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PPROI®

ALIGNING PRODUCTS, PROCESSES AND RESOURCES TO **MAXIMIZE ROI**

BREAKTHROUGH IN MEASUREMENT
TURNING POINT IN MANAGEMENT
A LEAP IN ROI AND PROFIT

INFORMATION SYSTEM FOR AN ERA OF TRULY SCIENTIFIC MANAGEMENT
NEW IN TERMS OF ITS CONCEPT AND CONTENT
IS ALREADY UP AND RUNNING

ONE OBJECTIVE

PPROI is a conceptually new information system that describes and aligns a company's products (P), processes (P), and resources (R) in their mutual ties to the objective, comprehensive goal of any business, maximally increasing the value of invested capital, or maximizing a company's ROI. Enterprise management thus enters into the era of science.

Maximizing ROI should not be unbounded, particularly from ecological and social aspects. PPROI makes it possible to set and respect limits of ROI maximization.

PPROI® **THE ROI IN ACTION!**

Based on

- **a new, truly scientific management theory**
- **new principles for describing processes**
- **a new information system architecture**

making use of the potential

- **of mathematics** and
- **current information technologies**

For the first time in history PPROI provides

- **correct, comprehensive, and timely management information**, most of which is not contained at all in other information systems

which leads each person, in whatever department of the company

- **to the optimal solution** in terms of **maximizing the company's ROI**

Conceptually new solutions

- **new key measures**
- **exceptionally detailed, exact and effective measurement**
- **mathematical linkages among all information**
- **advanced methods of management of product, processes and resources**

enable

- **to stop traditional unnoticed wasting capital** due to **the weaknesses of previous information systems**

Dramatically improved financial results

increasing since the first moments of implementing PPROI

can be used to

- **direct benefit of investors, employees of the company, community and society**

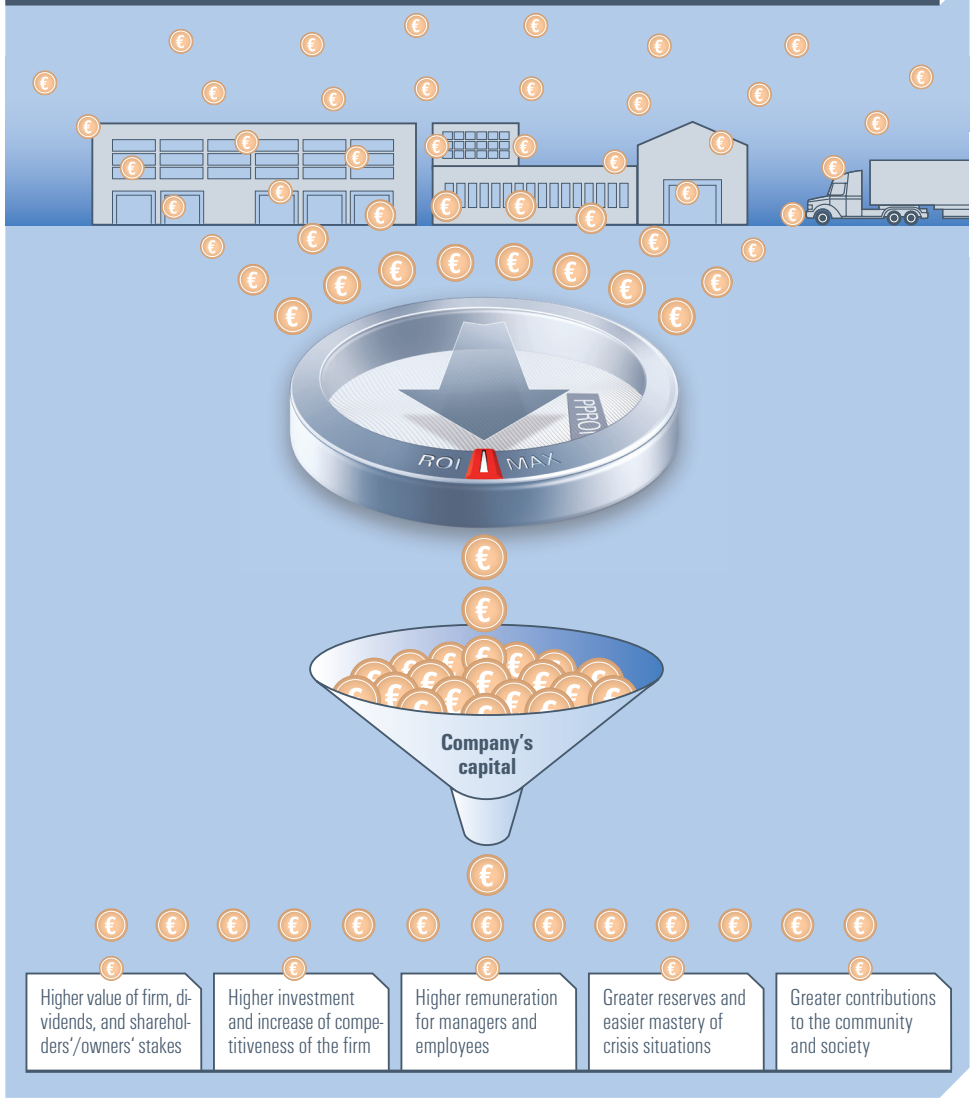
and/or

- **investment and improvement of competitiveness of the company** and/or
- **higher financial reserves in the interest of easier survival in a time of crisis**

WHAT MORE COULD ONE WANT?

BENEFITS AND MEANS OF PPROI IN A NUTSHELL

Management by PPROI → An end to capital waste as a result of IS' shortcomings



MEASURES: CAPITAL AND ROI PER PROCESSES AND PRODUCTS

PPROI is the first and sole information system that **calculates**

- **capital in processes** and consequentially
- **capital and ROI in processes** delimited **according to products,**

which makes it possible to manage products, processes and the resources contained in the processes in the interest of maximizing the company's ROI. This creates the **basic condition of scientific management.**

MEASUREMENT: DETAILED, ACCURATE AND CUSTOMIZED INFORMATION

Information on products, resources, and processes is exceptionally **detailed and addressed** in PPROI, and this is the necessary **prerequisite for precision of information and its utility in management**.
With respect to the specifics of the physical parameters of products and resources of various companies, in PPROI these parameters can be **flexibly customized**. Everything can be captured within the framework of the IS.

LINKAGES: ALL INFORMATION IS LINKED BY MATHEMATICAL FUNCTIONS

PPROI is interwoven by a **network of relevant mathematical functions, that successively synthesize elementary information** on products, resources, and processes **in the company's ROI value**.
The results of anything can thus be evaluated by comprehensive measure, the best of possible solutions can be selected, and, in general, **the company's ROI can be managed on root causes**.
It is also possible to determine **the responsibility of the company's departments for groups of ROI factors**.
Compared with ERP systems, **demands for working with information decline and the quality of calculated information improves.**

METHODS: ADVANCED PLANNING AND CONTROL, COMPREHENSIVE MANAGEMENT

PPROI effectively solves the issue of descriptions and management of advanced production processes called **lean production**. From elementary information the system calculates

- **variant time standards of operations in link when manned by various numbers of workers**
- **balanced, time-bound production plans for teams of workers,** reacting to **variable demand**

Fulfillment of time plans is recorded, motivating teams and individuals to performance and allowing rapid elimination of possible slippages.
PPROI plans also similarly determine the **demands of processes on the consumption and employment of necessary physical resources in real time**.
Automatic comparisons of reality, recorded in narrowly delimited territories, with the planned demands of processes realized in these territories, are entirely unique **physical and financial controlling**.
The procedures can also be used in part **in traditional production and in non-production processes.**

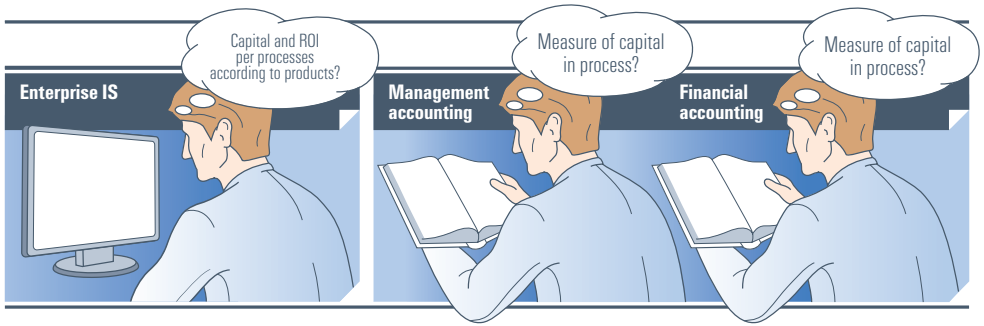
04 OBJECTIVE MANAGEMENT CRITERION

PRIOR TO PPROI: DARKNESS, GROPING, CONTRADICTIONS

> *» When you cannot measure what you are speaking about and express it in numbers, you have scarcely advanced to the stage of Science, whatever the matter may be.«*
> *Lord Kelvin (William Thomson)*

Darkness in information systems, tabula rasa in theory

Capital is the fundamental economic term of capitalism, and maximally increasing the value of capital is the fundamental goal of doing business. In recent decades process has been designated as a key term of management. Because capital increases in value in processes paid for by customers, it would be logical for ROI to be a criterion for both process management and management of portfolios of products.
The reality is just the opposite. Such a procedure is not followed in practice, there is no information on capital in processes in ERP or in any other enterprise IS, and the theory does not deal with measuring capital in process at all. It is therefore impossible to calculate ROI in processes delimited as per products and manage products, processes and resources in the interest of the objective business goal. Management, in the words of Kelvin, "has scarcely advanced to the stage of Science".



Management of processes: Groping among partial indicators and theories

In deciding among process options, as when as in assessing existing processes, a number of partial indicators are used in the function of criteria; these indicators are recommended by unilaterally focused theories. However, the optimal options from the many possible options are varied by various indicators (see the illustration on the right).
Individual theories practically come into conflict, and protagonists of a certain theory criticize other theories. For example, the author of the Theory of Constraint, Eliyahu Goldratt advocating for a "world of throughput" criticizes management accounting and its "world of cost." Managers in practice must necessarily grope to determine what theory is right and what measure to use for assessment and management of processes.

Management of products by profitability

Profitability, i.e., the ratio of the profit for a product to the product's price, is a standard criterion in the evaluation and management of portfolios of products. It is almost axiomatic, a matter of course accepted without reservation. Various capital demands of processes for various products are not perceived, since they are not measured. Profitability is often incorrectly considered as the rate of the increase in value of capital, ROI.

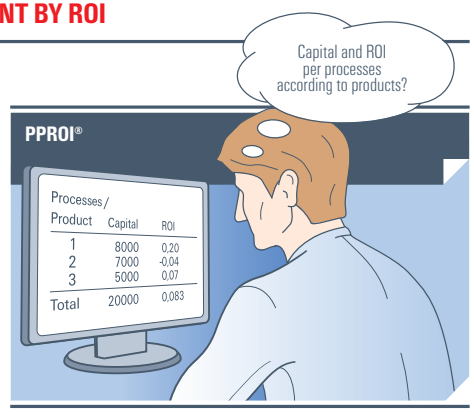
Management versus finance

ROI has the function of a criterion in finance. It is a peak, synthetic measure of ratio indicators of financial accounting. It is also used as an investment criterion. The contradiction between financial and management criteria is clear in the financial pyramid. Profitability, a criterion in management, is just a factor of ROI in the financial pyramid. However, theories of both management and financial accounting ignore the contradictions between management and finance criteria. This is probably a result of barriers of a rampant division of labour.

WITHIN PPROI: ENLIGHTENMENT, MANAGEMENT BY ROI

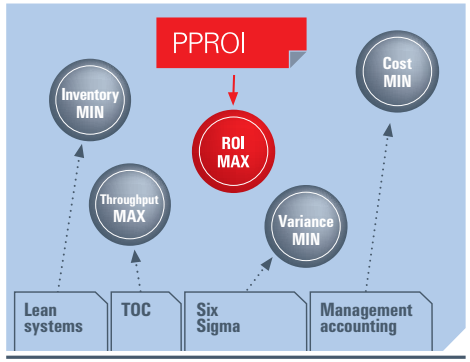
Breakthrough in information, break in management

As a standard, PPROI calculates not only cost of processes, but also the capital in processes. The latter is measured by an integral in money-time units. Afterwards both capital and ROI are calculated in processes segmented as per products or per customers, as the case may be. Managers thus acquire key information for management in the interest of maximizing a company's ROI value.
They perceive processes defined for products as areas of capital investment within the company, and they strive to optimize the capital and ROI in the areas, so that the company's ROI value is maximized. The thinking and actions of managers become the developed thinking and actions of investors.



The role of partial indicators of processes

Thanks to the possibility of managing processes in the interest of ROI maximization, the reason to use any partial indicator as a criterion for management disappears. Disputes among protagonists of various partial indicators turn out to be artificial.
The function of partial indicators within PPROI is the same as their objective relationship to ROI. They provide information on ROI factors from various perspectives and at different degrees of detail, and they serve ROI management through its factors.
At the same time, it is necessary to bear in mind that values of partial indicators are often in mutual trade-off relationships. It is often necessary to calculate the company ROI in order to make right decision among process alternatives.



ROI and profitability in evaluating products

Through evaluations by ROI, incorrect financial perceptions of the advantageousness of products in a company's portfolio disappear. Profitability ceases to be a criterion for evaluation; it is only a factor that, together with the capital demands of processes for products determines their ROI.
So, the hierarchy of ratio indicators in evaluating products is in accordance with the hierarchy of ratio indicators of financial accounting depicted in pyramids; there is no contradiction between management and financial criteria.

Example of different evaluations of products by profitability and by ROI

Product	Profitability	Capital demands	ROI
A	0,12	1,5	0,08
B	0,1	1	0,10
C	0,08	0,6	0,13

A different ranking of products by ROI compared with ranking by profitability is common, for a number of reasons. However, this is not necessary; relations between profitability and capital demands are various.

ACCURATE, CONCRETE, DETAILED AND TIMELY INFORMATION

BEFORE PPROI: POOR INFORMATION, RESIGNATION ON ACCURACY

Chronic distortion of product and process costs in theory

> *» The goal of properly ABC system is not the most accurate cost system. The goal should be to balance the cost of errors made from inacurate estimates with the cost of measurement. «* *Robert Kaplan, Robin Cooper*

In and of itself, the existence of correct measure of a phenomenon does not ensure correct measurement. Accuracy of the measurement is also required. The defect of management accounting is not only the complete absence of information on capital, but also the highly simplified methods for measuring the costs of processes and products, fundamentally distorting reality. For this reason, in the 1980s Robert Kaplan said that managerial accounting is "number one enemy of productivity." With colleagues he designed the Activity Based Costing method. However, the authors did not place great demands for accuracy. They declared it reasonable for the part of costs determined by the method to be distorted by 5% to 10%, claiming that greater accuracy does not pay as a rule, because the cost associated with greater accuracy is greater than the benefits of more accurate information for management. Because cost for direct material and a part of direct wages are generally calculated precisely, the distortion of overall costs of product using the ABC method should range from 2% to 6%.
However, in terms of ROI such distortion is consequential; the greater the distortion of the cost of a certain product in one direction (downwards) in the allocations used in ABC, the costs of the rest of the products are distorted in the other direction (upwards).

Product	Price	Real costs	Distorted costs	Real capital	Real profit	Distorted profit	Real ROI	Distorted ROI
A	100	92	89	80	8	11	0,1	0,1375
B	100	88	91	75	12	9	0,16	0,12

Distorted costs of about 3% in the example fundamentally distorted ROI and changed the advantageousness of the products. The distortion is generally and demonstrably far greater if ABC is applied for calculations of costs of product-delimited phases of processes. On this level, the method is unusable.

Poor and inaccurate information in ERP systems

> *» Many of companies have not achieved the anticipated results becouse they use ERP systems based on rigid principles of Manufacturing resource planning (MRP) that have remained almost unchanged for 30 or 40 years. «*
> *Toshiki Naruse*

Traditional information systems do not inform even about the costs of the most precisely recorded phase of a process – the processing operation for a part of product. Costs involved in a certain operation are often generated by a great number of resources, some of which only in parts of the overall time of an operation. It is impossible to record all resources, their times, and associated costs, because in ERP systems there are no fields for such records. And even if such fields existed, the traditional method for determining information and records of data into the IS would be unbearably demanding.
Nor can the problem be solved by superstructures over ERP. If it is not possible to precisely calculate the cost of a phase of a process, it is not possible either to calculate the cost of the entire process, and thus the cost of the product.
Information on processes is generally unsatisfactory in ERP systems. This also applies to non-financial information. For example, calendar times of operations of production orders in MRP plans are very inaccurate, filled with a merely orientation function. This follows not only from insufficient input data but also from the unsatisfactory methods for processing them.

IN PPROI: A MASS OF NEW AND ACCURATE INFORMATION

PPROI, compared with the management modules of ERP systems, contains much greater amount of concrete information, ensures markedly greater accuracy of information, deliveres it timely and decreases demands for acquiring information.

Indicators of a lean production plan

The unique accuracy of physical information in PPROI is documented by a balanced binding production plan that determines a week in advance tasks for workers on teams in one-minute intervals.

Line	Shift	Production order	Part	Operations in link	Number of workers	Start	End	Number of pieces
LAL1	1	2600967002-0004	2600967002	10-20	3	21.4.2009 6:00	21.4.2009 6:37	40
LAL1	1	2600967005-0004	2600967005	10-20	3	21.4.2009 6:37	21.4.2009 7:18	31
LAL1	1	2600967008-0002	2600967008	10-30	2	21.4.2009 7:18	21.4.2009 8:36	49
LAL2	1	2600967005-0004	2600967005	30-50	1	21.4.2009 7:18	21.4.2009 9:17	31
LAL1	1	2600967007-0005	2600967007	10-35	2	21.4.2009 8:36	21.4.2009 11:13	145
LAL2	1	2600967008-0002	2600967008	40-60	1	21.4.2009 9:17	21.4.2009 13:31	49
LAL1	1	3300728001-0006	3300728001	10-40	2	21.4.2009 11:13	21.4.2009 13:30	244

If time standards for varied numbers of workers have not been set very precisely, and if the complex calculations were not accurate, coordinating times for production plans for many parts on tens of lines, the plan would be impossible to realize and the operators would say it was nonsensical.

Financial indicators

The specificity and accuracy of financial indicators in PPROI is illustrated in the table of planned values

Part number	Operations in link	Depreciation of machine	Depreciation of tools and jigs	Cutting tools	Machine electricity	Machine gas	Cooling water
3300728001	10-40	3,87	0,64		2,45		
3300728001	50 -65	0,94	0,11	0,95	1,32		0,21
3300728001	70	1,08	0,08	0,24	0,42	2,68	
3300728001	80 -120	4,91	0,25		3,41	5,65	2,08

The values in the table are aggregates of costs generated by individual machines in microphases of operations. And these data must be accurate, because their correctness can be checked randomly, and, furthermore they create the basis for automatic controlling – comparisons of reality with the plan. If the data were inaccurate unexplainable variances would arise.
The stated items of costs in a table are only a part of machine costs calculated in PPROI. For operations in link additional units of direct and indirect costs and units of capital demands are calculated.

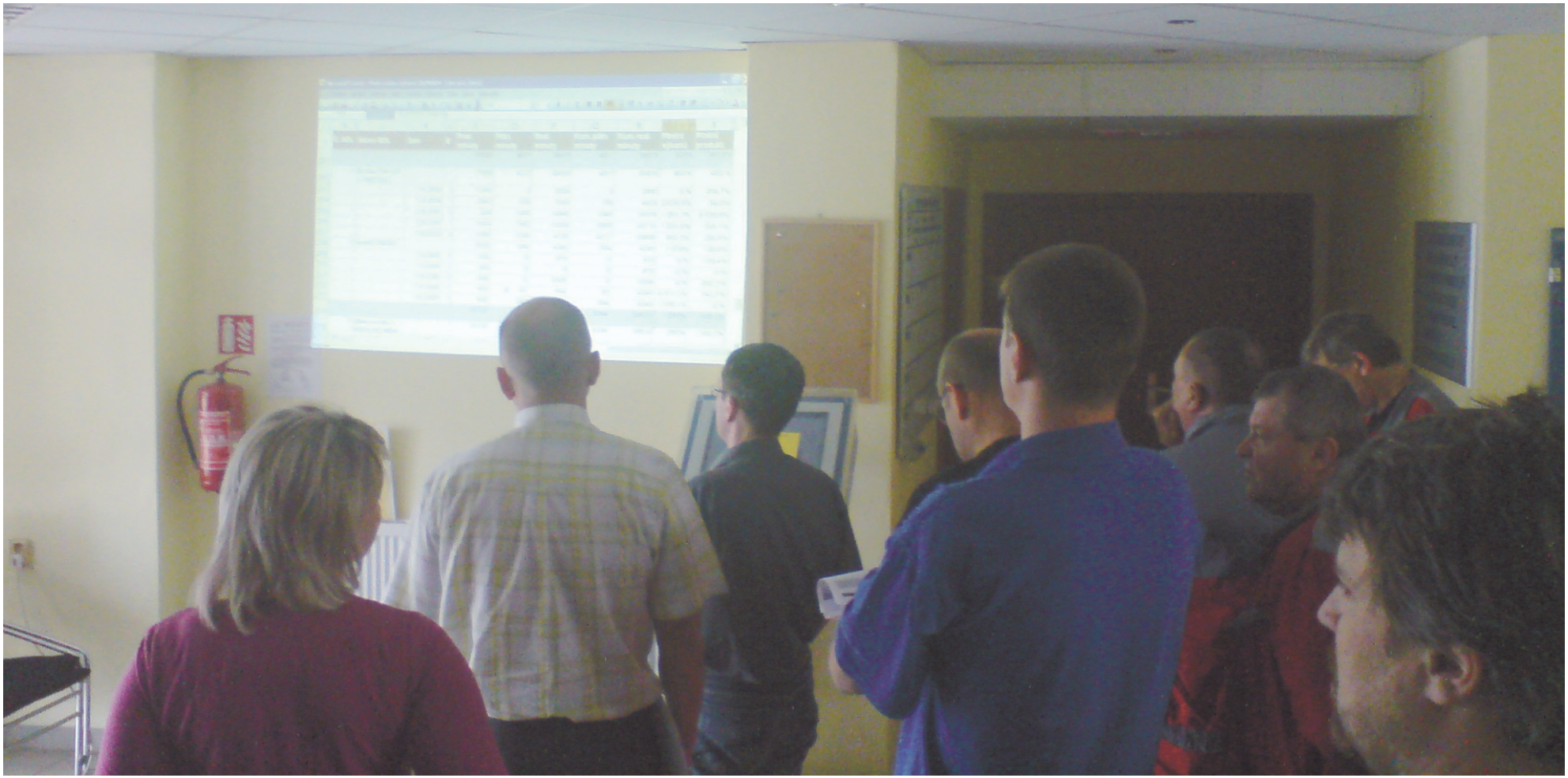
New generation of information and methods, and what about previous generations?

From the example the general procedure in PPROI is clear: successive compilation of elementary factors by mathematic functions whose partial outputs serve management and allow control. The procedure, in accord with reality, is the complete reverse of the allocation of company aggregate values of costs on activities and products in ABC, or in other simplifying models of management accounting. With the existence of accurate calculations these allocations and models lose their relevance. The question also hangs over the future of traditional ERP systems, with their conceptual weaknesses in process description, planning and control.

ROI MAX

06 MORNING REPORTING

EVERY MORNING PPROI PRESENTS A SUMMARY OF THE PREVIOUS DAY'S RESULTS ACCORDING TO THE COMPANY'S TERITORIES, AND THE PEOPLE RESPONSIBLE EXPLAIN THE REASONS FOR ABNORMALITIES, IF ANY OCCUR.
BRIEF QUESTIONS, ANSWERS AND CONCLUSIONS CAN FOLLOW.



REVOLUTIONARY COMPANY IS

FROM INTERVIEWS BY PETR ZAVORAL WITH PROFESSOR MILAN MATEJKA

Ing. Petr Zavoral has over 20 years of experience with company information systems in Europe and North America. He has worked in high management positions in departments of international companies such as **SAP, KPMG, Oracle, and SAS Institute.**

I first became aware of PPROI in 2007, when the part of the system for production planning and control was functional. At the first glance the mass of detailed information amazed me. I followed the development of the other parts of the system and their implementation at HZP Prostejov, where PPROI completely replaced the management part of the BPCS system - conventional ERP. In 2008 I reported on my strong impressions in an article for Czech journal Moderni rizeni (Modern Management). From notes on debates with the creator of the PPROI concept, Professor Milan Matejka, I have compiled this set of questions and answers that characterize the properties of PPROI, which I consider revolutionary.

BASIC QUESTIONS

1) Can you briefly characterize PPROI ?

PPROI is **first and only one** information system developed for managing a company's products, processes, and resources in the interest of maximum return on invested capital, ROI, which is

- **the objective, rational, and comprehensive goal of doing business, and**
- **respects the interests of investors.**

PPROI information is tied by a mighty set of mathematical formulas, from the physical parameters of individual resources and products to the company's actual ROI value. For example, if you change a machine's parameter with positive effect on the time of process the time standards and the time plans are automatically shortened. The capital demand and cost of relevant processes and products decline, their ROI rises, and thus the company's ROI also increases.

A company managed according to PPROI takes on the characteristics of a living organism, managed by primary factors – root causes.

2) Aren't products, processes, and resources managed according to ROI in existing information systems? If not, what is the management method?

There is no information on the ROI of products and processes in ERP systems. From this point managers are simply blind, regardless of what type of IS they use. Products and processes, and hence their resources, are managed **according to partial, mutually contradictory indicators whose values are, furthermore, distorted.** The management is necessarily incorrect.

3) It is clear that PPROI information is exceptional, in content and the degree of detail. Furthermore, in comparison with ERP systems it saves work with information in various departments of enterprise. How did you achieve this?

Through structural IS changes, a new delimitation of the elementary unit of a process, mass sorting, linkage of information with mathematical functions, and other **means of science** when making **use of the potential of contemporary IT**. The apparatus used effectively replaces the prior work of people with information. The precision and timeliness of PPROI information further spares management workers who traditionally control processes according to subjective judgments.

4) What financial benefits can PPROI bring?

The elimination, or at least a substantial reduction of wasted capital that follows from incorrect and, further, expensive management. True, this waste is not noticed, but in general it is great. When the potential of PPROI is made use of,

ROI is – by conservative estimate – increased
- **in industrial companies by 3 to 10%,**
- **in other companies by 2 to 5%.**

The higher yields for industrial companies result from PPROI's ability to manage progressive production processes. ERP systems are tagged as "electronic cans" of obsolete production.

MANAGEMENT CRITERION – WHICH DECISION IS CORRECT?

5) According to what should managers control products, processes, and resources? What should the management criterion be?

The company's ROI. It is illogical to manage anything what influences the company's ROI value by other than this indicator. The optimization theory has the basic experience: **"which criteria - such results."** If you manage according to criteria other than ROI, you are choosing mostly other alternatives than those that lead to the maximal ROI value.

Example 1	Process	Criterion
Which process is better for the given product?	A	Cost MIN
Which is an improvement of the process?	B	Lead time MIN
A → C or C → A	C	**ROI MAX**

Example 2	Product	Criterion
Which of the products is the most advantageous?	X	Profitability MAX
Expand which production, cut which?	Y	Labour productivity MAX
	Z	**ROI MAX**

6) In practice, processes are financially managed according to cost, and products according to profitability. When can such management be different compared to management by ROI?

Different evaluation and decision making can occur **in all basic contexts**, including

- To implement a process in the company, or buy the given item? Make or buy?
- To automate a phase in a process, or not? If yes, to what extent?
- How often and through what deliver material or goods?

Grocers have long known that goods with low "profit margins" and rapid turnover can be more effective than goods with high margins that turn over slowly.

7) Yet companies also record capital, and calculate and analyze ROI values. Capital is also worked with in calculations of EVA. So how is PPROI new?

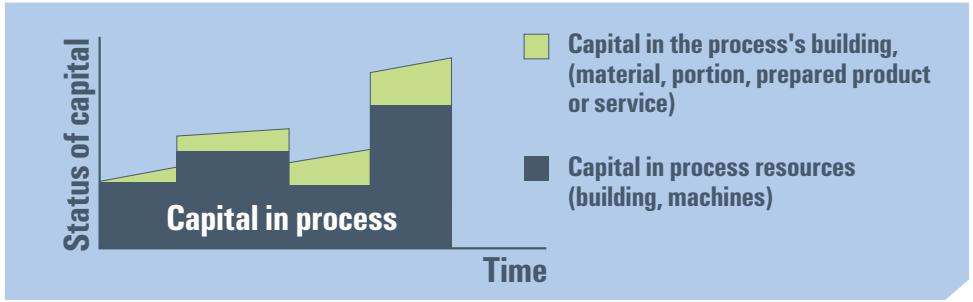
The indicators you mention, derived from the financial accounting balance, are company-wide, and **for managing products, processes, and resources** they are **unusable**. They provide absolutely no information about products and processes, and information on physically indivisible resources is scattered in various accounts from which it is impossible to recognize the coherence. These are the main reasons why, besides financial accounting, there exists management accounting.

Financial accounting provides **information** only **on results**, not on causes. **PPROI manages "on causes,"** and is concerned that the results – financial accounting numbers – are best.

CAPITAL INTEGRAL

8) Why does financial accounting record capital and management accounting ignores it? Why is it focused solely on cost?

In financial accounting capital is recorded to the beginnings and ends of standard periods (month, year). However, in that way the capital in processes cannot be measured, and management accounting **may not know how to proceed**. It's no wonder. In mathematical terms the **capital in a process is an integral.**



Such a process measure is described neither in management accounting nor in literature devoted to process management. It is simply a **blank space in the theory.**

9) The integral is part of higher mathematics. Will managers understand it and be able to work with it?

PPROI automatically calculates the integrals of capital in processes. The problem does not lie in this. However, there is **no avoiding an understanding of the integral**. It in fact measures the **key economic concept – capital – in a key type of management**, i.e., the **management of processes**. Technicians work with integrals regularly. And managers will surely expand their mathematical knowledge, if they understand that it is necessary.

PHYSICS AND FINANCE – BASIS AND SUPERSTRUCTURE?

10) PPROI operates not only through mathematics, but also through physics. The first of its two parts is called PPROI Physical. It is followed up on by PPROI Financial.

And that is how it is in fact. **Financial quantities are functions of physical quantities and prices**. The key physical quantity is time; from the illustration of capital this is clear, while with other financial quantities it is rather hidden.

11) Most so-called superstructure modules above ERP focus on financial calculations. Do you also understand PPROI Financial as a superstructure above PPROI Physical?

Not at all. **A company has no superstructures and therefore a company IS should not have one either.** True, financial calculations follow up on physical ones, but the two are inseparable. The connection is mutual. There are many physical alternatives, and only an objective financial criterion, i.e., ROI, can correctly decide on the selection of the optimal alternative.

MICROPHASES – A BREAKTHROUGH IN THE DESCRIPTION OF A PROCESS

12) You have introduced the concept of the microphase in describing processes. How is this concept defined, and what are its benefits?

A microphase is defined as a **phase of a process with the same and unchanging resources**; if, for example, a machine, i.e., one of the resources of a process, is idle in a certain phase and active in the subsequent phase, what we have are two microphases. A traditional, elementary phase of a process in an IS, operation, is broken down into multiple microphases.

This step and the ensuing classification of microphases have created the prerequisite for

- **Consistent determination of time standards** of processes within the framework of class of microphases through mathematical functions of the parameters of products and resources
- **Precise**, resource addressed **calculations of the capital** demands and **cost of processes and products**
- **Description, planning**, and overall **management of progressive processes**

The mathematical functions for microphases have made it possible to **integrate traditionally isolated information** on products, resources, and processes.

REVOLUTIONARY COMPANY IS

INTEGRATION OF INFORMATION AND PRECISION OF CALCULATIONS

13) Are you saying that information on products, processes, and resources in company information systems is accordingly only declared and in no way real? Can you demonstrate your claim with a specific example?

Let us assume that operations at one of many dozens of mechanized workplaces are carried out for 100 products. There are 500 products in all in the company's portfolio. Through a technical improvement in a machine its consumption of electricity per minute is decreased. So in reality, the **cost of electricity for the** given **100 products decreases.** Information on the processes for these products **does not react to this change in ERP systems.**

14) But the savings in electricity as a result of the improvement in the equipment must be reflected financially somewhere.

Certainly. In the electricity invoice, which goes to the financial accounting department. But you won't learn anything from that. From the point of view of calculating cost of products, the invoice **falls under overhead**, even though it involves direct costs of specific products.

15) What else happens with artificial overhead?

It depends on which method, in which IS superstructure module, or merely as a calculation in Excel, is used. Let us assume Activity Based Costing (ABC). This method reflects the savings in the cost for electricity in the processing activities, and these savings – according to machine hours, as a rule – **are spread over all 500 products**, even though the saving does not involve 400 of them at all.

16) How does PPROI react to a decrease in a machine's electricity consumption?

It automatically **lowers the electricity cost for the 100 products** that are processed on the equipment relatively to the times of the relevant microphase, the consumption of electricity per minute and the price of electricity.

REVOLUTION IN STANDARDIZATION

17) How does the microphase concept relate to the standardization of process times?

In PPROI the times of microphases are determined by mathematical functions of the parameters of resources and products within the class of microphases. This procedure cannot be sensibly used when standardizing operation times. An operation is made up of different sorts of phases (machine processing, various manipulations, ...) in which various resources are involved. The **function can be sensibly used only for phases with the same, unchanging resources.**

18) We're back to mathematics

Yes. And at the same time we see the **importance of its correct use**. An unsuitable mathematical function in suitable conditions, or the use of functions under unsuitable conditions can lead to nonsense.

19) Please elucidate the procedure for standardizing times in PPROI and its effectiveness.

Imagine a change of a machine's parameter that accelerates the machine processing. In this case, PPROI automatically converts the standard time of the machine processing microphase **according to the relevant deterministic function** for all the parts processed on the given equipment; the change does not affect the other microphases of the given type of operation. Conversely, when there is a systematic shortening of a certain type of hand manipulation microphase, PPROI converts only the times of parts in this type of microphase **according to the relevant stochastic function** as stipulated on the basis of sample observation. A change of one parameter of a resource in the class of microphase, in PPROI it automatically and consistently changes the microphase times for all (e.g. 100) parts, which are processed within this class of microphase, variously according to the relevant parameters of the parts in question.

A reaction of operation times to a change of a parameter of a resource in ERP systems would require 100 external calculations of new standards and 100 reports to the IS, with no guaranty of correctness of calculated data.

20) I see the relation of a parameter of a resource and of a parameter of the process phase of various products. How is a change of parameters of products reflected in the times of processes?

If a designer improves a parameter of a product, e.g., if he decreases the weight of a certain part, PPROI automatically changes the times of all the microphases of the processes for the particular part and folowing parts in which the parameter - weight of the part is a factor of time.

21) Your procedure is a revolution. Will standardizers be necessary at all? Won't the objectivity of standards be worsened?

Application of the PPROI procedure has truly led to cancellation of the traditional procedures of standardizers. The impulse to use these methods came right from the lack of objectivity of standards set using traditional procedures. The relations of existing time standards were often at contradiction with logic, and operators also pointed this out.

But this is no wonder, as there are many methods for setting standards, standardizer are changing, independent time snapshots of individual operations are influenced by the operators who are conducting the operations at that time. All of this leads to conflicting standards for comparable operations. You won't learn anything from the information system, because the standards are set outside the IS.

22) Can you describe the specific implementation of the method?
PPROI has completely replaced prior standards for 73,000 operations. Through functions for 2,100 types of microphases consistent standards for 560,000 microphases were created for specific parts. This means that through the functions for one type of microphase 560/2.1 = 270 microphases were standardized.
For new products PPROI automatically calculates time standards for existing classes of microphases according to entered parameters of products. Also automatic are associated calculations of cost and the capital requirements of products.

AUTOMATIC FINANCIAL CALCULATIONS – SAVING ACCCOUNTANTS TIME

23) But standards for direct processes in relation to products do not resolve the problem of assigning capital and cost of indirect departments, e.g., the department of the general director, to products. How does PPROI proceed with respect to this?
In PPROI **physical and accounting territories** are delimited in such a way as to allow the most relevant possible **assigning of financial claims of supporting departments to the main processes** that directly generate products paid for by customers. This assigning is either direct, if the supporting department directly supports certain phases of the main processes, or through an allocation pyramid, if the supporting department acts directly on other supporting departments. This is the case of the department of the general director.
In PPROI the user adapts the structure of the supporting departments according to the organizational structures of the specific company. PPROI offers suitable allocation coefficients, which are the parameters of the main processes. While the method of allocation is defined, **routine calculations proceed automatically.**

24) How often are routine financial calculations run?
Operative **financial plans** are calculated weekly, with **weekly** shifts of the plan's horizon. They react to the changing portfolio of products and the utilization of capacities associated therewith. Furthermore, calculations proceed for a stable portfolio of products in the annual plan. **Calculations of cost** and of **capital demands of new products** for the needs of price offers are possible by the **next day**.

25) And what about records of actuality?
Actuality is recorded for the previous day and week for realized phases of main processes. PPROI prices objects of processes on border of phases. Through evidence of consumption or utilization of resources in closely delimited territories PPROI very precisely calculates actual cost, capital demands, and ROI for realized processes. Also automated are comparisons with the plan, i.e., controlling.

26) So PPROI also automates traditional activities of accountants, or controllers?
Yes, the predominant part.

UNIVERSALITY OF PROCEDURES

27) We are speaking of a production company. Are the procedures that you have developed also useful in other types of company?
The principles we have been discussing are **highly universal**. After all, the same things are in play in a production company that are found in purely logistical or trading firms; a production company has departments for purchasing, supplying, sales, and marketing, along with administrative departments with functions analogous to those in non-production companies. For a production company we have applied the principles in warehouses.

ERP – OBSTACLE TO PROGRESSIVE PRODUCTION?

28) There is ongoing criticism of ERP as a brake on the introduction of advanced production systems. Suppliers of ERP systems reject this criticism and refer to positive statements by managers. In your introduction you claimed that the criticism is justified. Can you please explain?
In management, the generally fruitful 80s and 90s of the last century also brought new organization of production. Traditionally specialized, locally separate workplaces with the same types of machines – presses, grinders, drills, etc. – were replaced by cells that included various machines, among which various production streams flowed. For example:

Press → Grinder → Drill or **Drill → Grinder**

Flexible lines were also designed. Responsibility for the realization of processes was entrusted to **teams**. The number of people in a given line could be varied, with different divisions of work; so the speed – tacts of production could also be variable.
However, **ERP systems** were **unable to standardize and plan such flexible and effective production**, which is called lean production. Because they could not be controlled, physical progressive procedures were mostly abandoned. Contemporary companies, with exceptions, have traditional production methods, and lean production is merely a label.

29) Why didn't ERP systems react to effective reality?
There are 'many reasons. One of these reasons is the discussed delimitation of time for an operation. **If you link up two operations process arises that is different from the case of two isolated operations**. The beginning and/or final phases of isolated operations (placing parts into or removing them from a container, moving containers, ...) disappear, and much shorter transitional phases arise. The times of several linked operations are different from the times of those same isolated operations. The differences are varied, depending on which operations are linked. **ERP systems**, with unambiguously stipulated times for operations, **simply cannot cope with this**. Additionally, you must add to this the problem of determining times for the engagement of lines with various numbers of operators.

VARIANT STANDARDS OF INTEGRATED OPERATIONS

30) Based on previous debates, I can see that the problem, which ERP cannot resolve, can be solved by PPROI. In the linking of operations the end or the beginning microphases of isolated operations are replaced by transitional. Because PPROI has at its disposal times for microphases, the times of variously linked operations can be calculated. Is that how it works?
It is. But it isn't simple, if it is to run automatically, which PPROI can do. I must point out that this is only the **first necessary step** is managing truly lean production.

31) How do variant times for various numbers of workers on lines come into being, and how are they used?
PPROI automatically counts variant times, according to algorithms that have been developed. Numbers of workers are limited from below and from above by physical and economic limits. Bottlenecks in lines that determine the shortest possible tacts are automatically located. As the number of workers is increased their productivity declines. But accelerated production process has the benefit of better utilization of other resources.
The basic significance of variant times lies in the ability of production to **react to varying demand**. If requirements increase on some lines the number of workers on them is increased, and vice-versa. The **basic prerequisite for the creation of a leveled plan** then exists.

LEVELED PLAN – TASK NO. 1

32) What do you mean by a leveled production plan?
An **obligatory plan** for production lines **in minutes at least for a wee**k, which
- **corresponds to demand** and
- **ensures optimal utilization of production resources – machines and people.**

The current president of Toyota, Fujio Cho, states that without a leveled production plan it makes no sense to apply the other parts of TPS – an abbreviation designating Toyota's legendary production system.

33) Which system does Toyota use to plan production? What is the relationship between production planning in PPROI and planning at Toyota?
In the older authentic materials Toyota's principle for planning production is described as follows: According to demand, the sequence of types of automobiles on assembly is set, along with the assembly line's tacts, for a period of 14 days. Proportionally, the tacts of lines that produce parts for assembly are set, and the lines are occupied by commensurate numbers of workers. But this procedure is possible only with the constantly repeated production and small numbers of parts produced on individual lines.
PPROI creates leveled plans for variable production. There is no need for repeated production of a certain part during the course of the week. For these purposes original procedures were developed in PPROI, and these are the most sophisticated parts of the entire system.

34) Can you render specific such a plan?
According to the plan, **workers in team operate either alternating or in parallel on multiple lines**, if one line does not constantly occupy an entire team. Plans for lines with linked flows are interlinked, as well as plans for various parts produced together for technical reasons. **The weekly plans are tied together, respecting weekly change of the technological procedures and time standards.**
All of this is algorithmically very complex. But demands for planning and management of production on the part of the user are low. Planning requires **only one central planner**. Traditional shop floor planning and control does not exist. People are saved.

FULFILLMENT OF THE PLAN – PRIORITY OF DAILY MANAGEMENT

35) How is the fulfillment of a production plan ensured and recorded, and how are slippages resolved?
Through **records in kiosks**, PPROI records the presence of workers on individual lines, performance, quality, breaks of machines and other abnormalities. **Fulfillment of the plan is evaluated daily and publicly**, in the presence of the company management. The **motivation of operators** by incentives for fulfillment of the plan is very effective.
If **delays** in fulfillment of occur, they are quickly eliminated by, among other things, **accelerating the tacts** with an increased number of workers as opposed to the plan. There are **no modifications of the plan** due to slippages on some lines, because that would lead to the collapse of the overall balanced plan.

IN CONCLUSION

36) How could you formulate so many interlinked pioneering tasks and master their solution?
- If you make one principal change in an existing system you cannot avoid changes to other principles. And all the more so if you set the target of managing everything according to a comprehensive financial goal, through the most progressive procedures.
- In terms of work, daily close cooperation of the creators of content, structures, and mathematical formulas with informatics and the abilities of both parties was of basic significance. In conceptually new matters there was nothing to draw from.
- Also irreplaceable was ongoing contact with the company - the IS object, in terms of generating requirements and verifying results.

37) What does PPROI require of users?
Knowledge, initiative, and discipline in the maintenance of input data.
Working with PPROI requires greater knowledge than is the case with ERP systems, especially knowledge of mathematics. People who influence a certain group of primary factors of ROI must take initiative in improving them, or on flexible optimization. Source, input information must be maintained on an ongoing basis, and changes in it must be edited in a timely manner. Otherwise all the linked, calculated quantities cannot be up to date.

INTRODUCING PPROI: THE EYE OPENER, IMPROVEMENT

CHANGES OF INFORMATIC, PHYSICAL, AND FINANCIAL THINKING

Ing. Radek Páleník
Financial Director, before that Production Director,
before that IT Manager for HZP Prostejov

From opponent to admirer

When the company's general and financial directors, having completed a two-day, Executive development program at the Prague School of Economics in 2006, presented a proposal to our company's managers **to transform the company into a lean firm according to ROI, including basic changes of the information system**, I was the lone opponent. I have worked in IT for nearly 15 years. I myself programmed a substantial part of the information system, and so I had the opportunity to look deep into the nuts and bolts of ERP systems. A basic change of these traditional, conceptually identical systems seemed impossible to me. Today I speak of **PPROI** as **the harbinger of a new generation of information systems**.

I am completely convinced of this, because I lived through the changes in thinking as the leader of the entire transformation project. **PPROI's characteristics exceed all imaginable criteria**. We economically described our production process with amazing precision. I am fond of saying that we even see the movement of a pallet a few centimeters closer to a machine in financial terms.

INFORMATICS SHOCK

1. Description of a process – microphases and their parameters

As soon as they began working at our firm workers from the CEPC consulting firm addressed the need to **rework all process routings and replace all time standards** as a necessary condition for introducing truly lean production. This involved over 4,000 active product parts, over 70,000 operations, and more than 200,000 time standards determined outside the IS, and over a million data reports in ERP on which technologists and standardizers had been working for dozens of years. The absurdity of the target, in my eyes, only grew when addressing the requirement **to break down operations into microphases** and to set detailed physical and financial parameters for each of them. To me, this meant **tens of millions of hand data records into the IS and unimaginable demands on determining standards, as well as financial numbers outside of ERP.**

On the other hand, based on video recordings and analyses the CEPC consultants documented for us how our standards were incorrect and were unusable for planning and managing lean production. Even the standardizer leaned towards the necessity of changing all the standards.

So I felt that **we were in a trap** – facing the need to solve a key problem, but in terms of the work required the problem could not be solved. Today all of us at the company know that **the problem can be solved**, very effectively, but not by procedures that are traditionally used. The description of the process encompassed **science - mathematics** in particular, in a way we had never heard of, had never thought about, had never dreamed of.

2. Operations in link

Breaking operations down into microphases also proved to be a condition for correct standardizing, planning, and overall management of flexibly integrated operations that are characteristic of lean production and are called „operations in link" in PPROI. It was a revelation for me when the consultants explained to us that an isolated **operation**, the traditional basic unit of a process, **is changing in link with other operations**, and that it makes no sense count the times of isolated operations. I was considerably surprised by automatic calculations **variant standards of operations in link**, which PPROI counts for various numbers of workers on flexible line, and which allow us to change the **speed of production according to demand** in production plans.

3. True integration of data – striving for the same end

In connection with the properties of PPROI, for the first time what the term, **"integration of data,"** was supposed to mean really dawned on me. The full interrelationship of information through mathematical equations in PPROI automatically reflects **the physical parameters and prices of individual resources and products on the company's ROI**. It leads **everyone**, during improvement or optimization, **in all positions in the company, for affecting the ROI as best as he can. In ERP** systems this is **unimaginable**. ERP systems now seem to me to be **sets of nearly isolated parts - moduls**, with minimal mathematical relations among data. And so in comparison with PPROI these systems count nearly nothing; they are like **data storage facilities, rather than calculation tools**. When using the BPCS ERP system we never had problems with times of calculations, even with an obsolete, low-performance server. The utilization of its capacities was low. Conversely, PPROI calculations load up the capacity of one of the latest servers to nearly 100%. Now I am aware of the enormous **potential of current information technologies**, which is **unused in ERP systems**.

4. Seeking out bottlenecks

As a programmer I was fascinated by PPROI's ability to seek out bottlenecks. Each **operation, even the operations in link, is limited in terms of time**. Using the same equipment, for various products there are bottlenecks due to different parts of the machine. For example, for various products on a rolling line the bottleneck shifts among the furnace, the rolling mill stand, and the manipulators. I used to think that there was always just one bottleneck in production process, and that after improvement it would move elsewhere. Today I see that **bottlenecks are dynamic**, and move at different circumstances among different pieces of equipment. I never saw PPROI's functionality to capture this anywhere else and hadn't even heard that it existed. I encountered several suppliers of APS systems, and in free discussions they confirmed that they have nothing like it.

INTRODUCING PPROI: THE EYE OPENER, IMPROVEMENT

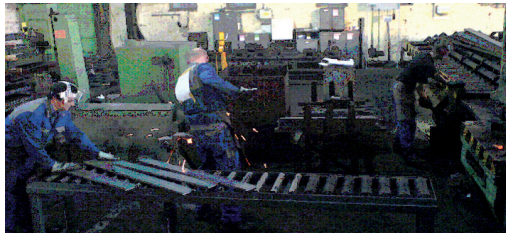
PRODUCTION THROUGHPUT– A SHOCK IN PRODUCTION THINKING

At the time I fully understood PPROI's methods and as the leader of the restructuring project was striving to push it through in production processes, **foremen and operators thought it was nonsense**. And I didn't find the required support among the production managers either. In the interest of competency for overcoming opposition I was entrusted with the position of production director.
The critical moment came on the first flexible line, which served as a pilot. The new way of work was to be tested by workers for the operations on three work stations in the link. **The original standards for isolated operations had the following number of operators and operating times per unit**

Line	Cutting press →	Punch press →	Grinder
Number of operators	2	1	1
Time/unit in minutes	0,5	0,4	1,2

PPROI proposed for the three operations in link
3 workers and **time per unit < 0.87 minutes,** i.e., less than original (2x0.5+1x0.4+1x1.2)/3

Increase of labor productivity in standards was explainable due to the decline in manipulations compared with work at isolated work stations. But this was seen as a **mathematical vagary, because the grinder limits the throughput** and does not allow a time/unit of less than 1.2 minutes. Only one of the workers was willing to take part in the experiment. I decided to demonstrate the new procedure personally in cooperation with the willing worker and an employee of the technical department. Neither this worker nor I had the proper manual routine. During the course of the experiment we were led by CEPC consultants.



Our **flexible transitions and redistribution of work**, as well as **the performance as per the new standard**, made a great impression on the onlookers and **broke the opposition. Today** it is **common practice**.

FALLEN FINANCIAL IDOLS

Cost and profitability

Like most managers, we took it for granted that the **processes** for a certain product must be **evaluated according to cost**, and various **products according to profitability**. The deep-rooted belief, refuted by Professor Matejka at his training sessions, was definitively struck down by two variants for producing door hinges for automobiles.

Hinge price = 4
Variant A: Production of 2 parts plus assembly
Cost = 3,5, Profit = Price – Cost = 0,5, Profitability = **Profit/Price = 0.125**
Variant B: Only assembly; the parts are purchased as components
Cost = 3,8, Profit = Price – Cost = 0,2, Profitability = **Profit/Price = 0.05**
Everyone is under the illusion that variant A is more than twice as effective. But:
Variant A requires 5 times as much capital
The yield of capital, **ROI in variant B is more than twice higher than in variant A.**

Because we calculated this example ourselves it was a profound experience. I recommend this example for the first pages of management textbooks.

Inventories

The second fallen idol of partial financial thinking is inventories, whose minimization is urged by all the world. Everyone who has encountered the issue of lean production surely knows the images of a smiling "one piece flow." However, optimizing production lines for this ideal can be enormously demanding in terms of capital. **You gain small financial benefits from decreased inventories and you lose lots of money in little-used machines** in lines that allow the longest different flows of individual pieces. Therefore, as the financial director **I find it hard to understand the focus of financial audits on each cent in inventories and the absence of interest in the demands of processes on fixed capital.**

IMPROVING, PLANNING, AND FULFILLING PLANS

To me, **support of improvement by PPROI and the dissemination of changes is completely basic**. Any physical change in a workshop is captured with the help of a single microphase. PPROI automatically extends this change to all products that go through a given work station. Next week you already have **it in the production plan, including the financial plan**. And the **fulfillment of actual plans is the priority** of our daily management. Not only **in terms of JIT processes**, but **also in terms of consumption of resources.**

PRICE OFFERS

Our merchants constantly work with up-dated and very precise PPROI calculations in offering our products. An erroneous price contract can seriously damage our firm. During difficult business negotiations **we can go into absolute detail** and make the correct decisions.

PPROI ACADEMY

PPROI has saved time and work for a great proportion of workers who were either directly or indirectly involved in management. However, it has brought hitherto unrequired demands for knowledge of mathematics and skill in the proper use thereof. We train each other **in our own "PPROI Academy."**

CORPORATE RESTRUCTURING REQUIREMENTS SPAWN

A KEY MOMENT

Prof.Milan Matějka in 2001

The cornerstone in the building of PPROI was laid in 2001. At that time Milan Matejka, a professor at the Prague School of Economics, published the principle of measuring capital for processes relating to a certain product as a set of integrals in money-time units in the Czech magazine Moderni rizeni (Modern Management).In the ensuing years Mr. Matejka became the main architect of an information system which, instead of an originally planned superstructure on ERP, was built on entirely new conceptual elements. Attempts at creating a superstructure met with resistance in the form of the shortcomings of the basis – ERP – from its very viewpoint of a physical description of processes. This issue had to be resolved from the bottom up.

THEORY AND PRACTICE

PPROI was born in as close, long-term symbiosis of theory and practices in the restructuring of industrial enterprises, led by a small consulting firm, the Central European Productivity Center (CEPC), under the leadership of Professor Matejka. The firm placed emphasis on linking the physical, financial, and organizational changes of companies. In the interest of ensuring the broadest knowledge basis, a consultancy team was made up of workers of varying prior education and practice: statistics (general and economics), physics (nuclear), product design, production technologies, quality control, informatics, accounting, marketing, and HRM. As a part of corporate restructuring there were ongoing training sessions for people of the companies in new methods of management, and practical knowledge from restructuring was applied in CEPC's public education programs, and especially in executive education programs at the Prague School of Economics, which Professor Matejka led. Some of the participants in these programs, company directors, asked CEPC to lead the restructuring of their companies. The linking of theory and practices was thus multi-faceted.

ACQUIRING KNOW-HOW

In a timely manner CEPC fully seized the wave of the "management revolutions" of the final decades of the last century. In 1988, while serving an internship at MIT's Sloan School of Management in conjunction with visits to other American business schools and companies, Professor Matejka saw the USA during its greatest enchantment with Japanese methods. His studies at the University of Hitotsubashi Tokyo, together with visits to Japanese companies, including the Toyota headquarters, allowed him to deepen his practical knowledge of Japanese management.

In 1990 and 1991 Professor was the Czech director of the first western Executive MBA program in Czechoslovakia, organized by the prestigious Rotterdam School of Management, which was a comprehensive source of knowledge on the latest management theory. An extraordinarily significant source for practical restructuring know-how was the great literature of the American publication and consultancy company Productivity Inc., to which the direct creators of lean production, Taichi Ohno and Shigeo Shingo, contributed with their books. "Productivity" made it possible for CEPC workers to participate in its consultancy programs organized for American managers.

The knowledge of the CEPC team was also acquired from outside in conjunction with its own consulting activities. Its activities at Skoda Plzen made it possible to get to directly know the management at GE soon after the organizational reengineering into the Center of Excellence in Schenectady; also, knowledge about 6 Sigma, from training by GE instructors in Pilsen, was acquired shortly after the implementation of the method at GE itself.

But in practical restructuring project of CEPC all acquired know-how was insufficient.

Common weakness of all theories and practices was absence of right criterion .

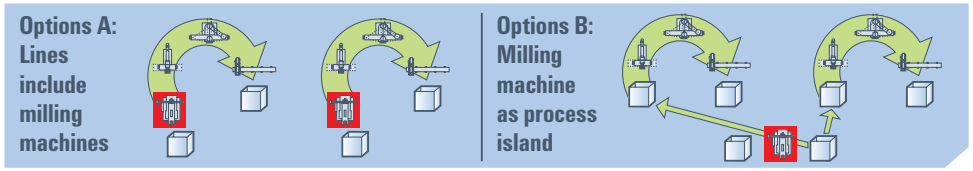
» A repeated story: Management paid a million dollars to a training company who taught us 5S and did a lot of 5S workshops. But we did not save any money, quality did not get better, and eventually management stopped the program.[1]/«

FINANCIAL DISAPPOINTMENT FROM RESTRUCTURING

The high expectations from the "revolutions" in company management were not fulfilled, especially in financial results. There are reasons for this. The literature, as well as the practical procedures, devoted only a minimum of attention to the financial aspects of restructuring; everything fell under the motto, "Do things the new way and the financial results will follow." With the popularization of lean production the number of quickly trained consultants focused on partial physical aspects of processes, starting with 5S. Their financial knowledge mostly approached zero, and their consultancy cost companies a great deal of irretrievable money. The rash application of models of lean production, continual flow, kanban, minimization of warehoused inventories, etc., just like efforts to achieve 6 Sigma in the variance, also had to have negative financial impact. Why make universal efforts towards extremely low variance when most products in use are fully suitable with much greater variance? How to understand Lean 6 Sigma, allegedly a symbiosis of lean production and 6 Sigma, when the model of lean production, Toyota, considers excessive precision as one of the 7 types of economic losses in production?

CAPITAL, COST AND ROI OF PHYSICAL SOLUTIONS

Production restructurings under CEPC's leadership are focused primarily on conceptual changes, the creation of flexible lines, and a multi-operational team work. In connection with this there are already key financial aspects. How to limit lines, which machines and equipment should be included in them? When one machine is enough to supply two lines, should it work alone or should two identical machines be included in the two lines? This involves the problem of capital not only in inventories but also in machines, building space, and also the cost aspects of the options. Only ROI can give the answer.



It was very difficult to quantify not only capital demands, but also cost of alternatives. ERP systems do not provide such information if only of existing operations. This was the one of most important stimulus to build a new information system, PPROI.

MANAGEMENT INFORMATION SYSTEM

It is necessary not only to optimally design conceptually new real processes, but also to manage them on a routine basis – to standardize, plan, keep records of reality, physically and financially, dynamically and effectively. ERP systems are not able to do any of this. Therefore CEPC was not able to cap off restructuring projects with a management information system. CEPC's provisional scheduling of production lines by spreadsheets helped only partially, they were demanding, and they were not linked to MRP in management of inventories. Building a new management information system and providing new information services became apparent as an urgent necessity. In the interest of this lean information firms were established – PPROI Development and PPROI Services. The development of the new information system, taking place in constant interaction with specific needs of practice, indicated the necessity of solving the issue fundamentally and comprehensively; to change the very bases of traditional information systems and to depict and control company products, resources, and processes comprehensively, in an integrated manner, in all of the company's departments. Such are now the properties of the current PPROI information system.

1/ Source: Jeffrey K. Liker: The Toyota Way

THE OTHER SIDE OF SUCCESS

The vision, abilities, cooperation, and boundless efforts of individuals at PPROI companies were not sufficient for the creation of a new type of information system. The other party also played a substantial role: people within restructured companies. Awareness of the need for fundamental change, faith in its success, a willingness to intensively participate in it. Chance also played a role.

LINET ZELEVCICE: THEY ARE NOT INTEGRALS?

A manufacturer of hospital equipment. Very innovative and successful. The first firm in which CEPC introduced lean production in the 1990s. When explaining the significance of the turnover of capital while training company employees, the company's director noted, „True, it's complicated, but these are not integrals." This comment was seen as marginal, a good joke. If the director had stated the reverse, the development of PPROI would have been begun many years earlier, probably. Now this comment is etched forever into the memories of CEPC consultants.

MORA AEROSPACE/HONEYWELL: THE FIRST STEPS

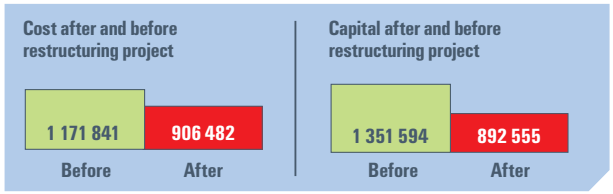
Manufacturer of aviation components a company owned by American investors. Relatively smooth introduction of lean production. First consulting halt by CEPC after resolving the issue of measuring capital in a process by means of an integral. Compact, progressive management of the company inclined towards managing in accord with ROI.
Works on it halted during the acquisition of the company by the Honeywell corporation.
In the management of production the Six Sigma+ and Balanced Scorecard were implemented. Both without a single financial number. A CEPC's presentation of the concept of managing production by ROI was not met with enthusiasm by the new production director who came from USA. He did not manage production financially.

EDSCHA BOHEMIA: PROTOTYPE

Manufacturer of components for the automotive industry. CEPC's first restructuring project, starting lean production with a declared orientation towards ROI. First computer calculations of capital and ROI in processes. Results of the project evaluated by the concern's management as extraordinarily positive. In financial results the company repeatedly came in first in the global „league" of the concern's companies.

On Saturday 8th September 2007 Edscha Bohemia celebrated first place of the company in the competition of all 23 Edscha production plants all around the world.

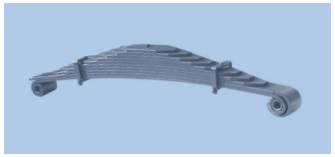
During the course of the project PPROI calculated annual savings in costs and capital in phases of processes for groups of products realized in newly created lines instead of former operations in isolated workplaces.



Costing in accord with the concern's methods based on data in the concern's spreadsheets. Great distortion of cost by the method; the clear conclusion of PPROI experts that the problem can be solved only by information relating to micro-phases of processes.

PPROI did not replace the ERP system. Production lines were scheduled with spreadsheets. The concern's consent to the replacement of the core of the widely used IS Brain was improbable. Calculation of capital and ROI per processes according to products was prototype of PPROI, used only for assessment of restructuring projects

HZP PROSTEJOV: PPROI IN MANAGEMENT OF THE COMPANY



Manufacturer of springs:
- multi-leaf springs for trucks
- coil springs for carriages

High quality products. Supplier to SNCF – TGV trains, Alstom, Scania ...

Intricacy and awareness of the need for change

In the manufacture of leaf springs, despite the efforts of planners, dispatchers, and foremen for coordination, was the permanent, great chaos. The problem followed from the extraordinary intricacy of the seemingly simple production on HZP's equipment. This was partially due to the specific procedures of the individual leaves of the given spring, but also the necessity of their common sequential processing on several pieces of equipment, the penetration of procedures of various types of springs on a single piece of equipment; the unclear convergence and divergence of the broad portfolio of products. There was a general awareness of a crisis in production management and the necessity of basic change. Also important was the possibility of change. The Czech owner of the company in no way limited the change, and no strait jacket of the practices of large concerns, which prevent innovations on a company level, existed.

Replacing the ERP core – stepping into the unknown

From the beginning, the restructuring project advanced on two fronts. Substantial changes in the layout, in the case of large heating equipment very expensive, a change of the method of work, ..., everything that is common when introducing lean production in physical processes. This exhausted the capacities of the people. And concurrently the comprehensive replacement of the ERP core with, among other things,
- revision of routings of all parts, numbering in the thousands
- replacement of problematic standards of many ten thousands of operations with precise plastic standards in hundreds of thousands of micro-phases
- classification and comprehensive setting of parameters of products and resources in PPROI

This required not only a new, unknown method of work for the members of HZP's great restructuring team, but also boldness and patience on the part of the firm's management. This was the first such case in history, and concerns as to the result were appropriate. Only a few companies are willing to pioneer into the unknown.

The EU's Lean Firm training project

The company's restructuring received great assistance from the mass cascade training of employees as part of the Lean Firm project, with financial support from an EU fund. This training involved the management, the entire production staff, salespersons, and other company employees. This helped mutual understanding, and the overcoming of the barriers of the company's departments. And finally, it facilitated the next phase of the restructuring project, which changed the method of work throughout the firm and integrated everything into one lean supply chain.

An outstanding personality

Success often depends on individuals. In this extremely demanding project HZP engineer Radek Palenik played an irreplaceable role. He was the project's guarantor, at the beginning the chief of informatics. In the past he prepared aids for HZP workers on spreadsheets, which were required as a result of the clumsiness of the BPCS ERP system. In the course of the project's first phase he was the production director, and at the end he was the financial director. He understood all the new procedures in detail, and he led HZP's workers in an ongoing manner. He even physically demonstrated for the workers multi-operational work on the lines.

The customer's acknowledgement

The first look at PPROI by employees of Scania, a major customer of HZP, resulted in a positive reaction. HZP received increased orders from Scania, and the PPROI team was invited to Sweden to present the information system.

PRINCIPLES OF MANAGEMENT BY ROI

PRINCIPLES OF STRATEGIC MANAGEMENT ACCORDING TO ROI

The basic areas of increasing the value of capital are processes delimited according to products and customers who pay for these products. The cause of different ROI values in the same processes for the same product, but for different customers, can be varying prices of products. If prices of products for various customers are the same, the basic areas for increasing the value of capital are the processes delimited according to products.
A company's ROI value is the weighted average of ROI values in these basic areas. The weights are the amounts of capital in these areas. If the basic areas are processes according to products, then

$$ROI_p = \frac{\sum_i ROI_i * C_i}{\sum_i C_i} = \sum_i ROI_i * \left(\frac{C_i}{\sum_i C_i} \right)$$

Where

ROI_p	is the company's ROI value
ROI_i	is the ROI value in the processes for product "i"
C_i	is the capital in the processes for product "i"
$C_i / \sum_i C_i$	is the share of capital in the processes for product "i" in the total capital in the processes

The influence of the capital weights on the company's ROI value is great. Situations when ROI values in individual areas rise and the company's ROI value declines, or vice-versa, are not exceptional. Therefore managing the structure of capital in processes according to products is one of the basic features of strategic management of a company that is oriented towards maximal growth of the company's ROI.
The structure itself of the capital is determined

- by the capital requirements of individual products
- by the quantities of individual products

Managers must take both into consideration when managing the structure of capital. However, managers control their companies' ROI values primarily by managing partial ROI values in processes according to products and customers.
Changes in structure of capital and partial ROI values are not independent. Sometimes it is possible to increase a company's ROI values, through changes in the structure of capital associated with declines of partial ROI values.

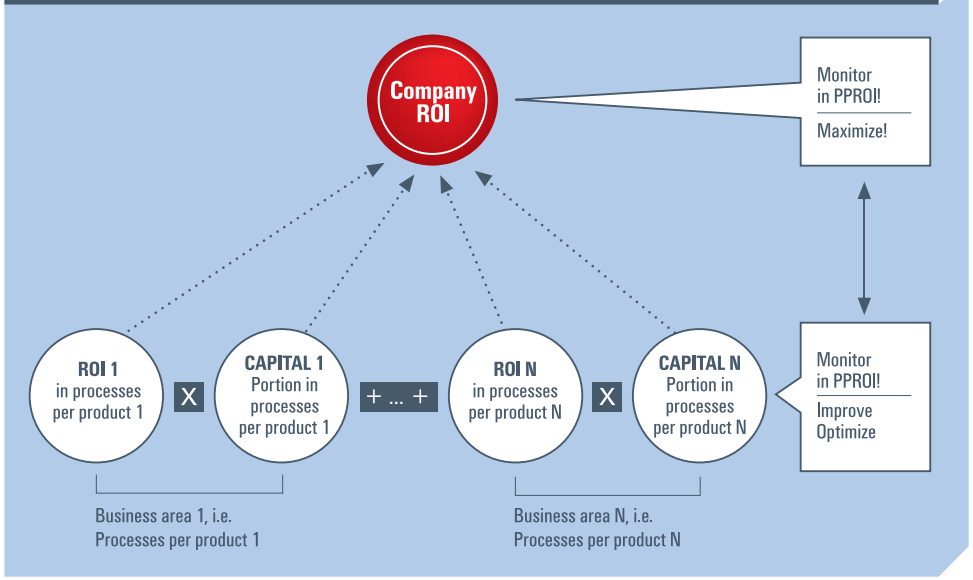
THE THINKING OF MANAGERS = THE ENRICHED THINKING OF INVESTORS

Capital investors with portfolios including of multiple companies

- are watching return of investment to each of the companies
- by purchases and sales of shares or other capital stakes govern the structure of the capital.

When managing companies by ROI, managers act in the interest of investors, so as to ensure for them the highest ROI of their capital in individual companies. When managing the structure of capital they proceed in a way that is analogical to the way investors behave; but they manage the structure of capital on a deeper level.
Portfolio investors do not have the opportunity to directly control partial ROI values, which are, from the investors' point of view, the company's return on investment. Conversely, for company's managers controlling partial ROI values is a basic obligation. The thinking and procedures of portfolio investors in the management of companies according to ROI are thus insufficient, and it is necessary to enrich them substantially.

Schema of company's ROI maximization



MANAGING PARTIAL ROI VALUES

ROI values in the processes for a certain product are determined by the price of the product, cost, and capital in the processes relating to the product

$$ROI_i = \frac{PROFIT_i}{CAPITAL_i} = \frac{PRICE_i - COST_i}{CAPITAL_i}$$

where

i	is a symbol specifying processes according to products; I = 1,2,...,N

Management of partial ROI values thus relies on the management of prices, cost, and capital in relations as set forth in this equation.
Cost of processes and capital in processes are determined by resources that are at work in the processes, the duration of their involvement and their capacity utilization. However, individual resources are reflected in cost and capital in various ways. In variants of processes for a given product the relations of cost and capital can be in conflict. Compared with another variant, one variant could have higher cost, but lower capital demands for the processes for the given product. In those cases it is necessary to balance both quantities against each other, so that the company's ROI can be maximal. Special attention is devoted to this issue on on further pages.

EXAMPLE OF PROCEDURES IN MANAGEMENT BY ROI

Company employees improve the ROI of the company in basic – starting situation
- **first by improving the structure of the capital according to products**
- **then by improving the processes.**

Different products are manufactured on shared machines and equipment.
Capital in processes is primarily measured in euro-minutes (€min.), and in the tables it is stated in millions of euro-years (€years).
Values in individual situations relate to comparable periods.

A) BASIC SITUATION

Product	Number of products	Unit price	Unit cost	Unit profit	Unit capital	Sales of production	Cost of production	Profit from production	Capital for production	ROI = Profit/capital
	Unit	*€*	*€*	*€*	*€ years*	*€ mn*	*€ mn*	*€ mn*	*€ years mn*	*€ mn/ € years mn*
1	16000	6000	5000	1000	5000	96	80	16	**80**	**0,20**
2	3500	5000	5800	-800	2000	17,5	20,3	-2,8	**70**	**-0,04**
3	20000	2000	1825	175	2500	40	36,5	3,5	**50**	**0,07**
Total						**153,5**	**136,8**	**16,7**	**200**	**0,0835**

B) CANCELLATION OF PRODUCT 2, INCREASE IN PRODUCTION OF PRODUCTS 1 AND 3

Achieving higher sales of products 1 and 3 by lowering their prices. Values of ROI in the processes for the individual products decline. However, changes in the product structure of capital more than compensate the decrease in ROI values for the individual products and the company's ROI increases.

Product	Number of products	Unit price	Unit cost	Unit profit	Unit capital	Sales of production	Cost of production	Profit from production	Capital for production	ROI = Profit/capital
	Unit	*€*	*€*	*€*	*€ years*	*€ mn*	*€ mn*	*€ mn*	*€ years mn*	*€ mn/ € years mn*
1	24000	5800	5000	800	5000	139,2	120	19,2	**120**	**0,16**
3	32000	1925	1825	100	2500	61,6	58,4	3,2	**80**	**0,04**
Total						**200,8**	**178,4**	**22,4**	**200**	**0,112**

C) IMPROVEMENT OF PROCESSES FOR PRODUCTS 1 AND 3

The ROIs in processes for the individual products rise as a result of decrease both the capital per product units and cost per product units.
The total capital of the company declines in comparison with Situation B) as a result of the decrease in inventory; the fixed capital remains unchanged. Share of capital per product 1 with higher ROI then per product 3 slightly rises which has positive effect on company's ROI.
The company's ROI rises as a result of the increased ROI values in the processes for both products, and due to the change in the structure of the capital.

Product	Number of products	Unit price	Unit cost	Unit profit	Unit capital	Sales of production	Cost of production	Profit from production	Capital for production	ROI = Profit/capital
	Unit	*€*	*€*	*€*	*€ years*	*€ mn*	*€ mn*	*€ mn*	*€ years mn*	*€ mn/ € years mn*
1	24000	5800	4840	960	4800	139,2	116,16	23,04	**115,2**	**0,2**
3	32000	1925	1741	184	2300	61,6	55,712	5,888	**73,6**	**0,08**
Total						**200,8**	**171,872**	**28,928**	**188,8**	**0,1532**

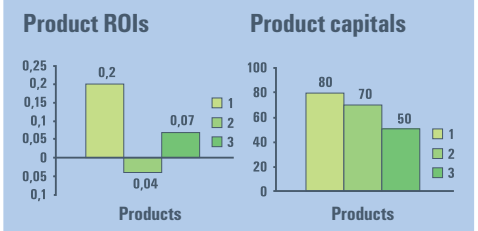
Calculation of company's ROI value
Starting situation example

$$\frac{0{,}20 * 80 + (-0{,}04) * 70 + 0{,}07 * 50}{200} = 0{,}0835$$

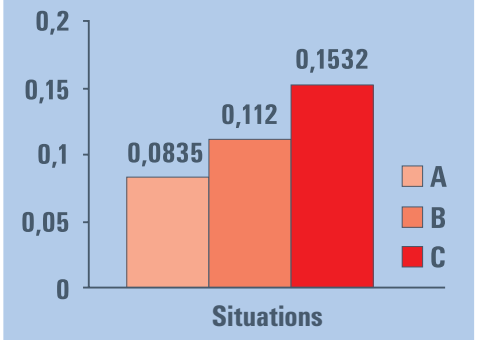
nebo

$$0{,}20 * \frac{80}{200} + (-0{,}04) * \frac{70}{200} + 0{,}07 * \frac{50}{200} = 0{,}0835$$

Product ROIs and capitals, graphically
Starting situation



Development of company's ROI value



COSTS VERSUS CAPITAL

TRADE-OFF AND TRADE-OFF-FREE SITUATIONS

Costs and capital in process alternatives for a certain product generally have different relationships. Frequently one variant requires lower costs, but higher capital than another. Capital and costs are in trade-off, and it is necessary to find the optimal variant. But this situation need not always arise. Sometimes one variant is more advantageous than another according to costs and capital; this is a "trade-off-free" situation; the most common case of this is improving the phases of processes by elimination or simplification of some activities without investment. In such situations making decisions is unambiguous.

LIMITED COMPENSABILITY OF COSTS BY CAPITAL ACCORDING TO ROI

In the management of products, processes, and resources according to ROI in trade-off situations costs and capital are balanced in such a way that the ROI value is maximal

However, in ROI higher costs can be compensated by lower capital for only if the cost of the product is lower than the price of the product, i.e., the profit is positive.

UNLIMITED COMPENSABILITY OF QUANTITIES IN "ECONOMIC" PROFIT

In management the term costs is commonly used in the sense of accounting costs. Economic theory also works with so-called economic cost as defined by the equation

Economic cost = Accounting cost + Capital * standard ROI

The product of capital and standard ROI value express standard yield of investing capital beyond the situation being evaluated. The economic profit is calculated from sales and economic cost.

Economic profit = Sales – Economic cost

The compensability of cost by capital in economic profit is unlimited. This type of quantity has become very popular under the abbreviation EVA which is applicable only for assesment of the whole company. With information on capital in processes per products it can also be used for evaluating products. Economic profit is a completely different measure than ROI, for two reasons:

- Mathematical relations between the same quantities are, in economic profit, different than in ROI
- Economic profit, unlike ROI, is additionally defined by the standard ROI value

According to the economic profit production with a book loss can be rated as better than profitable production.

Situation	Sales	Accounting cost	Capital	Standard ROI	Economic cost	Profit	ROI	Economic profit
1	100	102	50	0,12	6	- 2	- 0,04	- 8
2	100	98	100	0,12	12	2	0,02	- 10

Evaluations according to economic profit depends on selection of standard ROI value, which is speculative. And it is generally difficult to defend that accounting loss is better than an accounting profit. The company is able to finance itself with a low profit, but not with a loss. PPROI can calculate economic profit per processes acording to products, but nobody in company would accept the preference of products which generate loss (situation 1 in a table) over profitable products (situation 2). The governing objective criterion has to be ROI.

DIFFERENT TURNOVER OF GOODS

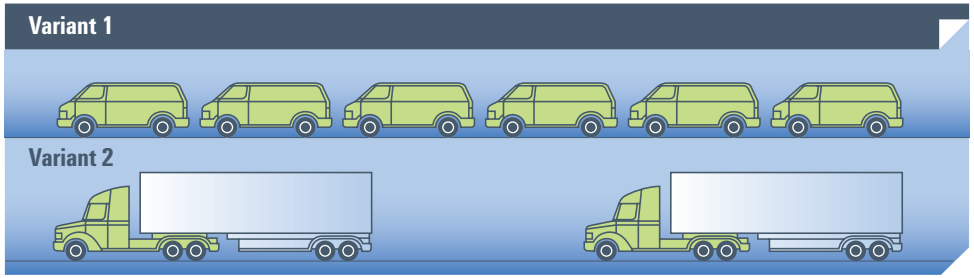
The long-time experience of merchants is that a lower profit per goods with rapid turnover is better than a higher profit from products that sit on shelves longer. This is simple situation of a trade-off between costs and capital. Goods employ capital in themselves and in the equipment and building in which they are located.

Goods	Purchase price - €	Logistical and other cost - €	Sale price - €	Profit €	Turnover days	Capital in € Kyears	Profitability	ROI
A	80	19	100	1	7	5	0,01	0,2
B	75	20	100	5	120	50	0,05	0,1

Article A has low profitability but rapid turnover. Capital employed in the article and in fixed capital per unit of an article is low and ROI is high. Slower-selling article B, which is 5 times more profitable has only half of ROI in comparison with A.

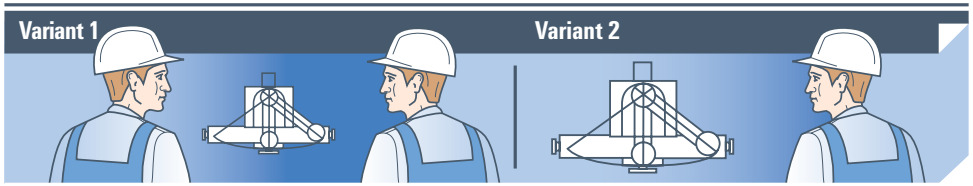
VARYING FREQUENCY OF FLOWS, FREQUENCY OF DELIVERIES

Material flows, both intra-company and inter-company, take usually place in batches of items. Smaller batches generate usually higher costs of individual products, but they decrease capital in inventories and space demands. In the example of external deliveries variant 1 is better in terms of capital in company investories, and variant 2 is usually better in terms of delivery costs.



DIFFERENT STRUCTURE OF RESOURCES. LEVEL OF MECHANIZATION AND AUTOMATION

Another common factor in trade-offs between capital and costs in process variants is a different structure of resources. An example is the differing automation of a process. Two persons in variant 1 work simpler machine, one person in variant 2 works bigger, more automated machine



With the growth of automation capital in machines and equipment increases, while wage costs decline, and overall costs can also decline; in the example Variant 1 demands more capital than Variant 1, but costs in Variant 2 can be lower.

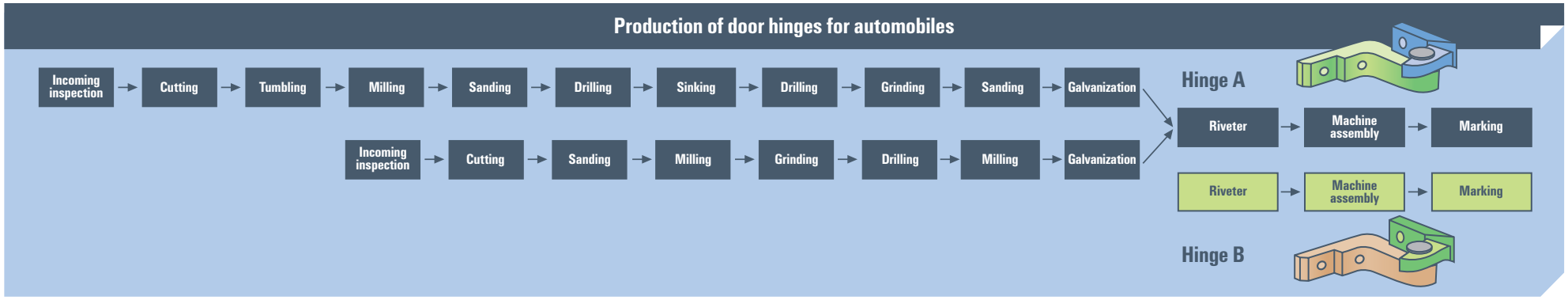
INFLUENCE OF PROCESS EXTENT ON CAPITAL AND COSTS

EXTENT OF PURCHASE, COMPLEXITY OF PRODUCT, COMBINATION

The basic problem of management decission making is what to purchase and what to realize from one's own resources – "make or buy." The decision has a basic influence on the extent of a processes per producst within the company. Another factor of the extent of a process is the complexity of the product. If the financial parameters of various products are compared, both factors usually act at the same time. Greater extent always increases the capital demands of processes, and with given profitability of products decreases ROI values.

VISUALIZATION OF A PROCESS AND ITS CAPITAL DEMANDS

The extent of processes is marked on process maps, from which it is possible to deduce the capital demands of a processes. The following schematic shows the difference of capital demands of two nearly identical products. The parts are made for one hinge, and they are purchased for the other hinger. In both cases the parts are assembled.
The next example illustrates the production of products of differing complexity from the same incoming materials.



Financial demands for processes per hinges

Hinge A is made in 23 workplaces, while hinge B is made in 3 workplaces.
For simplicity let us assume that for each of these workplaces the capital demands of production in €minutes are the same and, expressed in €years equal 0,2.

- The capital demands of making hinge A in 23 workplaces are 23*0,2 = 4,6 €years
- Production capital for hinge B = 3*0,2 = 0,6 €years.

For simplicity let us further assume that other capital, in the supply and sales phases, and in supporting processes, is comparable for both products and amounts to an aggregate 0,4 €years.
The total capital for hinge A = 4,6 + 0,4 = 5 €years, and for hinge B = 0,6 + 0,4 = 1 €year
The capital demands of processes for hinge A are thus 5 times greater than for hinge B.

- The price of both hinges is €4 per hinge
- The cost of hinge A = € 3,5, and of hinge B = € 3,8; the profit for hinge A = € 0,5, and for hinge B = € 0,2

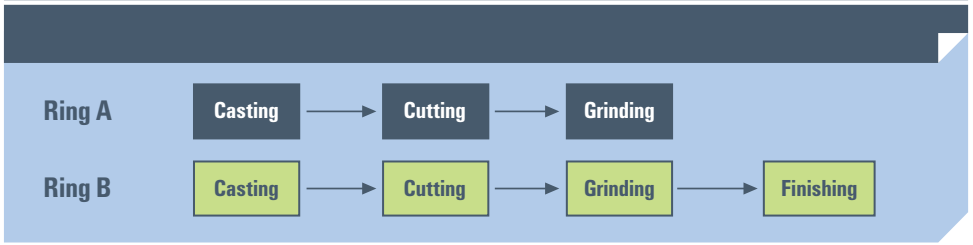
The values of ratio indicators are summarized in the table:

Hinge	Capital	Cost	Price	Profit	Capital / Price	Profitability	ROI
A	5	3,5	4	0,5	1,25	0,125	0,1
B	1	3,8	4	0,2	0,25	0,050	0,2

Traditional financial evaluation of products according to their profitability is evidently misleading. True, product A is 2.5 times as profitable, but its production requires 5 times as much capital. ROI, is therefore twice higher in the processes for product B.

Example of production of products of differing complexity from the same incoming materials

A company casts two types of piston rings which are different in terms of precision in their processing. We divide the production into groups of operations.



Let us assume that finishing is demandig on capital in very expensive machines

Ring	Material	Other cost	Total cost	Price	Profit	Capital	Profitability	ROI
A	100	90	190	210	20	300	0,095	0,667
B	100	110	210	240	30	500	0,125	0,600

Even this way of increasing the extent of a process on a product thus may lead to products with higher profitability have, as a result of greater demands on capital, a lower ROI value.

FROM DETAILS TO A COMPANY'S ROI VALUE

ACCURACY, MANAGEMENT ON ROOT CAUSES, RESPONSIBILITY

The schema on this page illustrates the procedure for calculating costs of cutting tools in PPROI. From the schema it is clear that even the cost of a single drill, in one microphase of the process, is generated by more physical factors, and by prices for acquiring and maintaining the drill. Without the information marked in green color it is not possible to calculate accurate cost of the process and the product for the drill. Information of PPROI is very important for practical management of cost factors. Cost of the drill can be managed only by physical parameters of the drill and driling machines and by purchase prices of the drill and prices of its sharpening. This is management on root causes. Detailed information of PPROI is also very important for assingning the responsibility of company departments for cost factors and for controlling the results od departments. Procedures and information of PPROI have no competition in ERP systems. And attempts to obtain needed information outside of IS would be unrealistic.

COMPACT INTERLINKED ENTITIES OF PPROI

The schema elucidates PPROI's architecture as a system of interlinked, compact, transparent entities. Requirements for information inputs are minimized in this architecture, and the efficiency of outputs is maximized by PPROI's processing algorithms.
The company must have available the physical data that PPROI requires for correct financial calculations primarily for the correct physical realization of processes and products. PPROI structures this information transparently and efficiently within the framework of the database system, which maximizes its usefulness and controllability.
The data in the schema contain only a selection from the parameters in the entities. Also, the micro-phases within operation in the table are incomplete. The given operation can include various micro-phases, according to links with subsequent and previous operations.

Procedure for calculating the cost of drill bit no. RO1538 for the operation of Drilling the Central Hole in part no. 2144301 using the Heltos IV drill

Process routings – definition of operations for parts by classes

Part no.	Operation no.	Group of operation	Type of operation	Sort of operation
2144301	...			
2144301	30	Drilling	Heltos IV	Central interstice
2144301	...			

Cost of operations in linkage

Part no.	Operations in linkage	Cutting tool
2144301	10 - 40	
2144301	50	
2144301	60 - 90	

LEGEND

- Edited values of parameters are marked green
- Dotted arrow lines characterize the logical links of parameter values
- Solid arrow lines characterize computational ties of parameter values
- Logical links of related entities are not represented in the interest of the overall transparency of the schematic

Parameters of micro-phases of parts

Part no.	Group of operation	Type of operation	Sort of operation	Micro-phase of type of operation	Time of micro-phase
2144301	Drilling	Heltos IV	Central interstice	...	
2144301	Drilling	Heltos IV	Central interstice	Automated drilling	
2144301	Drilling	Heltos IV	Central interstice	...	

Minute costs – Cutting tools

Tool no.	Minute cost of machining
RO1538	

Acquisition and maintenance costs – Tools

Tool no.	Acquisition price	Sharpening price
RO1538	580	40

Physical parameters of parts – trapeze leafs

Part no.	Type of steel	Thickness	Central interstice diameter
2144301	46SiCrMo6	12	15
...			

Physical parameters of types of steel

Type of steel	Hardness
46SiCrMo6	280
...	

Physical parameters of drilling machines

Type of drill	Adjustable RPM...	Adjustable advance
Heltos IV	56, 90, 140, 224, 350, 560, 900, 1400, 2240	0,11, 0,18, 0,28, 0,45
...		

Micro-phases of types of operations

Group of operation	Type of operation	Micro-phase of type of operation	Type of tool
Drilling	Heltos IV	Moving container by crane from storage	
Drilling	Heltos IV	Moving patrs by handler to drill	
Drilling	Heltos IV	Fitting the part in the jig	
Drilling	Heltos IV	Automated drilling	Drill
Drilling	Heltos IV	...	

Physical parameters of cutting tools – drill bits

Bit no.	Type as per producer	Diameter	Steel hardness	RPM recommended by producer	Advance recommended by producer	Durability of edge in minutes	Number of sharpenings in lifetime
RO1538	221143	15	280	248	0,13	80	8
...							

THE INTEGRAL OF CAPITAL IN A PROCESS

A NEW MEASURE IN ENTERPRISE INFORMATION SYSTEMS AND IN ACCOUNTING

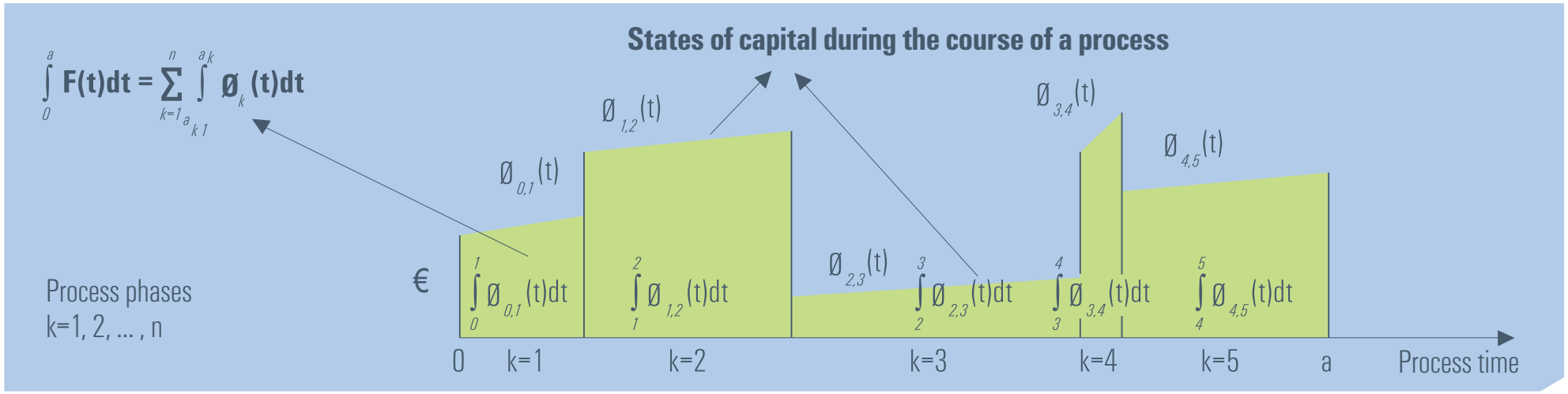
Each process has two types of financial demands generated by resources: costs and capital employed. While cost belongs to the traditional, single-dimensional quantities and is measured in monetary units, the capital in a process is a two-dimensional quantity, measured in monetary-time units. From a mathematical point of view this involves the integral that "sums" up the states of capital employed at individual moments in a process into the value of the total quantity of capital in a process. The specific of the measure of capital is striking in its graphic depiction as a surface; traditional, one-dimensional measures are functions that are depicted by curves.
The integral must become the standard measure in accounting and in IS as well, because to further ignore capital in a process, even if it can be measured precisely, as demonstrated in PPROI, would be absurd.

A NATURAL MEASURE. FRIGHTENING SYMBOLISM?

The integral is the natural measure of capital in a process, and it is natural to compare the yield with the thus-measured capital when calculating ROI.
One cannot avoid the integral for the needs of right financial evaluation of processes, their products and resources.
The symbolic annotation of an integral can be frightening. But the mysterious symbol ∫ is only a special annotation of the letter S – the symbol for a sum that, according to historians, originated in the transcriptions of the integral by the secretary of the British Royal Society, using the narrow, elongated letter. Mathematicians liked it, and so it remained. In terms of content, the integral of capital in a process is very comprehensible, and it is possible to remove the mystery from the mathematical symbols.

A SYMBOLIC RECORD AND IMAGING OF CAPITAL IN A PROCESS

Capital in a process is measured in monetary-time units. When dividing a process into phases the integral can be noted and displayed in the following manner:



TWO TYPES OF CAPITAL IN A PROCESS

The picture represents the total capital in a process. This capital comprises two main parts:

- capital contained in the object of the process; in manufacturing process this is capital contained in the produced part and recorded in inventory status; the status function grows continuously;
- capital contained in resources of the process; in manufacturing this involves in particular capital in machines and equipment and in parts of buildings that serve in the realization of the process; this capital changes in jumps at changes of phases of the process and can rise and decline.

Therefore the area of total capital in a process has a shape, as illustrated by the image.

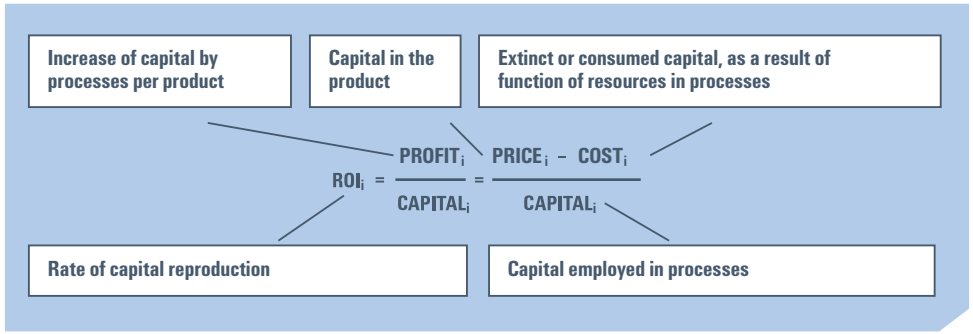
COMPONENTS OF CAPITAL AND COMPONENTS OF COST

Capital in buildings, machines, and equipment, broadly, in movable and immovable property, are fixed, as a rule. Capital of this type also contains intangible resources of processes, e.g., various software programs. These resources, likewise as any other resources, generate cost. However, not all resources represent capital in the resources. For example, workers and services, both very significant in terms of cost, do not represent capital (from financial point of view). These resources are reflected only in the capital contained in the object of the process.
Calculations of capital in a process, as well as the structuring the capital in the process, differ objectively from calculations and the structuring of cost. In PPROI these differences are reflected in reports, among other places.

CONTENTS, VARIANTS AND ANALYSES OF ROI

A MEASURE OF THE REPRODUCTION OF CAPITAL

The quantities, which define ROI per individual product, can be all interpreted as measures of capital



Interpretation of ROI as a measure of the reproduction of capital best sums up the content of this key quantity, and it is useful to keep it in mind. It is also useful to see the cost of product as consumption of capital and the profit for product as the absolute growth of capital in the processes per product.

COMPREHENSIVENESS OF ROI; A NATURAL BALANCED SCORECARD

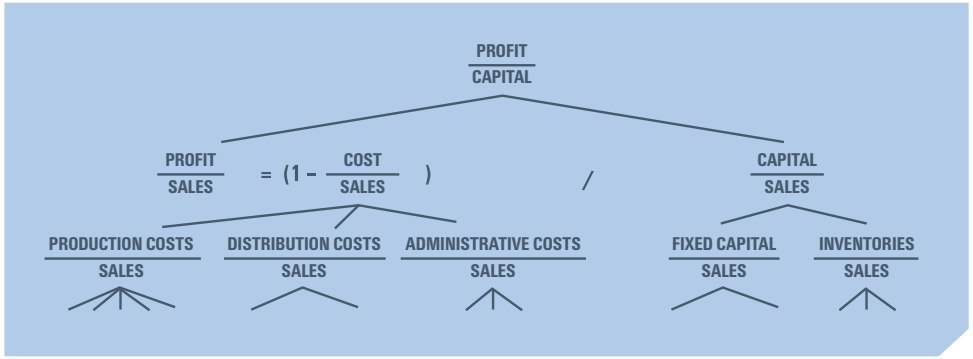
ROI can be seen as a natural, objective, "balanced scorecard" of everything. Everything else in relation to ROI is ether factor or a constraint.
Various artificial "balanced scorecards" are always subjective, both as a selection of factors and as a formulation of their ties. The resulting BSCs values are impossible to interpret in terms of content. Efforts to maximize the resulting BSC values can lead to erroneous decision-making, as are efforts to maximize or minimize the values of partial indicators (see the next page).

DELIMITATION OF CAPITAL FOR MANAGING PROCESSES AND PRODUCTS

On a company level ROI is calculated in multiple variants, most often as ROA – return on assets – and ROE – return on equity. These variants are not suitable for managing processes and products. Furthermore, ROA is a distorting measure of the reproduction of capital, because assets contain inter-company overlaps of capital. Capital contained in one company's receivables is also contained in the debts of other companies.
In PPROI, capital is primarily measured for the resources that are really involved in company's processes, regardless of how they are covered financially.
If company processes take place on items owned by a customer, the capital in these items (material, goods, ...) is not included in the capital employed in processes of the company that implements the process. The overlaps of capital are avoided.
PPROI also makes it possible to keep records of capital in receivables for individual products and financial commitments to suppliers relating to delivered materials and other items. It thus allows a view of ROI of products in terms of financial coverage.

PPROI AND FINANCIAL ANALYSES OF ROI

ROI's synthetic nature, its superiority over all other financial quantities, and the necessity of evaluating the financial demands of production on resources in terms of costs as well as capital, are striking in so-called pyramids of financial ratios. These pyramids exist in multiple variants, particularly at thein lower levels. Example:



Pyramids came into being in the 2nd decade of the 20th century at Dupont for analyses of the development of ROI. In 1959 the Centre for Inter-firm Comparison was established at Great Britain, which compares the ratios of participating firms.
The central idea is the same. Comparisons of the values of analytical indicators should determine strengths and weaknesses of the company in definite period of time and indicate what needs improvement.
This seemingly logical procedure has two fundamental, corresponding weaknesses

- It assumes the independence of values of individual indicators in the pyramid's horizontal level. Frequent trade-offs have the effect that better values of some indicators are inseparably linked to worse values of other indicators in a given situation as compared with another. These trade-offs are different and unknown and isolated changes of indicators are unrealistic.
- It works with company-wide values, not with values for products and processes

These weaknesses explain the marginal significance of these financial analyses in the practical management of companies.

PPROI AND ACCOUNTING IN MANAGING ROI - SUMMARY

From a look at the pyramid it is clear that costs, the key measure in management accounting, are just a factor of ROI in financial accounting. Another weakness of management accounting lies in inacuracy of its information on costs.
However, information of financial accounting cannot be used at all for managing products and processes, which is the basis for managing a company.
PPROI measures costs and capital in processes in detail, and all partial values reflects in the company's ROI value. It provides necessary information comprehensively and accurately.

System	Capital, ROI	Products, processes
Financial accounting	YES, but	No
Management accounting	No	YES, but
PPROI	YES	YES

PPROI AND ONE-SIDED THEORIES

ONE-SIDED THEORIES AND PRACTICES IN THE LIGHT OF ROI

The last decades of the 20th century saw the birth of more new theories that affected a significant portion of management practices. Because each of the theories prefers a different indicator, managers had to grope in the dark for which option to manage the company by. Doubts were raised by criticism of traditional management according to cost. The problem disappears with the possibility of managing according to ROI, because the management is carried out according to complex measure in accord with the objective goal of doing business.
However, the question of the relationship of partial indicators and ROI can arise. Here we will briefly comment on lean production, 6 Sigma, the theory of constraint, and TPM. The traditional management according to cost we comment on other pages.

Lean production – minimization of inventories

Lean production is most frequently associated with production flow and minimization of inventories. Sometimes it is called inventory-free. Inventories should be minimal not only in production, but also in input and output storage facilities.
However, focusing on minimal inventories can be harmful overall. It can lead to excessive transport and handling cost and capital or to an excessive number of production lines and low use of production equipment. Insufficient inventories can also be the cause of the impossibility of fluid supplying of production lines and the losses of capacities associated therewith. Financial losses due to these reasons can be much greater than the savings that follow from low inventories. Insufficient inventories of finished products and goods can be financially fatal in terms of sales and lost customers – not only in production, but especially in vendor companies.
This criticism cannot be dismissed by referring to the Toyota. Toyota's production is not inventory-free. Quite the contrary, inventories of parts before and after lines are a necessary condition for production itself, because management by kanban is based on removing containers from inventories. True, Toyota emphasizes low inventories, but it primarily focuses on the very best financial results Toyota also has always accented savings on machine equipment. Its focus on the economy of production spaces is more recent. Both lead to low capital demands of processes. Currently, Toyota is also explicitly accenting ROI under the name, capital efficiency.

6 Sigma – minimization of variance

This method markedly revived statistical management of quality, which came into being in the 1920s. It links quality exclusively with variance, rejecting tolerances. The only new feature is the cut-and-dried stipulation of a very low variance value that should generally be achieved. Under the name, Lean Six Sigma, there were also efforts to merge the method with lean production. But that is out of place. Lean production as conceived by Toyota accents tolerances and forbids excessive decreases in variance.

> *» Excessively precise processing is as wasteful as insufficient processing. A milling machine operator is wasting any time that he or she spends achieving a tolerance ± 0.001 mm when ± 0.01 mm is entirely adequate.* [1/] «

Toyota's approach to quality is economical and logical. The required variance should respect the nature of the product and its use; e.g., the variance of the values of parameters of parts of a space ship must be far lower than the variance of the values of the parameters of the parts of a lawn mower. 6 Sigma is in conflict with any economic management of processes and products, not only with management according to ROI. With time the method has markedly exceeded its original focus and transformed itself into a general method for improvement and management. But it thereby lost clear management measure against which it would be possible to take a position.

Theory of constraint – maximizing throughput

The theory of constraint accents the existence of bottlenecks in company processes that are the decisive as to the achievable production of the entire company. With an overhang of demand over capacity its use is a significant factor of ROI. In the reverse situation bottlenecks do not exist, and efforts towards maximal throughput in any workplace would lead to overproduction, by Toyota, to Waste No. 1.
ROI depends on any place in the company, because cost arise everywhere and it is possible everywhere to waste committed capital. True, bottlenecks are extraordinarily important, but they are not decisive with respect to the company's efficiency.

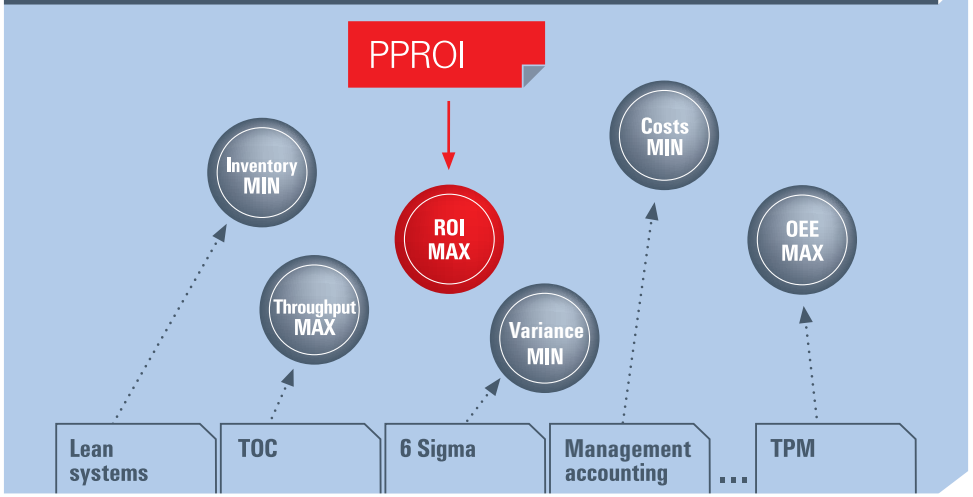
1/ Source: Toyota Production Systems; presentation brochure, 1992

TPM – maximizing the overall efficiency of equipment

TPM is short for the name, Total Productive Maintenance. Similarly as in cases of previous methods, TPM has also sometimes outgrown its original narrow and clear focus. Within the framework of the original focus the basic TPM measure is "overall equipment effectiveness" (OEE), which indirectly measures losses associated with equipment. Among the losses are included not only breakdowns but also setup times for equipment and defects caused by equipment. So already TPM's narrow focus has overlapped into quality management and the general standardization of production processes. However, this too involves a partial measurement, bringing under control only several ROI factors.

To summarize, the focus of basic indicators of individual methods is varied, somewhat inconsistent, and none of the indicators are comprehensive; none of them can replace ROI in the management of a company processes, products and resources.

Complex objective of PPROI instead parcial objectives of contradictive theories



PARTIAL INDICATORS IN PPROI

PPROI is conceived in the interest of managing a company in all management phases, from evaluating alternatives prior to adopting them, through standardization, planning, recording reality, and controlling, to analyses of development.
In the phases of standardization, planning, and recording reality it necessarily works with all the factors that determine ROI. This also applies for factors on which the above-noted theories concentrate.
In terms of quantity, place, and time inventories are precisely planned and recorded; For the phases of a process defects are planned for and recorded; there is dynamic work with bottlenecks in processes, not only on an overall level but also on the level of the lines; losses associated with production equipment are built into the plans and recorded in reality. So PPROI reflects the benefits of new partial theories.
However, the values of partial measures are not maximized or minimized, they are optimized, so that the company's ROI value reaches its maximum.

FROM THE FIRST REACTIONS OF SPECIALIZED MAGAZINES

The possibility of publication

The content and graphics on the previous pages of the PPROI presentational material were completed at the beginning of April 2010. With respect to their main focus on the basic problems of management – criterion of assesment and decision making, accuracy of information, and the effectiveness of measurement in information systems – the material was sent to over twenty specialized journals for evaluation of the possibility of publishing its content. Most of the addressed journals have an academic focus - with editorial teams made up of university professors in various parts of the world. Some of journals have a more popular focus. The request was addressed to the chief editors:

"I am aware that the material is written in popular style for practitioners, but for the first impression the content is more important than the form. If you will find some part of material, which is suitable to rework and publish in your journal I will react."

Prof. Milan Matějka

Several magazines have rejected publication, citing different focuses. None of the responses pointed to the incorrectness or lack of originality of the claims in the material. There follows a selection from the positive responses lined up mostly in chronological order as they arrived during the month of April.

I have now had time to go over your wonderful materials and I find them very interesting and relevant. I guess the EAR's reviewers will find them innovative. It is important to stress the theoretical implications of your study.

European Accounting Review

Professor Salvador Carmona

The texts do fit the themes of this journal. I need interview of P. Zavoral and text of R. Palenik in Microsoft Word files, so I can process them accordingly.

Journal of International Information Management

Professor Chang T. Hsieh

Yes it sounds very interesting although quite complicated. Perhaps you could develop one or two articles, with the first describing the concept and some examples, and then a follow up case study or two.

CEO Refresher

Rick Sidorowicz

My preliminary sense is that your material is too technical for publication in CMR. If you can rewrite it as a narrative with less technical material, we could be happy to send it out for review.

California Management Review

Professor David J.Vogel

Yes. Prepare at least more than 25 pages and above on your given topic and use and write in research paper Journal submission style. Make sure with positive feed back.

International Journal of Managerial and Financial Accounting

Dr. Junaid Saikh

As you mention material is targeted at practitioners and hence, it is difficult to discern the intellectual content from a research perspective. On the other hand, if you do submit a paper for the journal I will coordinate the review process.

Decision Sciences

Professor Asoo J. Vakharia

The concept of aligning products, processes and resources to maximize ROI is a topic that could fit well into The CPA Journal's management section. I suggest that you might rework the beginning of your attachment.

The CPA Journal

Professor Mary-Jo Kranacher

This is interesting which can be used in an undergraduate accounting class. As this is an innovative idea, please develop the paper to demonstrate how this new PPROI development will enhance our current knowledge in the field and suggest some future directions for research.

Journal of Accounting & Organizational Change

Professor Zarihul Hoque

The material is not in a suitable form for publication in a journal. However, it does look interesting. It would be appropriate to submit a paper describing the need for the new approach and the research that was done to develop it.

Production Planning & Control

Dr. Stephen J Childe

It looks potentially very valuable product in practice. However we do not publish papers which simply report and describe new products, even if they are very innovative. It would have to be located within the context of the current theoretical and or empirical debates which are taking place in the research literature.

Management Accounting Research

Professor Robert W. Scapens

This would be very relevant and I would like to see you develop thus into a paper.

International Journal of Innovation and Technology Management

Dr. Tugrul Daim

I'm very intrigued by this concept of PPROI. I'd love to put something on it in the journal LLQ. It appears as an updated scientific management.

Leaderlab

David Burkus