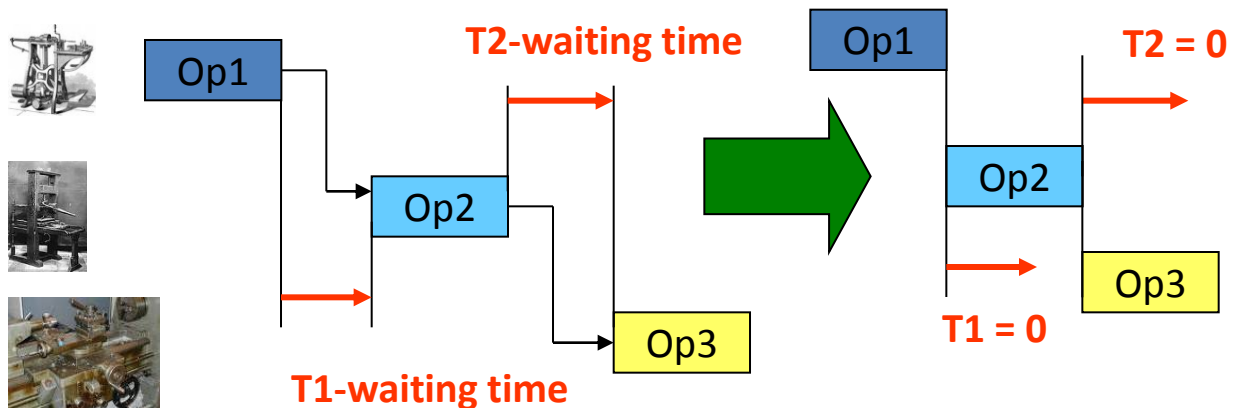
To solve it we should use **Finite Capacity Scheduling (APS)**

Gantt
chart

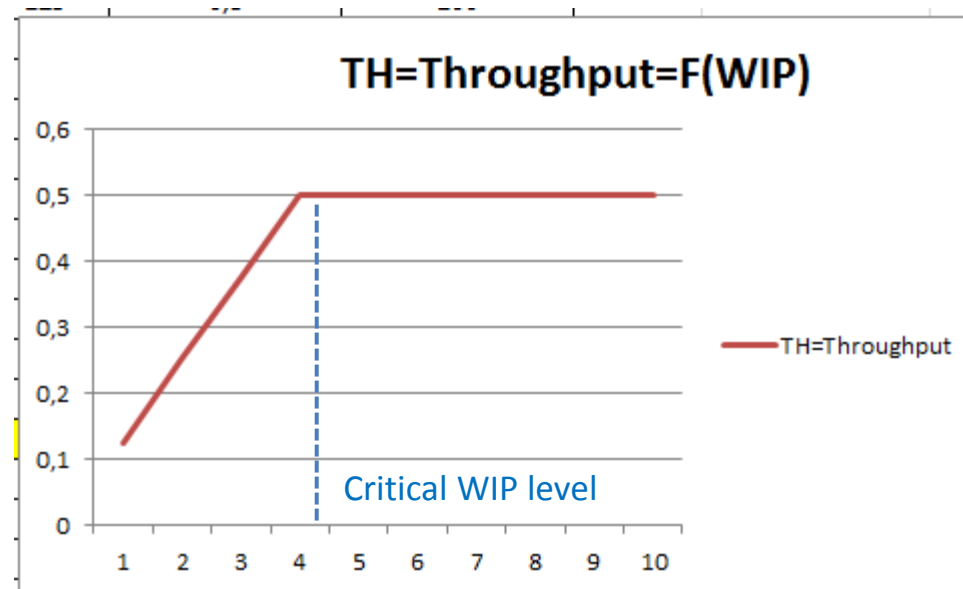


$$T1+T2=X$$

$$Opt=Min(X)$$



Basic problem III.



Will be explained later in Little's law presentation (MPH_AOPR)

WIP= Work In Progress

Throughput (also known as the **Flow Rate**) is a measure of a business process flow rate. Essentially, it measures the movements of inputs and outputs within the production process. It is an important metric in the operations management of a company.

Throughput and Productivity

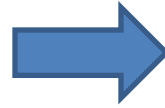
The amount of something (such as material, data, etc.)
that passes through something (such as a machine or system)

Throughput is the rate of production or the rate at which something can be processed ($\text{throughput} = \text{output} / \text{duration}$).

Productivity is defined as output per unit of input ($\text{productivity} = \text{output} / \text{input}$).

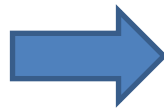
Another problem- colouring IV.

Black



White

White



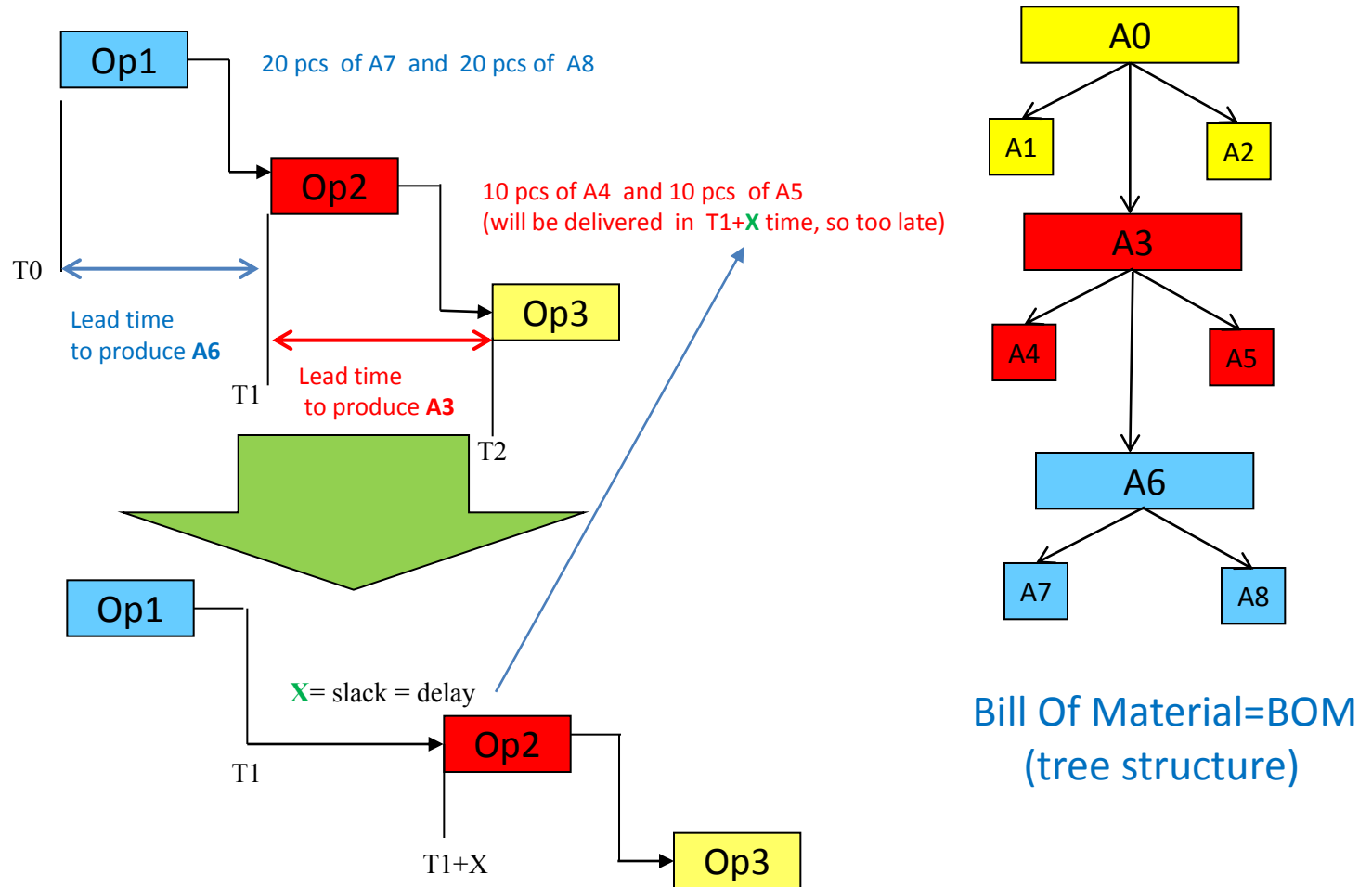
Black

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

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

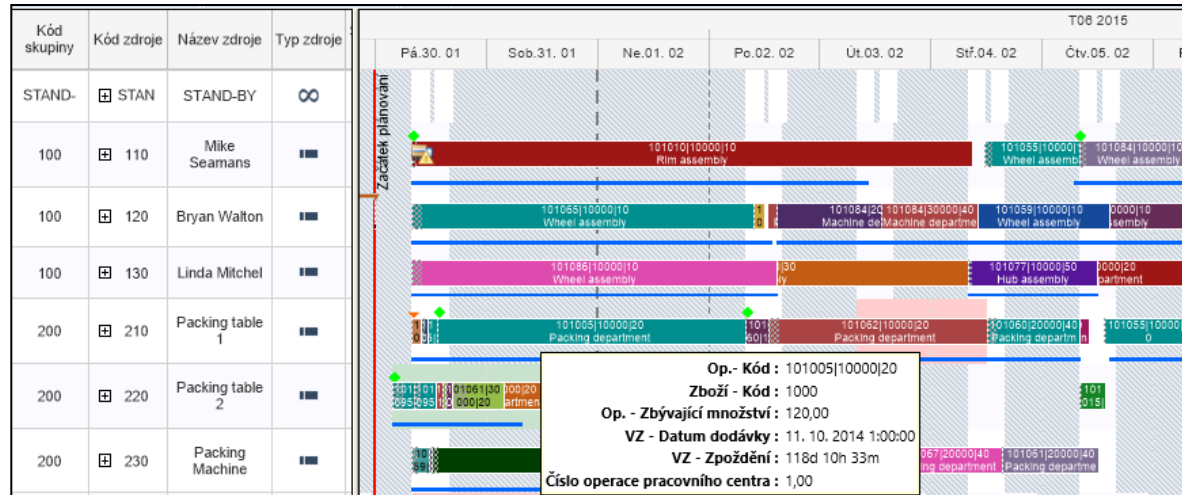
Main aim ->setup time minimization

Basic problem V-I. (availability of BOM components)



For sake of simplicity we did not mention components **A1** and **A2** and possible delays having caused in delivery times of bad quality !!!
 Same with capacities of machines allocated to OP1-OP2-OP3 (due to unexpected sudden breakdowns of these machines)

Basic problem V-II. (availability of components and capacity)



Gantt chart

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

APS = Advanced Planning and Scheduling result

Basic problem VI-I. (budget exceeded)

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

We will model a very similar example in the classroom using the Business Central system

* Basic problem VI-II. (budget exceeded)

1015 London Postmaster - **Purchase Invoice** Creation of the actual costs figures

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 VI-III. (budget exceeded)

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