Mendel University in Brno

Faculty of Regional Development and International Studies

Analysis of ERP System Impact on Business Productivity

Diploma Thesis

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Declaration

I declare that I elaborated my diploma thesis „*Analysis of ERP System Impact on Business Productivity*" individually and mentioned all used literature and other sources in the list of literature.

Brno, 2015/05/21

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Abstract

ZACHAROVA, A. *Analysis of ERP System Impact on Business Productivity.* Diploma thesis. Brno: Mendel University in Brno. Faculty of Regional Development and International Studies, 2015. Thesis supervisor Ing. Mojmír Sabolovič, Ph.D.

Diploma thesis is focused on description and quantification of the impact of an ERP system on business productivity of the company ISAN Radiatory s.r.o. The main content is dedicated to various approaches towards performance measurement, building on which the case study is assessed. Diploma thesis also includes a description of current IT management practices. The result is the application of the chosen theoretical models on the real company and summarizing the impact of the ERP system on the business performance of the company.

Keywords: business performance, IT, ERP, productivity, strategic management

Abstrakt

ZACHAROVA, A. *Analýza vlivu ERP systému na produktivitu společnosti.* Diplomová práce. Brno: Mendelova univerzita v Brně. Fakulta regionálního rozvoje a mezinárodních studií., 2015. Vedoucí práce: Ing. Mojmír Sabolovič, Ph.D.

Diplomová práce popisuje a vyčísluje důsledky implementace ERP systému na produktivitu společnosti ISAN radiátory s.r.o. Hlavní obsah se zaměřuje na popis mnohých přístupů k hodnocení výkonnosti společností, na čemž je dale postavená případová studie. Diplomová práce rovněž zahrnuje popis současných praktik řízení IT. Výsledkem práce je posouzení vlivu ERP systému na produktivitu společnosti, za použití teoretických modelů k analyze výkonnosti.

Klíčová slova: výkonnost podniku, IT, ERP, produktivita, strategický management

CONTENT

1. PREFACE

It is commonly assumed that the company is primarily an instrument of wealth creation. Owners invest the time and capital into their company and expect it to bring them a desired value. Besides the time and capital they also invest their ideas and especially their knowledge.

As the time passed, a system of the wealth creation was changing. From the initial transforming of the natural resources into wealth (principles of agriculture), over the next wave of the industrial revolution up to the third stage of the knowledge revolution (Neumaierova, Neumaier, 2002). The development of a system of wealth creation is driven by the information that is always a product of an intellectual capital. Throughout the history an intellectual capital had played the primary role in advancing the knowledge. However only during the third wave of the civilization changes has been created a solid foundation of innovation that provides the intellectual capital qualitatively new possibilities. With the support of the continuously increasing level of technology the role of knowledge is enhanced more than ever. With this development trend the conditions for more intense competition between the firms have been settled.

The ability to interconnect and meet the shareholders' as well as customers' demands is currently a very challenging objective. Knowledge of the customers' expectations, habits and preferences is the key to their willingness to buy. Everything that a firm does is dictated by the customer.

Nevertheless, the value that is created for the customer is first of all a method of obtaining the gain to the company itself. Therefore it happens that a company creates a value for its owners by creating a value for its customers. At this point, the key implication is the accurate resources optimization. In order to produce the output for the client, the necessary inputs are required. The appropriate inputs are transformed by the company's operations into the desired deliverables. It is crucial to control the firm's relation of the inputs and outputs, and especially the efficiency of the transformation of one to another.

Each company needs to carry out a number of activities, each of which performs its function in achieving the goal. This chain of activities, which creates a value for the customers, form a process. Management decides how these necessary activities are going to be grouped and connected. Such optimization of functioning can hardly be done from the perspective of the individual activities of the company – it must be conducted as a whole operation with the objective of making company's functioning more transparent and efficient (Neumaierova, Neumaier, 2002).

Besides the optimal adjustment of the processes, the most important role in company's accomplishments play the people. The driving force of the success are the employees. It is people who transform the ideas into actual products. The initial conditions for making a business are similar for every company, but it is their employees who can make a difference. By engaging the right amount of people with the right skills, providing them suitable working conditions, with an appropriate motivation and a functioning information system, a desired objective can be reached. All these requisites, such as investing in to employees' education and professional growth, providing them quality technical equipment and vivid working environment lead to their increased ability to deal with the customers.

Generally, the situation nowadays is no longer pushing customer to have such an interest in the product to make him queue for hours and hope that he can come out with the piece. Now, in the time with a significant excess of supply over demand - it is the role of the firm to meet with the client and win him over. However, by the time when a deal is signed the game is far not over. The system of the aftercare service for the client plays growing role in the business. The additional service with a subsequent opportunity to purchase, resulting from the good relation and knowledge of the client's need can lead to bigger sales network and loyal customer base. Therefore in order to promote a good client first approach, the company must have a well-designed tool to gather and store the clients' information.

All the challenges which a modern business implies can be handled by building a strong strategy incorporated to the company. Optimizing the use of the resources at one side, and promoting the customer relations at the other. In the world ruled by technology, all these milestones can be met by implementing the right

information communication technology (ICT) solution. Once the appropriate system is designed and deployed, the company will find itself on the right way towards the overall increase of its value. When the quantity is supported by the quality it gives rise to an overall increased satisfaction of all the stakeholders. Employees are using a system, which accelerates their work, and the savings per head are generated, which can be re-invested back to their education or bonuses. Production process is faster and gives a space to produce more products during the same time. Customers feel valued and stay loyal to the company.

All these factors result in a higher value of the company. My thesis investigates how an exploitation of the right information system can lead to a higher performance and hence the value of the company.

2. GOAL AND METODOLOGY OF THE THESIS

The primary goal of the thesis is to demonstrate how an implementation of the specific ERP[1] system can influence the company's productivity. In order to highlight such influence I will need to choose an appropriate evaluation method. For this purpose the theoretical part of the thesis will be devoted to analysis of the existing performance measuring methods as well as to the best common practice of the information technology management.

I will cover the net present value principle, including an EVA and MVA method. Further I will focus on the traditional financial performance measurement methods, such as profitability, liquidity, activity and debt ratios, and finally I will include a description of the modern complex performance measuring methods, such as pyramidal system of indicators.

Building on that, I will construct an evaluation model, which can demonstrate the correlation between the company's productivity and the ERP system usage the best.

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[1] ERP – Enterprise Resource Planning; term used to indicate the business information communication system

The very decision of the investment into the system itself will be evaluated using the real options method, which is built on the similar concept as the NPV, however it provides a better outlook to technological projects like this.

Further in the practical part of the thesis I will apply a chosen model to an existing company ISAN Radiatory s.r.o. I have chosen this company for several reasons; first of all it is located nearby to Brno, in Blansko, which allowed me to interlock with their representatives very closely, thanks to the face to face meetings. This way I was able to establish a solid relation with the company and gather the necessary materials. Secondly, it is a production company with a very wide portfolio of own industrial products. This way I was able to compose a comprehensive analysis of all kinds of operations, not only purely commercial ones. And the last reason for my cooperation with ISAN Radiatory is their information system, implemented in year 2007, which interconnects all the activities in the firm. This company is one of the quite rare examples of perfectly designed ICT infrastructure, covering all the aspects of the production, sales, human resources and the client first attitude.

I have dedicated the practical part to systematical analysis of their processes, transformed into financial indicators calculated using the selected method. Overall findings will be summarized in the conclusion.

3. TEORETICAL PART

The theoretical part of the thesis is divided in to three main sub-chapters. First one, 3.1. describes the ways and methods, how the performance of the company can be accessed, using the most common business valuation techniques. Second sub-chapter, number 3.2. inspects the means of productivity improvements, focusing on information technology usage. This sub-chapter will provide the reader an understanding of the interconnection between the company's performance and the ERP's features, which

pursues the higher company's productivity. The last sub-chapter, number 3.3. summarizes the assumptions from the previous two sub-chapters, and describes the criteria for further evaluation in the practical part.

3.1. Performance measuring systems

3.1.1. Introduction to performance valuation

It is not easy to describe a functioning of the firm, since there is no single comprehensive model, which could cover all the implications and the complexity of all the firm's aspects and structure. Every shareholder is interested in a different indicator, important to his own interests. Typical subjects of the valuation outputs usually are (Synek, 2002):

- Management of the company
- Statutory body
- Shareholders
- Employees
- Tax office
- Statistical office
- Banks
- Investment companies
- Creditors, etc.

No matter who is interested in the company's performance, it is not good to stray in the thousands of details, as well as to generalize the subject. For these purposes it is important to identify and capture the key facts, which underline the company's performance the best.

3.1.2. Evaluation criteria and indicators

There are many perspectives from which to access performance measurement. However, when concentrating on the valuation criteria, according to *Synek* (2002) there are three main types:

- *Standards* – planned values (comparison of real values with the norm, or plan); they are expressed in different kinds of units, starting with physical, ending with monetary
- *Comparison in time* – comparison of absolute indicators (difference, or share)
- *Competition comparison* – based on spatial comparison
- *Regular indicators* – required behavior of employees, working elements arrangements, etc.

Evaluation criteria are usually economic, presented in the monetary variables, which is the most convenient for the shareholders. The financial data, such as amount and structure of the assets, structure of the funding, capital appreciation, liquidity indicators, cash flow belong to the economic criteria.

Nevertheless lately there is an increased popularity of also non-economic criteria, for example market share, management quality, products image, innovative potential of the company, customer satisfaction etc. However, according to *Synek* (2002), it is questionable, whether some non-economic indicators are not just a transformation of the economic indicators into a natural form. It is important to notice, that traditional indicators, used for financial analysis are not sufficient for modern companies, and therefore they were enriched by the non-financial (non-monetary) indicators as well.

When monitoring the performance it is crucial to realize, that evaluated can only be measurable values. If the indicators are not measurable, they can hardly be managed. Another implication is that goals must be operable and formulated in the manner to allow specific units to perform required actions in order to meet the goals. This implies, that in order to monitor and measure the company's performance, only one indicator is

not sufficient. The whole system of indicators must be developed with specific goals, defined for each level of the management, starting with the financial based, intended for the top management, and continuing to less and less monetary on the way to lower levels of the company. *Synek* (2002) distinguish three main levels of the company:

- *Companywide level* – indicators focus on strategic objectives, usually related to sales, market share, new products, employees, technology, organizational structure and everything related to business and basic company's functioning
- *Procedural level* – for every function in the company the performance metrics are identified, and achieved level is compared with the planned values
- *Workplace level* – overall non-monetary indicators, identifying the key activities and targets for employees

This system follows the conception of Professor Kaplan and Professor Norton from Harward Business School (1992) known as *Balanced Scorecard*.

3.1.3. Strategy and planning

3.1.3.1.Goals establishment

It is important to begin with identification of the *goal* of the company. This comes hand in hand with the clarity on the criteria of business performance, the way of its expression and measurement. Not all companies have the same primary goal. It depends on the situation in the company and the current position on the market.

Synek (2002) classifies the goals of the companies according to following criteria:

- *Importance of the goal*
- *Dimension of the goal*
- *Time perspective*

- *Interrelationship among the goals*
- *Content of the goal*

According to *importance* of the goal we can further divide primary and secondary goals, based on their hierarchy. They are often supported by the milestones, used for reaching the main objectives. Independent milestones might for example promote the higher turnover by introducing a new product, or entering the new markets in general.

According to *dimension* we may distinguish limited goals, where the objective is determined specifically, and unlimited, where the reaching of the maximum value is pursued.

According to *timeline* the goals are divided to short-term, middle-term and long-term. Long-term goals are a result of the strategy, set my managers. They are aimed to fulfilling the complex ideas of the company's owners. Short-term goals are designed as the means of meeting the long-term goals. The responsibility for the short-term goals bear also the lower management positions.

Based on the *interrelationship of the goals* we may have:

o *complementary goals* – fulfilling of one goal leads to fulfilment of another
o *competitive goals* – prioritization of one goal leads to later fulfilment of the other
o *opposite goals* – completion of one goal enables to complete the other
o *indifferent goals* – fulfilment of the goals are not related

According to *content* the goals can be divided to *economic, technical* and *social*. Economic goals can be further defined by performance, finance and output. Technical goals are concentrated to promote development of the new products, improve the system of production and to promote overall level of technology and production capacity in the company. Social goals are directed towards the surroundings of the

company, including creation of the new employment opportunities, protecting the environment, tax payment, etc. Another part of social goals is obviously care for the employees (wages settlement, creation of stability, motivation etc.).

The appropriate goal determination is always a task for the management of the company. They have to make sure, that all the shareholders' interests are synchronized. Luckily, there is one common financial objective, on which all the shareholders agree: *maximization of the current market value of their investment in the company* (Allen, Myers and Brealey, 2014).

After all goals have been identified, it is time to monitor, measure and control the chosen inhibitors, so that company goes towards established direction. In order to manage all corporate goals it is crucial to formulate a correct strategy. *Neumaierova and Neumaier (2002)* believe that when creating the strategy it is especially important to clarify how to link interest of the owner of the company, with requirements and expectations of clients and employees. It is the strategy which shapes the character of the company, and it is up to managers to control the right realization of it. It is them who report the status of the company's "health" to the shareholders, therefore they have to make sure to cover all the important elements of the business performance.

In order to monitor the status of the company the variables must be expressed in numerical values. Such numerical determination is the only way to find a common denominator for all the activities that take place in the company. These are reflected in the financial statements. Basic financial statements are balance sheet, profit and loss statement (income statement) and cash flow statement.

Balance sheet

A balance sheet is a financial statement that shows the state of balance in the form of tangible and intangible assets (assets) and sources of their funding (liabilities) accountable to certain period of time. Usually it is compiled on the last day of each accounting year, or a shorter period. Balance sheet presents an overview of the company's assets in a static form. Therefore the real statement of three areas are obtained: equity situation of the company, sources of financing and financial situation. The first area is the asset situation of the company, which shows in what specific kinds

of assets is the property bound, how it is valued, how amortized it is, how quickly it can be turned, etc. Second area are sources of the financing and acquisition of the assets, whereas the primary interest is in the amount of own equity, debt funding and their structure. Last, but not least, information on the statement shows the financial situation of the company, where the profit of the company is recorded, how it was divided and also the eligibility of company to cover their liabilities.

Profit and loss statement

Profit and loss statement gives an overview of revenues, expenses and profit or loss for the period and therefore does not capture the movements of income and expenditures. It is a statement, which is an important basis for assessing corporate performance. The structure of profit and loss statement allows users to see several degrees of results (profits). Individual results of operations differ from each other by the potential costs and benefits entering into their structure. Profit is therefore divided to operating profit, profit from financial operations, from ordinary activities, extraordinary profit, profit for accounting period and profit for accounting period before tax. The most significant is the operating profit, since it reflects the ability of the company to create the positive result of the business. Unlike the balance sheet, the profit and loss statement relates to specific time interval and it is the result of operations executed during this period.

Cash flow statement

Monitoring the cash flow is one of the modern methods of financial analysis. It compares the total resources used for creation of the monetary inflows (income) with their usage (expenses) for the certain period, and therefore creates the overall picture about the real financial situation. It presents how much cash funds were used for what purposes.

Cash flow statement says, what were the expenses and income for the period, broken down into three areas: cash flow from operating activities, cash flow from

investing activities and cash flow from financing activities. Unlike the income statement, which describes the amount of revenues and expenses, cash flow statement describes the amount of revenue and expenses during the period. Objective analysis of the income statement is to understand the evolution of profitability of the company, therefore, why a certain income or expenses decreased or increased, and how these changes have affected the costs and revenues the company's profitability (profit / loss).

One of the common ways of monitoring company's development is horizontal and vertical analysis of financial statements. The results of the horizontal and vertical analysis give us a basic overview of the development of individual variables in the statements of financial accounting. We can find out whether the company is focused on the use of fixed or current assets, and whether the firm is mainly financed through foreign or equity

Then the managers can decide which other indicators will be important for evaluating the results of the business. For example, if a company uses for its activities primarily fixed assets, the key for the business results profitability would be indicators of long-term capital employed (ROCE, return on capital employed), because this constitutes the essence of the business. As to the liabilities if the company is focused mainly on financing from debt, managers will closely monitor primarily an indicator of financial leverage. It is common to begin with vertical analysis.

Vertical analysis means identifying the share of each sub-item of the statements on the whole. In the case of the balance sheet as a whole is regarded assets and total liabilities, in the case of the profit and loss – sales or revenue from production are considered as the whole, depending on the subject matter of the company. In the balance sheet we can therefore find the main assets and liabilities and in profit and loss statement we get the main items of income and expenses of the company. Observations of vertical analysis is expressed in percentage.

Horizontal analysis shows us the development of individual items of assets, liabilities and items of the income statement at the time. The result of this analysis may therefore be characterized by either a positive change (increase entries in time) or negative change (decrease entries in time).

Obtained information from financial statements' analysis is aimed not only for the financial directors of the company, but they are subject of interest of all the stakeholders, who are related to the company.

3.1.3.2.Prediction & estimation

Once the goals are settled, the next step within a strategy formulation is prediction of further development, based on which the targets are defined. The correct prediction of the future of the company is important for a wide range of people. It is compiled by the top management and serves as a baseline for strategic planning. Quality forecast may prevent unwanted decisions, influencing the company.

Predicting revenues is the starting point for financial planning because sales affect the size of all other financial variables. Growth or decline in sales has an impact on both sides of the balance sheet - assets on one side and liabilities on the other. Changes in revenues may also affect every element of the income statement, such as cost of goods sold, operating expenses, financial expenses, income tax, etc. Accurate prediction of sales allows the financial manager to prepare an adequate both short- and long-term financial plan.

According to *Ehrhardt and Brigham* (2013) is revenues forecast mainly the responsibility of the marketing department. The marketing departments of companies may use different methods to forecast sales. To develop a solid sales forecast, marketing managers use both data about the past sales, as well as individual products sales estimation, or whole business areas predictions. Forecasting revenues typically use three basic approaches: an assumption based on an *expert estimate*, *trend analysis* and *regression analysis*.

- *Subjective (expert) estimation*

The subjective (expert) estimation of expected revenues depends on personal experience and intuition of independent managers and sales representatives. It solely relies on the judgement of the person who performs the prognosis. *Kaen* (1995) provides

a following example of an expert estimate: "Based on a survey among sales representatives, we expect next year to be sold 100 thousands units of the product." In this case, the forecast of 100 000 units sold relies on the estimation of sales representatives, who provide (building on their own experience) the outlook to the next year. By summing up the estimates of all representatives and multiplying it by the expected price per unit we obtain the expected value of the sales.

- *Forecast based on trend analysis*

According to *Kaen* (1995) is a sales forecast using trend analysis based on data about past sales. The level of sales in the future is obtained by interpolation of sales during the past years. Revenue estimate based on trend analysis works with the expression of revenue as a function of time.

The simplest application of trend analysis is the assumption of zero changes. In this case, it is assumed that revenues in the forecast period reaches the same value as the revenues in last known year. Sales in prior periods are ignored. However, such simplification of abstracting from the development in the past can lead to erroneous conclusions. Therefore more often are used assumptions based on an analysis of sales development in several consecutive years.

The forecast for revenues based on the trend analysis is usually more accurate when applied to short-term forecast. For longer periods, with the extrapolation of past sales is higher probability of missing significant recent milestones, either upward or downward. Management may adjust the predicted trend based on knowledge of the situation in the company. If, for example, it is known that the decline in sales last year was due to a strike by transport companies and that the reasons for the strike are no longer valid, they can artificially improve the trend, which emerged from a simple extrapolation (Kaen, 1995).

- *Regression analysis*

Prognosis based on trend analysis does not reflect possible changes in the economy or industry. To overcome this disadvantage regression analysis can be used, where sales are expressed as of some macroeconomic variables, such as GDP, employment, the development of sales in the sector etc. The accuracy of forecasting using regression analysis depends on the precision of estimates of both economic development and also values of the coefficient of determination made by regression analysis.

If the estimate of the gross domestic will contain an error, this error will naturally influence the value of estimated revenues. On the other hand, estimation of variables such as GDP, is usually an output of a very sophisticated process with a high degree of reliability. The second determinant of the accuracy of estimates is the coefficient of determination made by regression analysis, which depends primarily on the appropriate choice of explanatory variables. In some cases, a better predictive ability than GDP may have the expected development of sales in the sector, or an estimate of demand for the commodity (Kaen, 1995).

According to Allen, Myers and Brealey (2014) is as trend analysis as well as correlation analysis and expert estimation helpful in narrowing of the range of possible future results. Thorough revenue estimate is the cornerstone of quality financial planning.

3.1.4. The concept of the Net present value

In order to evaluate the company's performance it is necessary to be able to define the criteria of the efficiency. The key criterion of the company's performance is the *Net Present Value (NPV)*. Firm is sufficiently productive when it reaches a positive net present value. The higher the positive value, the more efficient it is.

The aim of the owner is to gain more than he invested in to company. It is defined by what company is capable to return. If the company brings more than was

initially invested by the owner, it represents the increase of the net present value (Neumaierova, Neumaier, 2002).

When evaluating business' performance it is important to remember that:

1. Money received today has higher value than money received tomorrow.
2. Safe money has higher value than the risky money.

According to *Neumaierova and Neumaier* (2002) the first principle means, that the owner should not be indifferent towards the cash flow timing. The sooner the money is obtained, the sooner it can be at disposal. Later the money is received, the lower will be the actual value of the inflow. When determining the value of the firm for the owner it is necessary to discount the cash flows which is company able to bring, which means to lower the flow by the rate proportional to the distance from the date of future valuation of the company. To capture the current value of the future expected profits, we have to multiply the individual inflows by the discount rate, which is reciprocal of the sum of one and a rate of return.

$$\text{discount factor} \ = \ \frac{1}{(1+r_e)}$$

Second principle implies the size of the rate of return, which represents the discount rate in the discount factor. The higher the riskiness, the higher the discount rate must be used. Discount rate r_e is called *alternative average cost of capital* and stands for the profitability of similar investment alternatives, witch comparable risk (Neumaierova, Neumaier, 2002). By choosing the particular alternative, an owner loses a profit, which could have been generated by a different alternative with an equivalent risk. The profitability of this alternative is expressed by cost of own capital. With the increasing risk, increases the alternative cost of own capital (the rate of return required by owners).

The company's value to the owner is represented by the sum of all future cash flows, discounted by the weighted average cost of capital. Building on that, it is possible to evaluate a degree of plan fulfillment and to identify, whether there was an increase of

the value, by receiving either positive or negative net present value of the investment. The following relation applies:

$$NPV = -I + PV$$

where

NPV   net present value,

I   the investment to the company,

PV   the value of the company to the owner.

We can also express the statement in the following form:

$$value\ of\ the\ company\ =\ current\ value\ of\ the\ future\ cash\ flows$$

$$= \frac{Z_1}{(1+i)^1} + \frac{Z_2}{(1+i)^2} + \ldots + \frac{Z_n}{(1+i)^n} = \sum_{t=1}^{n} \frac{Z_t}{(1+i)^t}$$

where

Z   expected future cash flow in year t

i   discount rate

The aim of the owner is to obtain more than he invested to the company. If the company achieves positive net present value, this company is efficient enough. It follows that the higher positive net present value a company is able to produce, the more it is productive. Therefore, as pointed by *Neumaierova and Neumaier* (2002), criterion of NPV is also applied in the concept of corporate governance known as shareholder value and used in the *Economic Value Added* (EVA) and *Market Value Added* (MVA).

3.1.5. Economic and market value added

Due to operational involvement of the management in everyday business activities and controlling the company's functioning, they happen to be better informed about the status of the company, rather than their owners, and other stakeholders. Nevertheless, those are owners who bear the responsibility and are exposed to risk. Moreover with the spreading globalization and international character of the economy, the importance of international investor has increased. This time implies more than ever the importance of maximization of the capital, invested to the company, therefore the need for corporate governance based on maximizing the value of capital into the company is emphasized. It resulted in creation of new indicators quantifying the performance of the company from perspective of market value added (MVA) and economic value added (EVA) (Marik, 2007).

3.1.5.1.MVA

Indicator of market value added (MVA), together with the economic value added (EVA) was developed in 1993 in the consulting firm Stern Stewart Management Services in New York. Both these indicators are approaching a business goals of the companies from the perspective of shareholders' value.

As *Synek* (2002) states MVA indicator reflects the difference between the market value and the capital invested, thus the difference between the amount that shareholders and other investors would gain by selling their stocks and bonds, and the value they have put into the company. If the company's shares are publicly traded, the price of share then can be seen from the capital market. Therefore, we can determine the net present value = market value added. Market value is the same as the net present value of long-term indicator enterprise performance.

Market value is then accordingly defined as the difference between the market price of the share and the book value of own equity per share and therefore applies (Neumaierova, Neumaier, 2002):

$$MVA = P - BV$$

where

P   market price of the share

BV   book value of the equity per share

MVA indicator can be both of positive values and negative values. A negative value is indicated as the market value lost (MVL). When the MVA is positive, it means that company works well and creates new value. Conversely, if the value is negative, company's strategy must reconsidered, since the value investing decrease. The aim of the company's managers is to continue to pursue for maximizing market value added.

Market value added, compared to maximizing share price, reflects the changes in the value of shares and is therefore a better tool for management. It shows how much money investors have put into the company and how much money they can recoup by selling their shares on the stock exchange (Marik, 2007).

This indicator is also used for measuring the annual change in value: MVA increases when the value of the company grows more, than the new capital, injected to the company at the same time.

Then we can calculate MVA using the following relationship:

$$(P_s - P_p) * n$$

where

P_s selling price of share

P_p purchase price of share

N   number of shares

Using this indicator for measuring the performance of the company is limited to stock listed companies on the securities market. Possibility of more general use provides an EVA indicator.

3.1.5.2.EVA

Indicator of economic value added (EVA) has been in recent years widely promoted not only in economic theory, but especially in the economic practice of companies in countries with developed market economies. According to a *Marik* (2007) it is connected with a well-known term used by economic theory - economic gain.

It is necessary to distinguish an accounting profit, which is recorded in the statements, and economic profit, where not only common costs are paid, but also the costs of own capital. Thus, an enterprise can generate both accounting profit and economic profit only if the accounting profit is greater than the cost of embedded own capital.

Economic profit (EVA) is therefore different from the annual net profit. Economic profit is lower than the accounting gain by the absolute value cost of own capital. Absolute value of cost of own capital is expressed as the product of an alternative cost of own capital and cost of own capital. (Neumaierova, Neumaier, 2002).

Besides the concept of economic value added is also used as the concept of value added in the profit and loss statement. Economic value added, however, expresses an entirely different concept than the book value added. Book value added produced by the company is in profit a loss defined as follows:

revenues from own goods and services - cost of goods sold + revenue from the production – costs of sales

Hereby produced added value is used, for example, to pay the salaries, cover a depreciation and interest payments or taxes. That part of it that remains the owner is a net profit. The size of the value added is therefore an important factor that determines

the size of the net profit of the company, making it one of the most important factors influencing EVA.

EVA is therefore required to include indicators based on the concept of economic profit, which according *Marik* (2007) are:

- link to the value of the shares and so that this link is provable by statistical calculations
- inspect all information and data provided, including accounting indicators, which are built on accounting data
- involve risk calculations and take into account the extent of bound capital
- allow a performance assessment as well as valuation of the company at the same time

Although there are multiple approaches to quantification of the EVA, it is generally understood as a net income from operating activities of the company, which is reduced by the cost of capital. Economic profit thus refers to the difference between the profit from net operating profit (NOPAT) and the cost of capital (WACC). The values are calculated as the difference between revenues and expenses from operating activities including costs of equity and debt.

The basic format of the formula for calculating EVA (Marik, 2007):

$$EVA = NOPAT - Capital * WACC$$

where

NOPAT = profit from operating activities of the company, after tax; in other words - operating profit after tax.

Capital = is seen as a value bounded in assets required to achieve an operational profit. Its determination is based on accounted assets, further modified by a number of items, such as costs for research and development.

WACC =   using weighted average cost of capital a discount rate is determined for the cost of capital

The general formula for calculating the average weighted cost of capital has the following form:

$$WACC = R_d * (1 - d) * \frac{D}{V} + R_e * \frac{E}{V}$$

where

R_d cost of debt

d   income tax rate

D   the market value of the firm's debt

R_e cost of equity

E   the market value of the firm's equity

V   total market value of invested capital (E+D)

EVA concept is based on the so-called economic model (representation of economic reality, which is close to the capital market point of view), which is based on an accounting model. This method seeks to capture the view of the economic situation in the accounting data, however, they are treated with an emphasis on the needs of shareholders and consistency of the data needed to measure the profitability.

In addition: if *EVA > 0*, a new value has been created, if *EVA < 0*, loss of value occurs. That is, if the EVA is positive, a company has produced sufficient revenues to compensate investors for the risk taking, and moreover there is enough left for owners, thus the new value has been generated.

This information plays a key role in measuring the financial profitability, used both by internal and external users.

3.1.6. Traditional financial performance measurement

It has been said that the basic criterion for assessing the performance of the company is the net present value and its application in EVA and MVA model. These indicators inform on whether the firm is or is not capable of creating value for its owners. However, it does not inspect the reasons of detected status. Therefore when measuring the overall performance of the company it is necessary to use such additional analysis, which allows in particular, monitor, measure and evaluate internal and external behavior of the economic situation of the company.

One of the best ways of approaching such financial analysis is using operating ratios, since it provides an interconnection between the expected figures anticipated by the management, and reality. The data source for financial analysis of this kind is found in financial statements and other resources from internal corporate accounting, as well as from the economic and monetary statistics and the capital market.

3.1.6.1. Profitability ratios

Profitability of the firm is an ability to generate profit using the invested capital. Profitability indicators are used to evaluate the overall effectiveness of specific actions, showing the combined impact of liquidity, debt and assets usage compared to results of business. Generally, profitability is expressed as the ratio of profit to the amount of capital invested. These indicators should have a time series of a growing trend.

For the financial analysis the most important are three categories of income which can be read directly from the profit and loss account. The first category is *EBIT* (earnings before interest and taxes). They correspond to the operating profit. In the financial analysis EBIT is used in cases where it is necessary to establish inter-company comparisons. This is based on the fact that although the company will have the same tax burden, they bear a different rate of creditworthiness, which could therefore affect the amount of interest resulting in the different net income. The second category is *EAT* −

earnings after tax (net profit). This is the profit, which can be divided into profit for distribution (dividends among shareholders), and retained earnings used for further reproduction of the company. In the profit and loss statement it is given as a result of ordinary operations for the accounting period. This category of net profit uses all indicators that assess the company's performance efficiency. The third category is the *EBT* - Earnings before taxes, thus operating profit, already downgraded or increased by financial and extraordinary profit from which taxes have not been deducted. It is used for providing performance comparisons of companies with different tax burden (Ruckova, 2010).

a) *Return on assets (ROA)*

Return on assets, also referred to as return on total invested capital is an important indicator measuring the performance and production power of the company. It compares the overall profit with all assets regardless of the sources of their character (own/foreign, short-term/long term).

$$ROA = \frac{EBIT}{Assets} * 100 \ [\%]$$

b) *Return on equity (ROE)*

This indicator expresses the profitability of own capital, meaning the capital invested by the owners. Thanks to ROE investors can find out whether their capital is reproduced in appropriate intensity corresponding to riskiness of the investments.

$$ROE = \frac{EAT}{Own \ capital} * 100 \ [\%]$$

c) *Return on capital employed (ROCE)*

This indicator presents a degree of appreciation of all investments funded by creditors (issued bonds and long-term bank loans) and funds from shareholders (equity).

$$ROCE = \frac{EBIT}{long-term\ liabilities + own\ capital} * 100\ [\%]$$

d)   *Return on sales (ROS)*

The indicator shows the profit margin of the company. This indicator should show a rising trend. Profit for the calculation is most commonly used in form of EBIT or earnings after tax.

$$ROS = \frac{EBIT}{sales} * 100\ [\%]$$

e)   *Turnover profitability*

Turnover profitability provides us the financial efficiency of corporate management. Turnover in this indicator represents an income from ordinary activities of the company. In financial analysis the size of this indicator and its development over time points out the ability of a company to generate financial surplus from the turnover process, which is necessary for further strengthening company's position and becoming financially independent (Ruckova, 2010).

$$Turnover\ profitability = \frac{CF\ from\ operation}{Output\ from\ the\ business\ operation} * 100\ [\%]$$

3.1.6.2.Activity ratios

Activity indicators measure how the company manages its assets. If there are more assets than appropriate, unnecessary costs are generated and hence lowers the gain. If there is a shortage, then the company cannot afford many potentially favorable business opportunities and loses the revenues that could be obtained. Activity ratios are usually provided in the form of indicators expressing bound of capital in selected assets and liabilities, turnover of assets (as an inverse form of commitment by assets) and the duration of the turnover (expressed in number of days) (Ruckova, 2010).

a)   *Turnover of total assets*

Measures an effectiveness of the use of all assets in the enterprise, regardless of their sources of financing. Generally, the higher the value of this indicator, the better, however the amount depends on the type of business venture. A disadvantage of this and some other indicators is that revenues are stream variable, while asset status is a static variable, and may vary during the year. Therefore, a calculation of this indicator at the end of the year is not entirely objective.

$$Turnover\ of\ total\ assets = \frac{Revenues}{Assets}$$

b)   *Turnover of tangible fixed assets*

Indicator also known as the relative bound of tangible fixed assets is an indicator of the efficiency and intensity of utilization of buildings, machinery, equipment, vehicles and other tangible assets, so is also referred to as productivity of the fixed assets. Value of the indicator is usually compared with sector averages. If the value is lower than the sector average, it indicates low utilization, and notifies the management to increase utilization of production capacities (Zivelova, 2007).

$$Turnover\ of\ tangible\ fixed\ assets = \frac{Revenues}{Tangible\ assets\ in\ residual\ prices}$$

c) *Inventory turnover*

It is the most watched indicator of turnover of current assets. It indicates how many times is each item sold during the year and restocked. The weakness of this indicator can be seen in the fact that revenues reflect market value, while stocks are reported in purchasing values.

$$Inventory\ turnover = \frac{Sales}{Inventory}$$

d) *Inventory turnover time*

Inventory turnover time shows the average number of days, during which are the operational assets bound in form of stock. Generally, the shorter the period, the better.

$$Inventory\ turnover\ time = \frac{365}{Inventory\ turnover}$$

e) *Turnover of receivables*

Receivable turnover indicates the number of rotations, meaning the transformation of debts in cash. The faster the turnover of receivables, the faster the money is collected and can be reinvested to further business activities (Zivelova, 2007).

$$Turnover\ of\ receivables = \frac{Sales}{Average\ state\ of\ receivables}$$

f)   Receivables turnover period

This indicator reflects how long is a company's property bound in the form of receivables, in other words – in what times are these claims covered. The recommended value is obviously a regular due date of invoices, since most of the goods is dispatched with an invoice. If the receivables turnover period is longer than the regular due date of invoices, it identifies failure to compile commercial lending policy on the part of trading partners. However, these days is quite frequent to overdraw the time of payment of the invoice (Ruckova, 2010).

$$Receivables\ turnover\ period = \frac{365}{Receivables\ turnover}$$

g)   *Liabilities turnover*

Turnover of liabilities is a significant indicator to creditors as it clarifies corporate payments. It states, how many times a year are liabilities met.

$$Liabilities\ turnover = \frac{Sales}{Liabilities}$$

h)   *Liabilities turnover period*

Time of turnover liabilities provides information about how long the company postpones the payment of invoices to their suppliers. According to *Ruckova* (2010), the time of liabilities turnover should be longer than the time receivables turnover, so that the financial balance of the company is not jeopardized. However, this indicator can be very useful for creditors, who can thereby observe, to what extend the company keeps its commercial and credit policy.

$$Liabilities\ turnover\ period = \frac{365}{Liabilities\ turnover}$$

3.1.6.3.Debt ratios

Debt ratios identify a capital structure of the company, especially usage of the foreign resources to finance business needs. Debt rate itself is not purely negative characteristic of the company. Its growth may contribute to the overall profitability and thus the higher market value of the company, but also simultaneously increases the risk of financial instability.

a) *Total indebtedness*

Total indebtedness is the basic indicator, which represents how many percent of total assets are financed by foreign resources. Also called an indicator of creditor risk (debt ratio), as its growth increases the risk of creditors. They prefer lower values for this indicator, however it may also apply that temporary increase of indebtedness will increase the overall profitability of the funds invested.

$$Total\ indebtednes = \frac{Total\ liabilities}{Assets} * 100\ [\%]$$

The total indebtedness can be further divided to long-term and short-term debts.

b) *Long-term debt*

Long-term debt indicates what percentage of assets is financed by long-term liabilities and long-term bank loans.

$$Long - term\ debt = \frac{Long - term\ liabilities}{Assets} * 100\ [\%]$$

c) *Short-term debt*

Short-term debt informs about portion of assets financed by short-term liabilities.

$$Short-term\ debt = \frac{Short-term\ liabilities}{Assets} * 100\ [\%]$$

d)   *Rate of self-financing*

Very important indicator of rate of self-financing (equity ratio) is complementary to the overall debt indicators informing about the financial independence of the company. Indeed it expresses the proportion in which the assets are financed with company shareholders' funds.

$$Rate\ of\ self-financing = \frac{Equity}{Assets} * 100\ [\%]$$

e)   *Financial leverage*

According to *Zivelova* (2007) is the financial leverage an inverse level of self-financing. It identifies, how many times the total capital exceeds the size of own capital. This indicator reflects the impact of changes in the company's debt, visible in profitability of invested capital and therefore has a great significance in evaluating the profitability of the company through a pyramid system parameters. A high proportion of own capital can lead to overcapitalization of the business, which means that company does not uses full opportunities of possible outside funding.

$$Financial\ leverage = \frac{Assets}{Equity} * 100\ [\%]$$

f)　　*Undercapitalized rate*

Riskier than the overcapitalization of the company is an undercapitalization, where the firm in order to increase its assets uses primarily foreign sources. Undercapitalized company has the value of this indicator below 1, because it must cover part of their long-term assets via short-term resources.

$$Undercapitalization = \frac{Long - term\ liabilities + Equity}{Fixed\ assets}$$

g)　　*Debt on own equity*

Debt to own capital or leverage ratio (debt to equity ratio) contains a similar information as the total debt. It grows proportionally as the debt in the financial structure.

$$Debt\ to\ equity = \frac{Total\ liabilities}{Equity}$$

h)　　*Interest coverage*

Interest coverage indicates how many times the profit is higher than the interest payments. If its value equals to 1, it means that interest payments expended all of the profit and shareholders are left with nothing. Recommended value should be higher than 3, however the "healthy" rate of interest coverage is usually 8 and above. These values are recommended especially for the reason of necessity of covering the cost of borrowed capital with sufficient amount even for shareholders. Debt to equity ratio has similar information as the total debt. It grows proportionally with the debt of the financial structure.

$$Interest\ coverage = \frac{EBIT}{Interest\ expenses}$$

Liquidity indicators characterize the firm's ability to cover its payment obligations. This ability is one of the basic conditions of its existence. When analyzing the financial situation from this perspective it is necessary to distinguish the content of liquidity and solvency, since they are often viewed as synonymous. According to *Allen, Myers and Brealey* (2014) liquidity refers to degree of complexity of the transformation of individual equity items into cash. The most liquid is money, cash equivalents, short-term investments, less liquid stocks and bonds, and the least liquid - long-term loans and time deposits. Illiquid or almost non liquid is tangible property.

Therefore *liquidity* is a firm's ability to pay current debts. And *solvency* is a general ability of the company to pay its obligations on time and in the required amount. The condition of solvency is liquidity presence.

a) *Current liquidity (ratio)*

Current ratio indicator, according to *Allen, Myers and Brealey* (2014) determines the number of times that current assets cover short-term liabilities. It means the number of times the company is able to satisfy its creditors by transforming their short-term assets at a given moment to cash. Although at first glance it may seem that the higher the value of this indicator, the more certain the liquidity, the optimal value is considered to be between 2 - 2.5 and should never be less than 1. It is important to acknowledge that not all current assets are as liquid as others, and some of them are not convertible to cash at all.

$$Current\ ratio = \frac{Current\ assets}{Short - term\ liabilities}$$

b) *Quick ratio*

Current assets also include stocks whose liquidity is relatively low. Therefore was adopted the quick ratio, which eliminates the disadvantages of the previous indicators in the numerator and leaves a swift current assets. The optimum value is between 1 - 1.5. It may be useful to monitor the relationship between the current and quick liquidity. If the difference is significantly different, the enterprise should find out, whether it has too big inventory.

$$Quick\ ratio = \frac{Current\ assets\ -\ Inventory}{Short\ -\ term\ liabilities}$$

c)   *Cash liquidity*

Cash ratio measures the ability of the company to pay the debts due. It reflects the actual liquidity because the numerator includes only the most liquid sheet items (cash, sources on common accounts, term deposits maturing within three months and short-term investments). A disadvantage of this indicator is that it does not take into account the due-date of short-term liabilities.

$$Cash\ ratio = \frac{Financial\ property\ of\ short\ -\ term\ character}{Short\ -\ term\ liabilities}$$

The optimum value is between 0.2 – 0.5.

d)   *Net working capital and its share in current assets*

Net working capital is a part of current assets, which is financed by the long-term financial resources, and company can freely dispose it to realize its projects. Net working capital, however, can also be understood as a part of the funds that would allow the company to a limited extent continue in its activities in case it would be forced to repay the majority of their current liabilities – therefore it is kind of a financial cushion for emergencies. Net working capital is also considered a liquidity measure and is

closely related to current liquidity indicator, which indirectly expresses the size of net working capital itself (Ruckova, 2010).

Net working capital = current assets - short-term foreign liabilities

$$Share\ of\ NWC\ on\ CA = \frac{NWC}{Current\ assets}$$

The size of net working capital is dependent on the business sector, however its share in current assets should reach 30-50%.

e)   *Liquidity from cash flow*

According to *Zivelova* (2007) this indicator expresses the firm's ability to meet short-term obligations from cash flow in the period, meaning the ability to produce cash to pay short-term liabilities.

$$CF\ liquidity = \frac{Operating\ CF}{Current\ liabilities}$$

f)   *Degree of debt relief*

The degree of debt relief indicates its ability to cover liabilities arising from its own financial strength.

$$Degree\ of\ debt\ relief = \frac{Operating\ CF}{Debt}$$

3.1.7. Complex financial performance measurement

3.1.7.1.Pyramidal system of indicators

Interpretation of comprehensive development of the financial performance of the company via ratio indicators, focusing on particular areas of the financial system of the company, is very demanding, mostly because of the frequent differences in trends and their levels. This assumes implementation of a methodological tool, which, building on knowledge of indicators and their interconnection, can be used for decomposition of indicators on partial areas representing the causal factors. To this purposes serves pyramidal system of indicators, which, through a dedicated hierarchy of indicators captures the context of what is happening in the company.

Example of such pyramidal system of indicators is the decomposition using Du Pont diagram, which considers the top indicator a return on equity (ROE) and defines three main determinants of the indicators:

- profit margin = net profit / sales
- asset turnover = sales / assets
- financial leverage = assets / equity

Neumaierova and Neumaier (2002) believe that pyramidal systems of indicators have many advantages. Given that fact that they capture the connection between indicators, there is a visible interrelationship among them as well as evident degree of analyticity and thus the importance of individual indicators. They also enable the implementation of any detailed analysis. A very important implication when using the pyramidal system is to compile a correct structure. Properly prepared pyramidal system of indicators should be based on the latest information and should also reflect the context of the various aspects of corporate performance.

Appropriately designed pyramidal system of indicators can systematically assess the past, present and future business performance. Knowledge of interconnections (the link between the indicators), ensures the use of special methods for the

quantification of the impact of the indicators from the position of the lower factors up to the impact on the top indicators over time. The most appropriate method is considered a logarithmic method - breakdown according to logarithms of indexes of analytical indicators. This method is best suited, because its result is not influenced by the evaluator (analyst).

The main contribution of the pyramidal decomposition is considered the visibility of control levers, which prove to be small in numbers and similar in all companies. They can be expressed using several ratios, and by their systematic analysis it is possible to understand the operations of the company.

On the other hand, the logical structure of each levers of the Du Pont diagram has a disadvantage of not showing a difference between the effect on the performance of equity, operating performance of the company and the company's financial policy. To eliminate this gap serves a model called INFA, developed by *Neumaierova and Neumaier* (2002), which clearly differentiates indicators of operating performance, by dividing the production of the company while monitoring the enterprise's ability to meet their obligations.

Model INFA interprets the ROE in the following way:

$$ROE = \frac{EAT}{EBT} * \frac{ROA\left[\frac{i}{BL+OBL} * \left(\frac{E+BL+OBL}{A} - \frac{E}{A}\right)\right]}{\frac{E}{A}}$$

Individual parts of the equation can be described as follows:

$\frac{EBIT}{A}$ Production power of the company represents the total return on equity. Its growth positively affects ROE.

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$\dfrac{EAT}{EBT}$ Share of net profit to profit before tax and therefore presents the level of tax. Decreasing of tax burden (reflected as an increase of net profit share) positively influences ROE.

$\dfrac{i}{BL + OBL}$ Interest rate of foreign sources. Lowering price of foreign sources has always a positive impact on ROE.

$\dfrac{E + BL + OBL}{A}$ Expresses the proportion of equity, bank loans and bonds to assets, thus share of chargeable capital on total capital. Its reduction has a positive effect on ROE.

$\dfrac{E}{A}$ The proportion of equity in the assets, which reflects the level of financial leverage effect. Leverage can affect ROE both positively and negatively.

$$\frac{EBIT}{Revenues} \qquad\qquad \frac{Revenues}{Assets}$$

$$\frac{EBIT}{Assets}$$

$$\frac{Earnings}{Assets} \qquad\qquad\qquad \frac{Interests}{Assets}$$

$$\frac{Net\ profit}{Own\ capital} \qquad \frac{Own\ capital}{Assets} \qquad \frac{Net\ profit}{Profit}$$

$$\frac{Net\ profit}{Assets\ Amount\ of\ shares} \qquad \frac{Own\ capital}{Amount\ of\ shares} \qquad \frac{Interests}{Bank\ loans\ and\ Obligations} \qquad \left(\frac{Chargeble\ sources}{Assets} - \frac{Own\ capital}{Assets}\right)$$
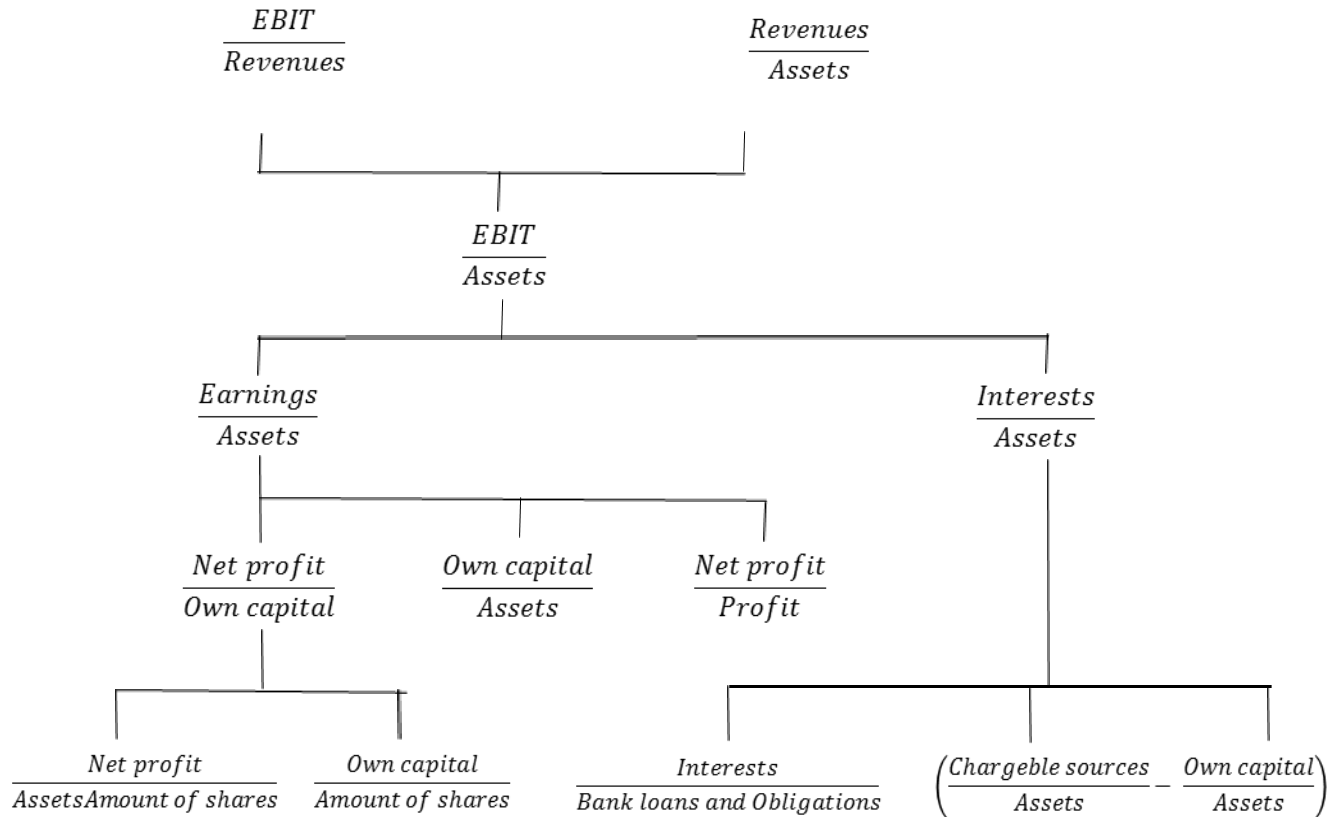
Table 1: Model INFA (Neumaierova, Neumaier, 2002)

3.2. Methods of increasing overall productivity

Increasing the overall productivity of the company is in the interests of management, owners and employees of the company. All parties involved should therefore constantly seek for ways of enhancing the company's performance and eliminate the causes of insufficient productivity, such as imperfect synchronization of workflow causing the downtime discrepancies in inventory management, duplication of work, insufficient use of machinery and equipment, low labor flexibility, improper management costs, errors in management companies etc. *Synek* (2002) lists the following approaches towards increasing company's productivity:

- **lean production** – eliminating loss rate using complex Just-in_Time method, where the perfect synchronization of the inventory management increases the speed of supplies;
- **lean management** – big emphasis on on team work'
- **costs reduction** – via standardization, outsourcing, etc.;
- **quality increase** - control according to ISO 9000, implementation of comprehensive quality management systems such as TQM (Total Quality Management);
- **reduction of time** - shortening production cycle period, distribution, etc. aimed to minimize inter-operational times, during which the value is not pursued;
- **customer management** - a detailed examination of changing customer requirements and their subsequent implementation in production;
- **employee involvement in management** - enabling employees to come up with suggestions for improvements;
- **integration of suppliers** - close cooperation with suppliers is a prerequisite for the introduction of Just-in-Time;
- **value analysis** - identifying and designing solutions for individual features of the investigated object in order to increase its effectiveness;
- **integration of information systems** supporting management processes; etc.

In the next part of the thesis, I will concentrate on the last mentioned way of productivity increase – integration of information system.

3.2.1. Enterprise computing

According to *Feuerlicht* (2008) the term enterprise computing does not have a precise technical definition, but it is generally refferring to a computing system, IT environment, databases and applications used to support business processes in the medium to large size companies. Such organizations typically have large number of users exploiting software applications designed for managing company processes. Software is also accompained with associated hardware infrastructure.

The software applications usually include Enterprise Resource Planning (ERP) system – a comprehensive software applications that consist of several related modules concentrated on individual business areas, such as finance, Customer Relationship Management (CRM), Human Resources Management (HRM), Business inteligence (BI), Data Warehousing and other applications designed to store and process lare amount of corporate data with the aim of deriving business value from the information. Most such applications that are developed and integrated based on underlying Database Management System (DBMS) and have been purchased from a software vendors in the form of package solution (Feuerlicht, 2008).

Since the system is used by a big number of users (from hundreds up to thousands) it must be transaction-intensive, i.e. be able to prosses hundreds of transactions per second). Enterprise computing applications have to be highly reliable, secure and scalable as they typically support mission-critical business processes. These requirements can only be met by a trusthworthy IT architecture that facilitates the operation of a multitude of different applications within an organization in an economical way (Feuerlicht, 2008).

3.2.2. Features of ERP

According to *Vorisek* (2008) since the 80s of last century the range of ICT application demands' growth accelerated significantly. Developing and producing all the applications became time consuming and uneconomic. Slow response of the corporates' IT departments to new business challenges began to hinder the development of production and commercial activities of the companies. This has given rise to dedicated companies, specialized in the ICT services delivery, with their own portfolio of products, available for outsourcing. Vertical integration of the internal IT departments became financially inefficient and therefore new business model grew in popularity. Most common systems of this kind are ERPs.

Traditional distribution model of information systems into companies became known as "software license". A company buys an ERP system and the associated

technological infrastructure from the external company. The system is usually installed and put into operation to an end customer by a mediatory company, so called *implementer*. Business as usual is then operated by the company itself (Vorisek, 2008).

This mode of operation has been used around the world for over 30 years. Based on research of 520 Czech companies, conducted by Karpecki (2002)[2], a significance of traditional model grows with the size of the company, whereby companies with less than 1000 employees are mostly oriented on local providers of ERP, while enterprises of bigger size predominantly sign for foreign vendors.

Type of solution	Number of employees	0-99	100-299	300-999	1000-2999	3000-9999	10000+
Customized solutions		51	56	45	34	49	11
Domestic ERP provides		33	24	30	18	3	0
Foreign ERP providers - middle range (Navision, Scala)		10	11	10	8	5	0
Foreign ERP providers - high level (SAP, Oracle…)		6	9	15	40	43	89

Table 2: Form of solution of ICT in the Czech Republic at the begging of this century (Karpecki, 2002)

When deciding whether to purchase an ERP, a company must be aware, what benefit can the system provide. According to Martin Zikmund[3], the CEO of IT solutions consulting company Nitana s. r. o., there are many positive effects, resulted from the ERP implementation:

Process standardization

One of the main contribution of the ERP, which is reflected in each area of the company, is process standardization. It implies that once the process is set, the action will always be performed in a specified way.

Every process should be based on the so-called Best practices, meaning the best way

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[2] Karpecki, L. (2002) quoted by Vorisek (2008)
[3] The consultation with Mr. Martin Zikmund was done over the phone; his contributions can also be found online at the portal businessvize.cz, available at http://www.businessvize.cz/informacni-systemy/k-cemu-jsou-podnikove-informacni-systemy

of fulfillment. This can be either designated by the producer or implementer of the ERP, or built upon own experience of the company's management. Good example is the case of dual production at two production plants, where one of the factory exhibits better results than the other. The processes of the more successful factory are then analyzed and the better practices are identified and implemented into core of ERP, in order to manage the rest of the company according to most efficient contributor.

Another plus of standardization is possibility of employees' substitution. From perspective of ERP it is indifferent who enters the data. Therefore even if the person is on sick leave, maternity leave, or vacation, the appropriate workflow is not disturbed. Once the person returns back to work, he can easily build on his colleague's inputs and continue in production, avoiding the time demanding hand overs.

Last, but not least, the standardization can help eliminate the discrepancies in the workflow, such as machinery downtime, ex post data entering or unallocated time dedicated not to the assigned task. All these faults are highly visible in the system, since it monitors the real time spent on the projects against the plan, and hereby evaluates its efficiency. Therefore during the first year after implementation it might appear that the work productivity decreased, however it only reflects the reinforced system, which is about to intensify the actual productivity later on.

Processes acceleration

Hand in hand with standardization comes the overall acceleration of the processes. Martin Zikmund explains this effect as follows: "Basically, it has two reasons: firstly, nobody shall any longer seek for work orders from his superior, because all actions are standardized and demands are delivered as per design to specific departments, with adequate work instructions. And secondly, there is no space for bypassing or elongation of necessary operations. If the necessary time for invoice issuing is set for 20 minutes, any broaching will be immediately visible in the report. Therefore, the control of the targets in a timely manner contributes to overall company's efficiency increase."

Responsibility delegation

This advantage of the ERP system helps to continue in the settled workflow, even if someone leaves for vacation. Usually there are fixed approval processes in the companies, with clearly identified roles and responsibilities between people. Nevertheless it happens, that one employee becomes more essential than other, and while his absence, many actions are pending his approval. With the correctly entered organization chart and stand-ins to the ERP, this prolongation can be avoided. Every person has an identified back up, and during his absence the system can automatically forward necessary task to him.

Drawing personal responsibility

Very important function related to personal responsibility is the process of ownership assignment. Every function, every process in the company has its appropriate way of proceeding, with appointed people to watch over the process. Once the specific person is responsible for a task, his actions will be visible in the system, with corresponding time of processing. Therefore, if the person does not stick to the schedule, leaves earlier, or leaves a document unacknowledged, the company management will easily derive his error from the system. This way higher reliability of employees can be expected.

Immediate data evidence

A huge advantage of the ERP system is the precise and immediate data evidence. It is key to log the data during the required current situation, without a lag. Later ex post filling is unwanted, especially for the administrative reasons (data might be forgotten, or lost). On top of this, ERP system can be linked with the attendance system (ie. a system that registers access and movement of people around the company premises), individual machinery, entrances etc. The collection of such data can be further automatized, which will result in time savings and a realistic numbers.

Automated data processing

The most beneficial feature of the ERP system is automated data processing. This means, that received data are automatically recalculated, evaluated, compared with past values and with predicted values, complemented by the generated text and graphical comments in form of reports. All these actions are processed automatically and provided to the appropriate people immediately. Time saving and accuracy of the output is amazing. "Before the ERP systems, even a banality such as balance sheet or income statement have been compiled in many hours spent with an accountant, and now it is just a click away," as mentioned by Martin Zikmund.

This possibility also applies for any other required reports and production outcomes. It is possible to implement the tools, allowing to monitor deviations from the plan, exceeding of the planned resources, decrease of productivity, etc.

Automated outputs are also a prerequisite for further implementation of Balanced scorecard, as well as strategic management.

Removal of human factor mistakes

Before the ERP, most of the companies were trapped in the world of spreadsheets, never-ending Excel tables and manual data overwriting. The bigger the amount of data, the higher the probability of human factor mistake. With ERP system the situations, when one document is saved and forwarded to a colleague for further update, and later changing items in the original version and forwarding once again, thus producing the discrepancies, can never happen. Everything is centralized under one database, with user-friendly interface.

Release of incompetent staff

Building on all previous functions, it is clear, that the work productivity is a high focus. With ERP integration an individual performance becomes very visible and

quantifiable. Under such conditions employees have no choice but perform with the highest quality. Although, there are always people not willing to act pro-actively, and rather shirk in some extent. Unfortunately (or rather luckily) their lack of involvement very quickly appears in the statistics, and they are often dismissed. Such filtering out of unproductive individuals leads to creation of opportunities for more self-motivated people, who can benefit the company better.

Support of predicting and planning

Another asset brought by ERP is meant for strategic management of the company. If the management is competent and knows how to work with the data, they get a powerful tool for increasing business effectiveness. ERP system enables to get the precise and accurate picture about the company's performance at any time. This way, potential problems and threats can be eliminated immediately. Martin Zikmund states an example: "Lets imagine, that a new product is launched on the market. Usually, receiving of first feedbacks took months. With ERP however, the results of the product launch can be visible immediately. It is followed by the analysis of individual aspects of the sales, seeking for the best functioning model. Based on information received from ERP, management can identify, that for example one region has higher sales than other. After approaching the specific sales unit, it can be detected, that a sales agent uses better techniques, like bundling the product with another, or providing reasonable discount. All the useful actions are immediately applied for all other regions."

The speed and interconnection via the system is the key for swift and efficient management of the company. These particular experiences, based on the individual outcomes and gathered by the system, are the ones, that later serve as the best practice for further development. Building on this, a company can form the strategy, which will reflect the market as well as internal situation of the company, and prosper in future. Knowing the real potential of the company is the key for future estimates and predictions. Forecasting so called Business Intelligence module allows management to rely on predeceasing data and formulate a reasonable future prediction. Based on the

prediction the management should act accordingly and take the steps leading to some tangible benefits.

Customer relationships

The meaning of the ERP system is different in case of usage for internal purposes only, or to managing the customers as well. According to *Vorisek* (2008) the case when the system is used as a means of communication with customers, partners and suppliers (external environment of the company) its significance rises even more. The system becomes an essential part of company's marketing and communication tool, crucial to its business success. In this case, the demands on system functionality are raised. Therefore the operation of business ICT must be highly secured so that it does not interrupt the overall commercial activities and thus the company's prosperity.

Nevertheless, most of the ICTs' benefits is based on people. First it must be ensured that people typed the right data to the system at the right time. This requires a consistent education of employees as well as full engagement of the management, so that all the functions of the system are fully utilized. It often happens, that many areas of the ERP are not exploited fully, and become useless, even though they can help the company very much.

According to *Vorisek* (2008), there are several potential issues that might occur when choosing ERP:

- *Problematic customization* – adjusting an ERP according to demands of specific customer requires very specific set up of thousands of customized parameters. The work is done by experienced implementers, who are highly paid, and their work therefore generates high administrative costs.
- *High education costs* – due to very complex character of the system, no one can start operating without a proper education first. Usually the key users are selected from each department, who are given the knowledge transfer and they share it with the rest of the department.

- *Low utilization of overall functionality* – as mentioned above, the ERP system consist of many modules and offer wide range of functions. However, the complexity of the applications are often so wide, that only part of them are truly utilized. Thus the loss of the full potential value happens.

- *High computer costs* – covering all expenses related to operation of the system. Tend to even increase with each upgrade of the system.

- *Complicated operation* – the higher the complexity of the system, the more difficult the operation becomes. Not all users (employees) are technically skilled and used to modern technology. Some of them might even express an unfavorable position, refusing to learn new ways of work.

3.2.3. Implementation of the system

This subchapter describes the most important principles of ERP implementation. It is based on personal experience of *Mgr. Lubos Krubner*, Executive Project Manager of HELIOS Green system, Asseco Solutions, a.s.[4]

Mr. Krubner believes, that the most important part of the process takes place in the pre-planning phase of the implementation - when the company representative and sales representative of the IT provider meet and initiate a negotiation, aimed to design the most appropriate system. Thus begins a complex process that ends with launch of production. This phase is the key for future flawless functioning of the system and customers' satisfaction, therefore a high focus must be assigned to initial agreement, with very specifically and precisely identified the needs of the client.

The role of the Lead Project Manager often begins with introducing the client a realistic framework with possibilities for their use, building on their ideas. Although it often happens, that clients have unrealistic expectations, which can be hardly met. Therefore it is recommended to conduct a feasibility study, with specific customer's

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[4] Asseco Solutions a.s., Praha, CZ

demands at one side, and the conditions, under which the supplier can deliver such items on the other. This serves as a baseline for further agreement.

Once the requirements are clarified, they must be quantified for final contract. The price of the complete solution depends on complexity of the chosen system. As Mr. Krubner describes, the calculation usually includes three main parts: price of the suggested solution, price of users' licenses and price of implementation of the system. While the license price is fixed, the implementation part depends on complicacy of the ERP. Also, since the overall project is divided to several stages, it is good to calculate and distribute the costs among the stages as well as considering the specific modules. The final amount reflects the specific solution for the customer, along with detailed implementation plan, and therefore becomes an essential part of the contract, signed between two parties.

During the negotiations, before the final contract signature, the process of integration is designed. Most important thing is to appoint responsible people, on both sides. This is often neglected from the customer's side, which causes many difficulties. Sometimes the project sponsor is selected from the least loaded employees, who have the time, but unfortunately they do not possess appropriate experience and decision power, which is required to run such comprehensive project. The other extreme is when the sponsor becomes a representative of the company's top management, who unfortunately does not have enough time to fully dedicate to the project. Nevertheless, the path to successful implementation leads through ongoing dialogue between the provider and the client.

3.3. Summary

According to *Sulak* (2004)[5] a performance efficiency is defined as ability of the company to valorize the investment put into the enterprise the best. This definition can however mistakenly lead to believe that a productive company is only the one which

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[5] Sulak, M. (2004) quoted by Vorisek (2008)

produces good economic results. This is not always true. From the perspective of long-term economic result there are other important indicators that must be taken into account.

Another issue is a diversity of assessment to performance valuation by different parties. Benchmark of performance for management is especially market share, loyalty of customers and low costs with equable cash flows. For customers the main criteria are quality of product, delivery time and price. Owners, on the other side, are interested in evaluation of the invested capital, and therefore indicators like return on investment, economic value added and value of the company. For a long-term prosperous business operation is important to meet the expectations not only of the owners, but also employees, business partners and the market surroundings as a whole.

A broad definition of the term productivity and especially its use in practice presents a challenge, which must be approached by the management. A regular establishment, coordination and especially control of all objectives bust be managed at all defined levels. For this reason a functional system must be determined and matched with the strategic business goals of the company.

Vorisek (2008) sees the strategic goals alignment with the everyday operation activities as the key to success of the business. In this case selection of appropriate metrics is crucial for further monitoring of strategy and its fulfillment. Correctly selected metrics create a system of performance management which is a starting point for an ERP implementation.

A common mistake during integration of the performance management system is insufficient initial analysis of the company's ability to assimilate such system. Not all the companies are capable of switching from their business as usual to completely new complex performance oriented management system. Experience has proved, that implementation of such systems and their further adjustment and upgrading takes time and ideally is broken down into phases, which cannot be skipped without a risk (Vorisek, 2008).

There is a certain model, developed by the company ARM Research (Kolomaznik, 2007[6]) describing a capability and maturity of companies towards process

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[6] Kolomaznik, T. (2007) quoted by Vorisek (2008)

and performance management. It indicates four stages of Business Intelligence systems implementation and the methods of performance management associated therewith.

1.   *Reaction*

In this stage is all the attention oriented towards the past. Therefore a designation "reaction", since all the current happening in the company is a reaction to some past actions. Such backward perspective might help to answer the question "Where were we?" and what lessons learnt did we gather. These assessments are usually done independently in individual departments, where "their" performance is evaluated based on the relevant indicators to their specific activity. In this stage are often used conventional spreadsheets in combination with manual listing. The emphasis is on improving the access to data, shorten a reporting cycles and the better concentration to details at certain level. Associated attribute is usually minimizing of reporting activities among the departments (Vorisek, 2008).

2.   *Forecasting*

Building on the reaction stage, the forecasting phase passes from the pure analysis of the past to more current approach. Processed material describe the current situation in the company and provide an answer to the question: "How are we doing right now?". Activities described in the previous stage are shifted from tactical to more strategic mode of operation, with appropriate owner of the activity (sponsor) assigned. Existing processes are reviewed with emphasis on their efficiency. Primary information tool of this stage is usually a dashboard, which reflects the actual state of the business processes. The main concern is the actual productivity of the company (Vorisek, 2008).

3.   Cooperation

Communication between the departments and its connection becomes essential in the next stage. Linking all the activities of individual departments under one common

strategy with information sharing, provides an easy assessment in future planning. The whole system allows to answer: "Where are we heading now?". Next step is to measure and analyze the relationship between the cause and effect of some activities, globally across the company. Aims and resources are assigned to several units simultaneously, which implies the integrated planning process. All information derived from the ICT are analyzed quickly and suggest immediately the best solution.

For productivity measurement are selected several operational and several financial metrics, which have a direct link to performance effectivity – Key Performance Indicators, known as KPIs. KPIs are targeted to the objectives, selected and implemented into strategy, and provide a company's management an overview about their direction. Both dashboards and scorecards are used in this stage. Decisions are done based on analysis of causes and effects.

4.   Orchestration

Companies found in the highest level of the implementation usually have a consistent and interconnected sight of their business' performance, and thus they are able to say "Do we all pull together in a same direction?". A productivity management becomes part of the company's philosophy and essential part of the firm's culture. Undertaking is then controlled by the valid results, supported by the service level agreement (SLA) (Vorisek, 2008).

Not all companies find themselves at the top level of the maturity of their process and performance management. Most of them belong to the stage 2, as resulted from the international survey of the AMR Research, conducted in 2007. 35% of the respondent companies see themselves in the first stage, while 55% in the second stage. Third and fourth stage occupy only 7% and 3% of respondents.

In the following part of the thesis I will describe, how company ISAN Radiatory approached their selection and integration of the ERP, its interconnection with company's strategic goals, what expectations did they have and how the system helped

their business. The information about ISAN Radiatory's ERP was provided to me by my counterpart in the company.

4. PRACTICAL PART

4.1. Description of the ISAN Radiatory s.r.o.

4.1.1. History of the company

The company's roots date back to 1953, when a production company Univa was founded in Blansko. The manufacture associated mainly glass and textile production. It was partly connected to a furniture and automotive production in the close neighborhood. During the time a merge of metalworking took place with further focus on the radiators production.

The year 1973 was an important milestone – a new production plant was opened. Since then a massive increase of radiators production came to the forefront. In 1992 a factory became a private property and shortly afterwards the minor parallel divisions perished, and only radiators division was left. The production concentrated mainly to design heating.

Another significant milestone took place in year 2003, when a merge of two companies – Univa and the trading company Amtex happen and a new modern enterprise was formed – Amtex Radiatory. A company has also became an owner of the company Opltherm s.r.o. Such union of two successful producers had an objective of developing a prosperous common business strategy towards favorable position on the market (both local and European).

On 1.6.2006 a company renamed to Isan Radiatory s.r.o. and the client oriented strategy began. Thanks to the long history of production and experience a strong portfolio of products have been compiled. Radiators are sold not only in the Czech Republic and Slovakia, but also at many foreign markets[7].

4.1.2. Organizational structure of the company

Company is suited in Blansko, South Moravian region. The production volume covers nearly 260.000 pc of sold radiators yearly. It has over 1000 customers in the database, 250 employees, 55 years of experience and is the leading producer of the bath and design radiators in the Czech Republic. It specializes on atypical project customized to the customer's request.

Role	Name
Director of the company	Jan Dirk van Kranenburg
Managing Director	Jan Sevcik
Financial Director	Ing. Ivana Spankova

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[7] Information from the annual company report 2012, available on justice.cz

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                        ┌─────────────────────────────┐
                        │   Director of the company   │
                        └─────────────────────────────┘
                                      │
      ┌──────────────────┐      ┌─────────────────────────┐
      │   Secretariat    │      │   Quality Management    │
      │  of the Director │      │     Representative      │
      └──────────────────┘      └─────────────────────────┘
                                            │
                                  ┌───────────────┐
                                  │    Head of    │
                                  │      OTK      │
                                  └───────────────┘

                              ┌───────────────────────────┐
                              │    Financial Director     │
                              └───────────────────────────┘
                                            │
                  ┌───────────────┬─────────┴──────────┬───────────────┐
          ┌───────────────┐  ┌───────────────┐  ┌───────────────┐
          │  Head of CR   │  │  Head of PO   │  │      IT       │
          └───────────────┘  └───────────────┘  └───────────────┘

                              ┌───────────────────────────┐
                              │    Commercial Director    │
                              └───────────────────────────┘
                                            │
          ┌───────────────┐  ┌───────────────┐  ┌───────────────┐
          │ Sales Manager │  │ Export Director│ │   Marketing   │
          │     CZ/SK     │  │               │  │   Director     │
          └───────────────┘  └───────────────┘  └───────────────┘

                              ┌───────────────────────────┐
                              │     Managing Director     │
                              └───────────────────────────┘
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        ┌──────────┐  ┌─────────────┐  ┌──────────┐  ┌──────────┐
        │  Supply  │  │ TPP Manager │  │ Planning │  │ Production│
        │ Manager  │  │             │  │ Manager  │  │  Manager  │
        └──────────┘  └─────────────┘  └──────────┘  └──────────┘
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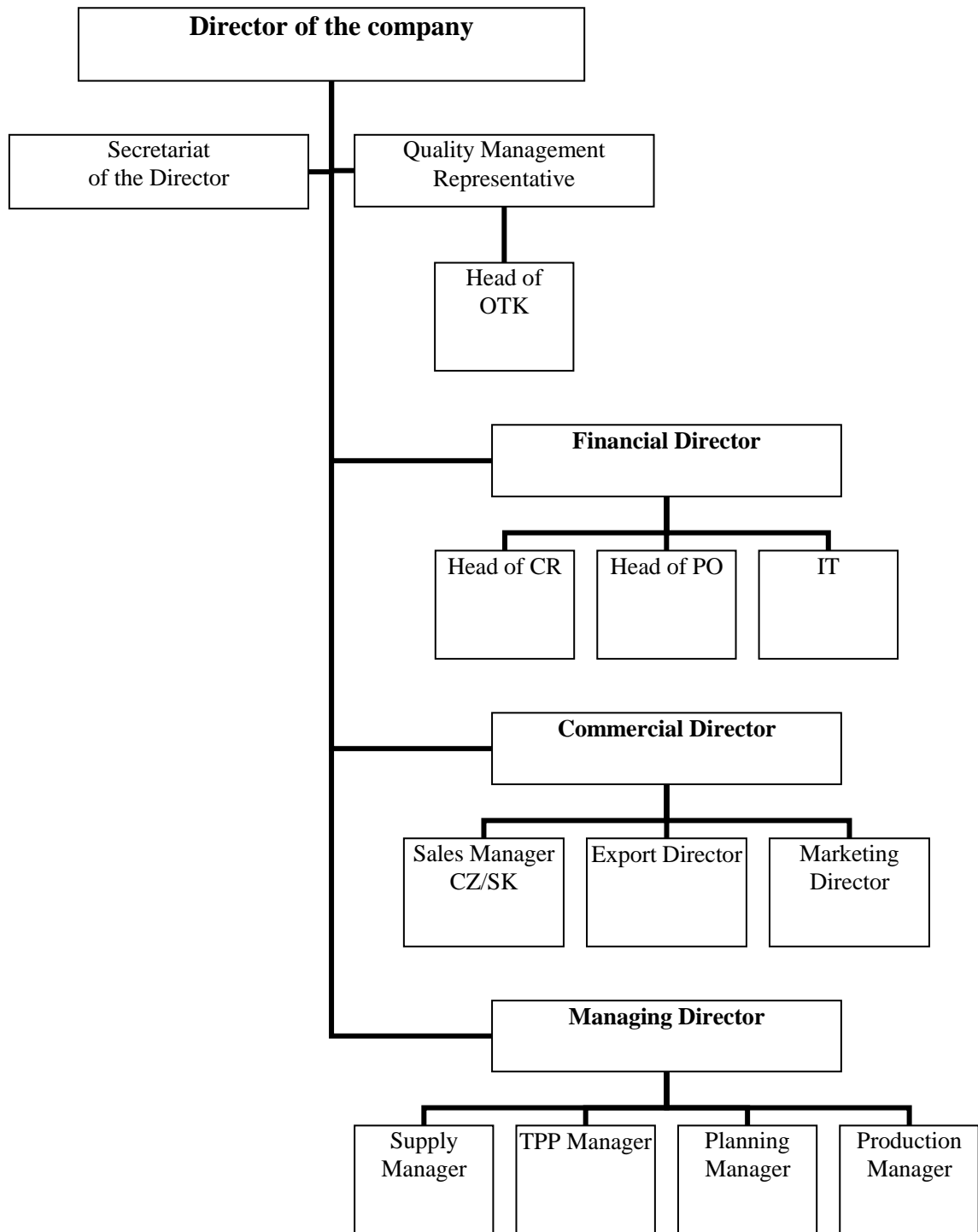
Table 3: Organization structure of ISAN Radiatory

4.1.3. Company's objective

ISAN Radiatory s.r.o., with extended range of floor convectors TERMO Practic, Dynamic, Activ and bath radiators MELODY, have adopted a vision for the company that promises to deliver any kind of radiator to suit any space, with emphasis on design. Offered range now includes bath and design radiators MELODY, standing convectors and lamellar radiators EXACT, sectional radiators ATOL and finned tube radiators SPIRAL.

A competition on the market is huge, and finding a right place to fit with the product is the crucial task. Global crisis has negatively affected many markets and disrupted some of the seemingly solid smaller supplier relationships. This provided a bigger companies, such ISAN, an opportunity to strike. However, it also went hand in hand with the increasing pressure on quality, used technology, effectiveness of the processes and the overall standard of the provided services alongside with the price challenging.

As a strategy ISAN Radiatory elected a cost reduction and extend of the products range. Primary objective was not becoming a "number one" on the market, but reaching a position, where they will be respected and feared rival, with the only target: to gain more market share at the expense of competitors and to storm a market leader. Such strategy is very risky and ambitious, but provided that the leader on the market does not deliver in the best possible quality, and knowing his weaknesses may lead to high profitability.

ISAN Radiatory see the two main target markets – new construction market and reconstruction. There is a high demand for non-standard atypical products, which plays into the hands of the company. In the long-run company expects a decrease of demand for classical white bodies and presume an increase of demand for design heating objects. Glass walls, French windows and balconies also increase a demand for underfloor heating suitable as addition to capacity deficit, creating thermal barrier in the modern type of housing. At the same time, increasing trend of underfloor heating is no obstacle for continuous production of usual bath heating.

4.1.4. Characteristics of the company's information systems

4.1.4.1.Identification of requirements

ISAN Radiatory is a modern company with professionals at all its management levels. They constantly approach all aspects of their business and seek for opportunities to increase their productivity. As indicated by the modern era, the way to successful competitive business lies in properly engaged technology. In year 2006 ISAN Radiatory have decided to access their complex management system and evaluate their possibilities of improvement. They have analyzed and consulted their performance with both internal and external experts, and defined several areas that can be improved. Building on their findings they initiated a search for the most convenient system, which will meet all their requirements[8]:

1. Complex system that can *interconnect all segments of the company* – commercial, accounting, HR, technical preparation of production (TPP), supply management, production, etc.

2. Appropriate customization for the company's *mixed production*, from repeated production up to engineering to order (applies especially for design radiators).

3. *APS (Advanced planning and scheduling* - the solution which includes fully integrated advanced planning which synchronizes and automates material and capacities for job orders.

4. *Complex product configurator* - an integrated tool for order configuration interconnected with the sales database (helping sales representatives during negotiation phase, and later in production – guarantees the feasibility of orders).

5. *Inventory management* - the solution that automates the calculation process and accelerates the clearance, as well as monitors the stock levels – keeps appropriate stock

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[8] Information provided to me by the counterpart in the company on the face-to-face meeting in March 2015.

level and simultaneously prevent a shortage of material (prognoses, safety stock and the size of a lot).

6. *Business Intelligence* – reliable tool for data collection, with a synoptic graphical output, which will be used as a baseline for further planning and decision making.

7. *CRM (Customer relationship management)* – a business solution that drives sales productivity and marketing effectiveness through social insights, business intelligence, and campaign management. The tool that can help to reduce the costs and increase profitability by organising and automating marketing processes that maintain customer satisfaction and loyalty.

8. *User friendly interface*, that allows all employees of the company easily use the system, no matter what technical background do they have.

9. *Czech language support* – preferable local company with solid backgroud as well as a high level of customization possibility.

4.1.4.2. Choosing a solution & implementer

After evaluation of the requirements and assessment of all offered solutions from many providers, ISAN Radiatory decided to sign for the *Infor SyteLine* Enterprise Resource Planning system. The only official distributor and implementer of the Infor SyteLine system in the Czech Republic is an Ostrava company *ITeuro, a.s.*

Infor SyteLine is a modern and flexible ERP system that keeps up with the latest technology. Its advantages include[9]:

- Reliable Microsoft technologies. NET, MS SQL 2008, thin client (ClickOnce installation)
- An open system using the advantages of SOA (service oriented architecture)
- Modern design and easy operation based on the Microsoft platform
- Integration with Microsoft Office (MS Outlook, MS Project, MS Excel)

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[9] Information taken from the official website of the company *ITeuro, a.s.*, available at *http://www.iteuro.cz/produkty/infor-syteline/*

- Management support from one place to the key user roles

- Integrated Workflow independent from the mail server

- Integrated CRM to support the sales and marketing

- Integrated tool for reporting, creation and evaluation indicators (KPI)

- Integrated advanced planning and scheduling (APS)

- User-friendly interface, adjustable user specific

- Connection of separate branches and the possibility of planning as a whole - Multisite functionality

The world headquarters of the parent company and the actual developer and owner of the system – *Infor Global Solutions*, is suited in New York, USA, and has over 1745 partners worldwide, with representative offices in 41 different countries.

4.1.4.3.Integration of the system

Integration of an ERP system into a company's structure covers more than just an implementation of the software. It includes a comprehensive analysis of the requirements, their transformation into parameters, evaluation of their feasibility and developing a scheme of their launch. The whole process is managed by experienced implementers in coordination with the company's representative. An open communication channel must be established between the parties, with agreed plan of the process.

Company ITeuro, a.s. uses an implementation technique *FOCUS*, which has proven positive results at Infor SyteLine integration at the Czech market[10]. The scheme of the FOCUS method is shown in the table below:

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[10] Information taken from the official website of the company *ITeuro, a.s.*, available at *http://www.iteuro.cz/sluzby/complex-implementace-informacniho-systemu/#metodika_implementace*

PURCHASE	1 - PLANNING	2 - ANALYSIS	3 - EDUCATION	4 - SIMULATION	5 - BAU	AFTER-CARE
Subject of the project	Project quality plan	HW, SW	Set-up of the system	Proof of concept solution	Data import	Support adjustment
Qualification of the business case	Project scope	Supply & Sales	Users' training	Process modelling	Go-live assistance	Regular customer audit
Orientation visit	Aim & Benefit of the project	TPP & Production	Supply & Sales	Processes simulation in use	Goals fulfill. assessment	Developing activities upgrades
Presentation to customer	Project schedule	Planning	TPP & Production	Accepting changes & modifications	Targets fulfill. assessment	
Reference visit	Organization of the project	Economy	Planning	Final testing	Cutover	
Final presentation	Communication matrix	Solution baseline	Accounting	Evaluation of readiness for BAU	END OF STAGE	
Contract closure	Documentation of the project	END OF STAGE	System administration	Key users education		
END OF STAGE	Risk analysis		Business Inteligence	Data preparation & system config		
	Handover protocol		Users' skills assessment	END OF STAGE		
	END OF STAGE		END OF STAGE			

PROJECT - ERP IMPLEMENTATION

Table 4: FOCUS methodology of ERP projects implementation[11]

The main benefits from the system, expected by the ISAN Radiatory are savings in inventory management, resulted from the accelerated terms of deliveries to customers and associated faster billing and monetizing of receivables. They also expect higher employees' productivity, based on automation of the processes and better control of the performance. Better monitoring options and standardized workflow also imply a decrease of product reject rate, resulting in higher customer satisfaction. The overall convenience and user-friendly interface should also contribute to the employees' satisfaction with provided working tools, and therefore better working environment.

Besides the improvement of internal processes productivity, company believes in total revenues increase, arising from the CRM module, which promises a sensible contribution to the commercial activities of the company. All client information is systematically gathered and stored in one system, evaluating trends and best practices

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[11] Information taken from the official website of the company *ITeuro, a.s.*, available at *http://www.iteuro.cz/sluzby/complex-implementace-informacniho-systemu/#metodika_implementace;* own translation

per region/product/company and provides an essential business tool for establishing better connection with the customer, based on the previous knowledge.

To make sure, that all ISAN Radiatory's expectations are met, ITeuro had to customize the SyteLine system with highly functional *controlling*, *analyzing* and *planning* applications. Based on detailed examination of ISAN Radiatory's internal processes they have configured the modules to include following functions:

➢ Control of   - entering material
                        - unreleased materiel
                        - incorrectly adjusted items
                        - safety stock
                        - paid production orders
                        - average time of release of production orders
                        - delay of production orders per contract/workplace

➢ Planning of   - minimum inventory level
                        - fast moving customer items on inventory
                        - work level

➢ Analysis of   - expendable materials
                        - produced items/parts
                        - performed work
                        - quality of production

The final design of the ERP, defined for ISAN Radiatory, developed and customized in joint effort of both implementer and ISAN Radiatory's representative is outlined in the table below:

SALES

- Integrated CRM module serves as a main commercial tool in communication with the client. All data are registered and stored in client's personal record, available for any synchronized devices with the CRM.
- All information is centrally uploaded to SL.
- Once the deal is signed, order is automatically generated based on target solution designed by the sales representative.
- Order is immediately transferred from CRM to SL, using a specified bridge between the modules.
- Client data are stored in the system for further identification and communication with the customers.
- Based on the data in CRM customers receive regurarly a "Client satisfaction survey".

ORDERS PROCESSING

- Once the order is registered in SL, it automatically generates the bill of material (BOM), appropriate technical documentation and directs it tothe TPP department.
- SL keeps the technical documentation up-to-date in the system and therefore it is the only approved source of technical documentation (all existing printed engineering drawings are not to be use because of the threat of validity).
- Based on an inventory level, SL automatically generates the list of required, but missing supplies and generates so called purchase demand. A lot of time is then saved by avoiding manual checks.
- After approval of the order by the TPP department and transfer to production, an invoice is automatically issued in the accounting module and sent to the customer. Therefore a due date of the invoice beggins in ahead of production and shipping > resulted in faster turnover of receivables.

PRODUCTION & EXPEDITION

- When a complete order is accompained with appropriate documentation and required material > it continues to production.
- All employees engaged in production (manual assembly) are obliged to register at the specified check-points, where the particular activity is set to a certain amount of man-hours. Once they finish their task, they swipp again, and the result of their work is immediately transferred to the independent wages SW of the company, using a manual bridge between the SL and the wages software (ISAN Radiatory use APSO wages application system).
- With the ready product an instruction to dispatch is sent, along with created delivery list and associated invoice.

Table 5: Workflow diagram of the SyteLine's main functions in ISAN Radiatory[12]

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[12] Information necessary for developing the workflow diagram have been provided to me by the counterpart in the company on the face-to-face meeting in March 2015. This is a summary of the consultation.

4.2. Application of particular measuring system

4.2.1. Determination of the KPIs

To begin with evaluation of the benefits of any ERP system it is important to set up a specific quantifiable indicators first, so that further measure of the system's contribution can be done. When ISAN Radiatory assessed their performance in year 2006, they have identified several areas with potential for improvement. The company has its own team of financial experts and advisors, and their methods of forecasting and estimations are confidential. Therefore for the purposes of this case study I have developed most reasonable key performance indicators, building on the requirements of the company and considering the functionality of chosen ERP system. My KPIs are based on traditional performance and productivity measurement methods, described in the theoretical part of the thesis.

Since the high attention of the company is oriented towards efficiency increase, I have examined the most crucial operating ratios that might have been influenced by the ERP the most. I have divided them into three categories: *profitability, activity* and *productivity*. These indicators will demonstrate the impact of the ERP the best.

In addition, to find out whether the company's productivity would remain unchanged, without an ERP integration, I have compared a predicted development of the company's performance based on the trend analysis of the previous years with the actual development after the ERP implementation. The prediction has been done via trend analysis using the least square method.

Also, in order to make sure that the investment into the system actually pays off, I have conducted an overall evaluation of the investment, using a real options method.

4.2.2. Evaluation of the investment using real options model

For the purposes of establishing the real value of the ERP system I will attempt to evaluate this investment opportunity from a new perspective - the real options theory.

Unlike the standard determination of the NPV of the future cash flow, or similar corporate resource allocation approaches, the real options acknowledge the importance of managerial flexibility and strategy adaptability. According to study, compiled by Xiaotong Li from University of Alabama in Huntsville and John D. Johnson from University of Mississippi, published in Information resources Management Journal, 15(3), 32-47, July-Sept. 2002 (available online at *http://cba.uah.edu/lixi/papers/IRMJ_proof_copy.pdf*), the superiority of the real options method over other capital budgeting methods (like discounted cash flow analysis) has been widely recognized in analyzing the strategic investment decision under uncertainties. Li and Johnson also refer to the studies of Clemsons 1991, Dos Santos 1991 and Kumar 1996, where the fact that many IT investment projects in the uncertain world possess some option-like characteristics was implied. Building on this, the real options based investment decision-making seem to be perfect platform for further integration of the IT dimension.

Options evaluation are widely used in financial world. When concluding the financial option a buyer receives the right, but not the obligation, to buy (call option) or sell (put option) at a predetermined price and at the particular time a certain underlying asset. Thus in case of unfavorable conditions a buyer can renounce his right to the deal, and bare only the costs of option premium (the price paid for option) (Kislingerova, 2007).

The analogy with financial options served as a basis for new concept of decision making analysis. This method included the flexibility factor and is known as options methodology, or also *real options*. Its usage is therefore suitable in the cases where there is a space (flexibility) for decision and the future development is uncertain, which can be characterized by a certain volatility, represented by variance of future cash flows (Kislingerova, 2007). The real option can be, for example, a purchase of some

kind of manufacturing machine, which promises a future flexibility of decision, based on the commodity prices at the market, thus it gives buyers the future possibility of either produce, or not. They are not obliged to continue in production if the prices are uneconomic. Another common example is the license bought for certain period of time. Based on current situation a company can then decide whether to continue in subscribing, or not.

Individual parameters characterizing the financial options (option premium, the current value of the underlying asset, spot price, expiration time, the volatility of underlying asset, risk-free interest rate) have their alternative in usage of real options:

Financial option	Real option
Spot price	Present value of future CFs
Strike price	Nominal value of the investment
Expiration period	Duration for potential realization
Risk-free interest rate	Risk-free interest rate
Volatility of underlying asset	Volatility of the project

Table 6: Analogy characteristics of financial and real options (Kislingerova, 2007)

The formula for determining the value of financial options can be, building on the above analogy, modified for calculation of the value of real options:

$$C = \sum \frac{CF}{(1+WACC)^t} * N(d_1) - C_0 * e^{-rt} * N(d_2$$

where

$$d_1 = \frac{\ln(\sum \frac{CF}{(1+WACC)^t} : C_0) + (r + \sigma^2 : 2) * t}{\sigma * \sqrt{t}}$$

$$d_2 = d_1 - \sigma * \sqrt{t}$$

WACC   weighted average cost of capital

CF   cash flows from the investment

C_0 investment value

r   risk-free rate

The factor e^{-rt} in the second part of the formula is used, when C_0 value must be recalculated to the present value; however in case when the investment is placed as a lump sum at the beginning of the project, this factor could be left out. This way we get an equation in the following form (assuming that the discounted CF is represented by the PV):

$$C = PV * N(d_1) - C_0 * N(d_2)$$

If compared to similarly rewritten formula for NPV, we get:

$$NPV = PV - C_0$$

It is obvious that the value determined using the real options differs from NPV only in the values multiplication by the normal distribution values. Simply speaking, real options can be seen as the NPV determination with included the utility of flexibility, which allows volatility. In case of very low volatility the value is nearly the same as NPV (Kislingerova, 2007).

4.2.2.1. Cost of equity – CAPM method

To begin with evaluation we need to start with the WACC determination. As mentioned in the chapter 3.1.5.2, the formula includes following items: cost of debt, income tax rate, market value of the firm's debt, cost of equity, market value of the firm's equity and a total market value of invested capital.

I will begin with the determination of the equity cost. Below is my used method of estimation, namely, the CAPM method with the country risk premium. I have

taken the data from the Professor Aswath Damodaran's on-line database[13], where the country risk premiums and beta leverages are defined for individual countries and markets. The rate of inflation was uploaded from the kurzy.cz website[14], and the ratio between own equity and debt in the company was manually calculated based on the financial statements of the company (year 2006).

rf (actual rate of return on 10-year government bonds USA)	3.8%
Beta debt-free for building material (the Global average)	0.8
The risk premium cap. US market (average 1926-2001)	5.17%
Rating of the Czech Republic	Baa1

Country risk premium (CRP)	1.050%
Country risk premium corrected by the difference in inflation (2.8%)	**3.9%**

Risk premium for a smaller company - estimate	2.0%
Risk premium for less liquidity of ownership shares - estimate	1.5%

The ratio of debt and equity in ISAN Radiatory s.r.o.	4%
Tax rate (2006)	24%

Beta leveraged	**0.82432**

Cost of equity	**15.4%**

4.2.2.2.WACC

The input from the CAPM analysis was used in the calculation of WACC as follows:

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[13] available at http://pages.stern.nyu.edu/~adamodar/

[14] Available at http://www.kurzy.cz/zpravy/142067-cr-mira-inflace-v-roce-2007-byla-2-8-v-prosinci-rostly-ceny-o-0-5/

A) WEIGHTS OF CAPITAL		
Capital item	**CZK**	**Share**
Equity	**28,197,000**	**18.6%**
Long-term bank loans	30,444,000	20.0%
Short-term bank loans	12,855,000	8.5%
Total debt	**123,691,000**	**81.4%**
Total chargeable capital	**151,888,000**	**100.0%**

B) COST OF DEBT			
Capital item	R_d	**Market value**	**Product**
Long-term bank loans	9.00%	30,444,000	2,739,960
Short-term bank loans	6.00%	12,855,000	771,300
Total		**43,299,000**	**3,511,260**
Average cost of debt			**8.11%**

C) COST OF EQUITY	
Estimation using the CAPM country-risk premia (CRP)	**15.41%**

D) WACC			
	Weight	**Cost**	**Product**
Equity	18.6%	15.4%	2.9%
Debt (after tax)	81.4%	6.2%	5.0%
WACC			**7.9%**

The WACC value was further rounded up to 8% and used as a discount factor in the following real options calculations.

4.2.2.3.Real Options determination

To identify the real option value, we need to know the following variables:

CF - estimated expected future cash flows, generated by the investment

C_0 - investment sum

WACC - weighted average cost of capital, to be used as a discount rate

r - risk-free rate

t - lifetime of the investment

σ - standard deviation

To set up a standard deviation, I will use an average value from the segment of building, which is 0.53[15].

A risk-free rate was estimated to 4% (estimation based on correspondence with similar projects).

Lifetime of the project is set for 5 years (further reevaluation of the system usage in 5 years was agreed between ISAN Radiatory and ITeuro).

The investment value is 7 000 000 CZK[16].

Expected CFs, resulted from the SyteLine contribution are estimated as follows[17]:

2007	7,000,000
2008	500,000
2009	6,000,000
2010	2,000,000
2011	10,000,000

Based on the variables above the equation can be formulated:

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[15] Information taken from the Professor Aswath Damodaran's on-line database, available at http://pages.stern.nyu.edu/~adamodar/
[16] For the purposes of the case study, the investment value is simplified into one lump sum, however the real charges for the system were cumulative, based on the software upgrades during several stages, and resulted into approximately 7 000 000 CZK (provided by the ISAN Radiatory representative).
[17] Own estimation built on the difference between the actual CFs for years 2007-2011 (based on company's CF statements) and the forecast of the CF from year 2006, based on company's previous development trend.

$$d_1 = \frac{\ln\left(\frac{19{,}949{,}036}{7{,}000{,}000}\right) + \left(0.04 + \frac{0.53^2}{2}\right) * 5}{0.53 * \sqrt{5}} = 1.649$$

$$d_2 = 1.649 - 0.53 * \sqrt{5} = 0.468$$

$N(d_1) = 0.950$

$N(d_2) = 0.680$

$$C = 19{,}949{,}036 * 0.950 - 7{,}000{,}000 * 0.680 = 14{,}201{,}364 \; CZK$$

The value of the option equals 14 201 364 CZK, which indicates a highly profitable investment. If compared to NPV, we get also a positive output of 12 949 086 CZK.

$$NPV = 19{,}949{,}036 - 7{,}000{,}000 = 12{,}949{,}036 \; CZK$$

Thus, building on the real option methodology the investment proven a profitable return, and we can continue to a further analysis of the sectional benefits of the SyteLine system.

4.2.3. Operating ratios

This part of the analysis is going to provide an overview about the company's performance before the SyteLine implementation, and after.

Performance indicators are grouped into three mail clusters: profitability, activity and productivity. Each section covers several operating ratios, with explanatory comments, describing the potential link with the ERP system contribution.

The necessary input was taken from the company's balance sheets and income statements (selected variables of the financial statements are attached in the Attachment 1 & 2)

4.2.3.1. Profitability area

The ERP system SyteLine (further as "SL") has been integrated into company's environment during year 2007. Beginning with the initial analysis of the investment in 2006, following by the several stages of implementation in 2007, resulted in the BAU (business as usual "live" mode) in January 2008. Therefore the breaking point in the ISAN Radiatory's performance is starting in 2008.

Important remark is however the unexpected world crisis, which appeared in 2008 and drastically influenced the market situation worldwide. Thus the visible decrease of performance is seen in 2008, which has negatively overlaid a positive impact of the SL. We can only assume, to what extent the world crisis would impact the company, if the SL was not implemented.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Return on Assets - ROA	25%	-3%	13%	4%	6%	-2%	17%	10%	11%	15%
			9%					**10%**		
Return on Equity – ROE	58%	-39%	38%	5%	25%	-15%	33%	21%	32%	34%
			17%					**21%**		
Return on Capital Employed – ROCE	38%	-19%	51%	18%	37%	-7%	49%	27%	47%	43%
			25%					**32%**		
Return on Sales – ROS	8%	-1%	6%	2%	5%	-1%	6%	5%	6%	7%
			4%					**5%**		

Table 7: Profitability analysis (own calculation)

The total capital invested has generated higher return, after SL implementation. It is not fully verifiable to what extent has SL contributed to ROA efficiency increase, however it is visible, that the distribution of the assets usage has become more stable and even, constantly above the 10% level.

A significant increase appeared in the area of profitability of own capital. Return on equity raised from average 17% to 21%. The internal policy has optimized under new strategic tool SL.

The overall capital employed has also proven higher profitability. The SL system provides much better overview and analysis outputs on the financial situation of the company, including decompositions of the past activities as well as forecasts to the future, which can be used in the correct strategy planning.

The return on sales has stabilized and shows overall increasing trend, unlike in the time when SL has not been deployed. This is supported by the functional management of the commercial activities via CRM module, which is significantly conductive in managing the sales activities.

4.2.3.2.Activities

The area of activity ratios has the highest transparency of the SL influence, since it represents the accelerated functionality of processes, driven by the SL functions.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Turnover of total assets	3.01	1.94	2.12	2.03	1.23	2.36	2.63	2.20	2.00	1.99
			2.07					2.24		
Inventory turnover	9.70	5.15	5.21	5.46	6.23	7.42	9.82	8.10	7.58	8.94
			6.35					8.37		
Inventory turnover time	38	71	70	67	59	49	37	45	48	41
			61					44		
Trade receivables turnover	11.12	9.98	11.48	10.06	10.16	12.15	13.91	15.77	17.31	15.88
			10.56					15.00		
Trade receivables turnover time	33	37	32	36	36	30	26	23	21	23
			35					25		

Table 8: Activities analysis (own calculation)

The most visible effect is in the area of inventory management. The total turnover of inventory increased from 6.35 up to 8.37, and the turnover time decreased from 61 days to 44 days. This is mostly due to terminal data gathering – an automated system with on-line information about the stock levels, specific items quantities and position in the warehouse; on-line information about delivery notes and their status at any time; continuous book inventory of the warehouse with ABC analysis and the trend data control, including elimination of the C-items ("dead" items, not utilized in the production). SL also accelerates the expedition preparation, by automatic printing stickers and labels, according to order.

All these characteristics form an indispensable tool for workers, which allows to get the information immediately and safe much time, not mentioning the accuracy of the information.

Besides the internal organization of the work activities, the company also assigns a great significance to their receivables tracking. As mentioned in theoretical part, the money received today are worth more, than money received tomorrow. By having the monetary means in place on time saves company many potential problems, such insolvency or inability to meet their own debts.

Due to implemented Electronic Data Interchange (EDI) application into the SL system, the company is delivering the invoices automatically in a very short period after the order placement. EDI aim is to progressively replace paper documents with electronic, thus reduce the costs associated with their replacement and simultaneously increase the efficiency and quality of processes implemented. EDI documents have the same legal significance as paper hardcopies. This way the time savings resulted in the decrease of receivables turnover time by 10 days. With the customers without built-in EDI system, ISAN Radiatory still communicate in a standard way, by issuing an invoices and forwarding it to the companies. Nevertheless, thanks to automated orders processing, the invoices are issued immediately after order placement and therefore shorten the time of the payment receive.

4.2.3.3.Productivity area

Profitability area has shown a major influence of the SL effect. The operation efficiency increased with appropriate standardization of the processes and acceleration of speed of the individual tasks and activities. Number of employees decreased, due to automation of the actions, while revenues increased.

Average number of employees decreased from 277 (in 2003) to 232 (in 2012).

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
277	250	240	238	237	235	235	232	232	232

Revenues increased from 347 407 000 CZK up to 358 116 000 CZK, which is an increase of more than 10 million CZK.

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
347,407,000	238,078,000	272,362,000	309,730,000	365,261,000	388,306,000	398,973,000	345,794,000	328,503,000	358,116,000

Such increase of productivity provides a space for wages increase and bonuses assignment, as well as investing in education of employees and increase of their overall satisfaction.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Work productivity	409,209	232,548	333,921	328,416	400,068	425,800	563,200	457,741	433,470	520,991
			340,832					480,241		
Wage productivity	0.37	0.75	0.56	0.66	0.62	0.68	0.48	0.60	0.65	0.55
			0.59					0.59		
Average wage per employee	152,531	175,096	187,688	217,903	246,633	288,281	268,034	276,556	281,427	287,319
			195,970					280,323		
Net profit per employee	102,863	-13,984	69,167	23,824	71,700	-10,945	106,847	68,517	113,319	102,108
			50,714					75,969		
Sales per employee	1,254,177	952,312	1,134,842	1,301,387	1,541,186	1,652,366	1,697,757	1,490,491	1,415,961	1,543,603
			1,236,781					1,560,036		

Table 9: Productivity analysis (own calculation)

Work productivity increased in average by 40%. Wage productivity remained at the same level, however it is important to consider a decrease of employees amount (by 45 people), thus the higher efficiency is visible. Average wage per employee increased by 43%[18]. Net profit per employee increased by nearly 50%, and sales per employee by 26%.

4.2.4. Trend analysis – forecast vs. reality

To see the possible scenario of the company's performance development, if the investment to the SL was not done, I have created a forecast of future values (2008 +), based on the previous company's results. The forecast (predicted development) is then compared with the actual values, generated with support of the SL system.

The prediction has been done by the constructed regression line. This method consists in finding a trend, formed by the monitored data, and project it into the next period. This method should be useful in a situation where external factors affecting the company are stable (or irrelevant), and do not enter the game and no significant external influences. My aim was to analyze the existing trends in the company without a macroeconomic influences.

For my own calculations I used the program Microsoft Office Excel 2013. On several examples I have verified that FORECAST function in this program provides the same results as the formula:

$$Y = a + bX$$

$$a = \frac{\sum y}{n} - b\frac{\sum x}{n}$$

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

---

[18] This indicator is however not very explicit due to high differential of wage rates in the company, from top management to manual assembly workers.

- *Profitability indicators*

ROA

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
25%	-3%	13%	4%	6%	-2%	17%	10%	11%	15%	10%
25%	-3%	13%	4%	6%	-1%	-4%	-7%	-10%	-13%	-7%
					Prediction of the trend (forecast)					

ROA

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROA after ERP	25%	-3%	13%	4%	6%	-2%	17%	10%	11%	15%
ROA without ERP	25%	-3%	13%	4%	6%	-1%	-4%	-7%	-10%	-13%

$y = -0.0313x + 0.1823$
$R^2 = 0.7033$
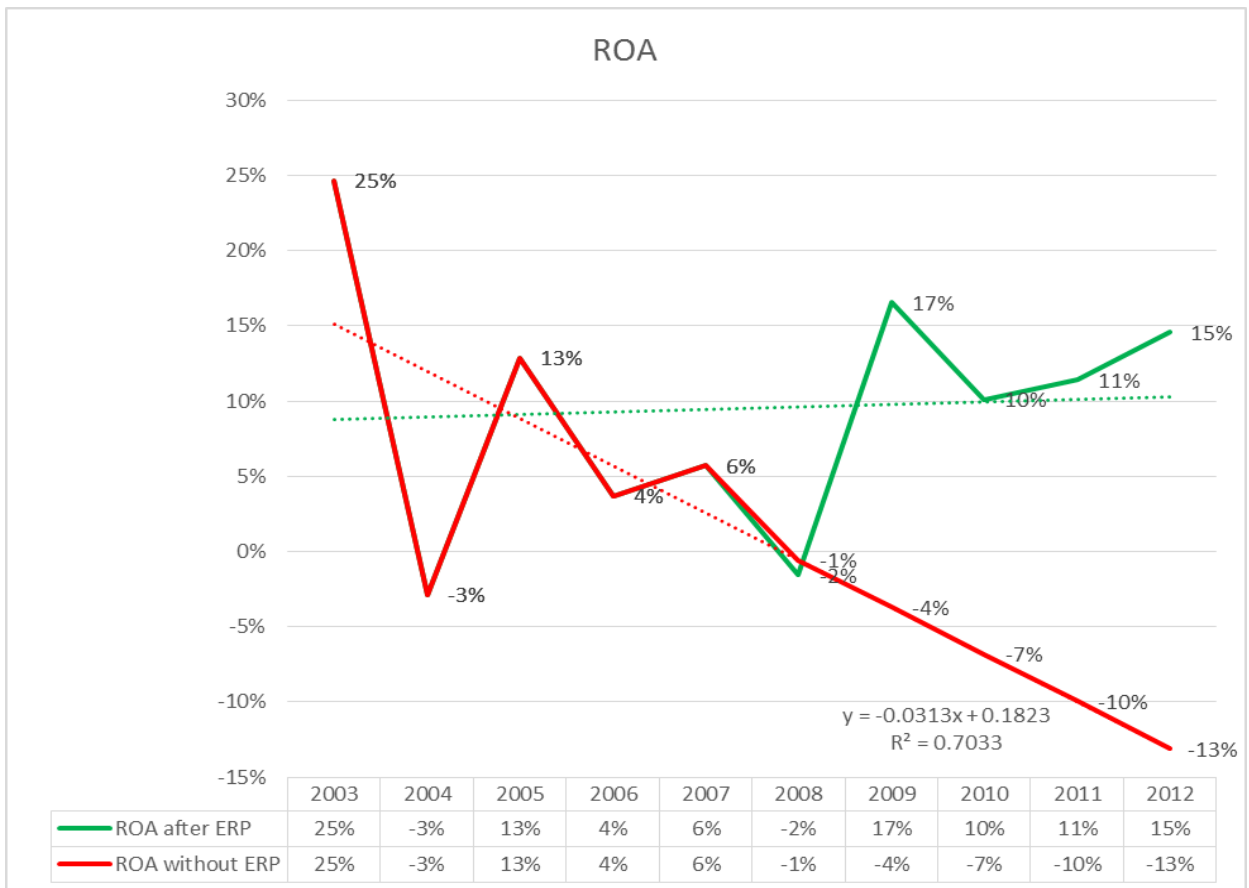
Forecast trend predicts a very deep decrease of ROA. This deviation is caused mainly by the reasonable decreases in past years, especially in 2004, and later in 2006. Nevertheless a determination coefficient indicates a high probability of this scenario.

Thank to the SL ERP the actual development of the return on assets generated stable results, with increasing positive trend.

ROE

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
58%	-39%	38%	5%	**25%**	-15%	33%	21%	32%	34%	21%
58%	-39%	38%	5%	**25%**	11%	9%	7%	5%	3%	7%
					Prediction of the trend (forecast)					
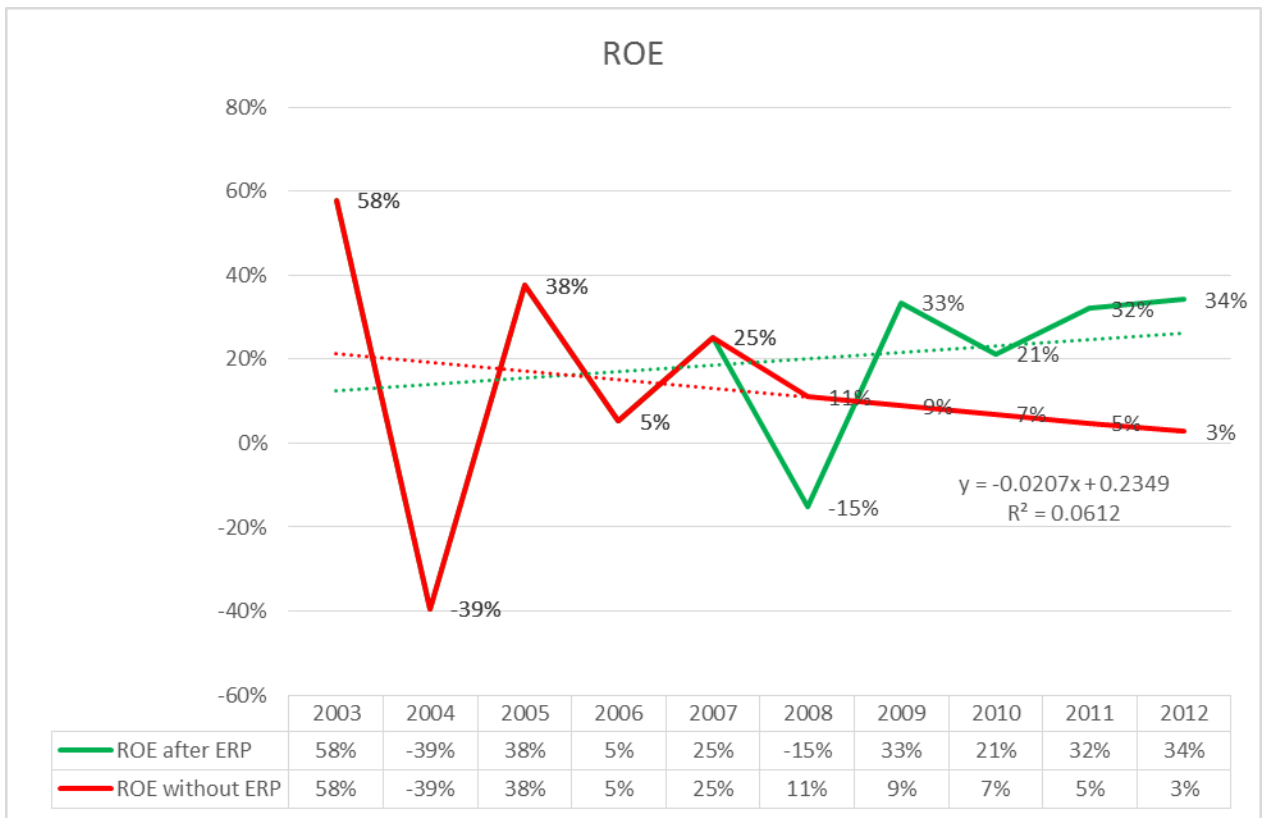
Similarly as the development of the ROA, return on equity after SL integration shows better result, except for the year 2008, where the impact of the world's crisis is visible, and was not envisaged by the trend analysis.

ROCE

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
38%	-19%	51%	18%	37%	-7%	49%	27%	47%	43%	32%
38%	-19%	51%	18%	37%	36%	40%	43%	47%	51%	43%
					Prediction of the trend (forecast)					
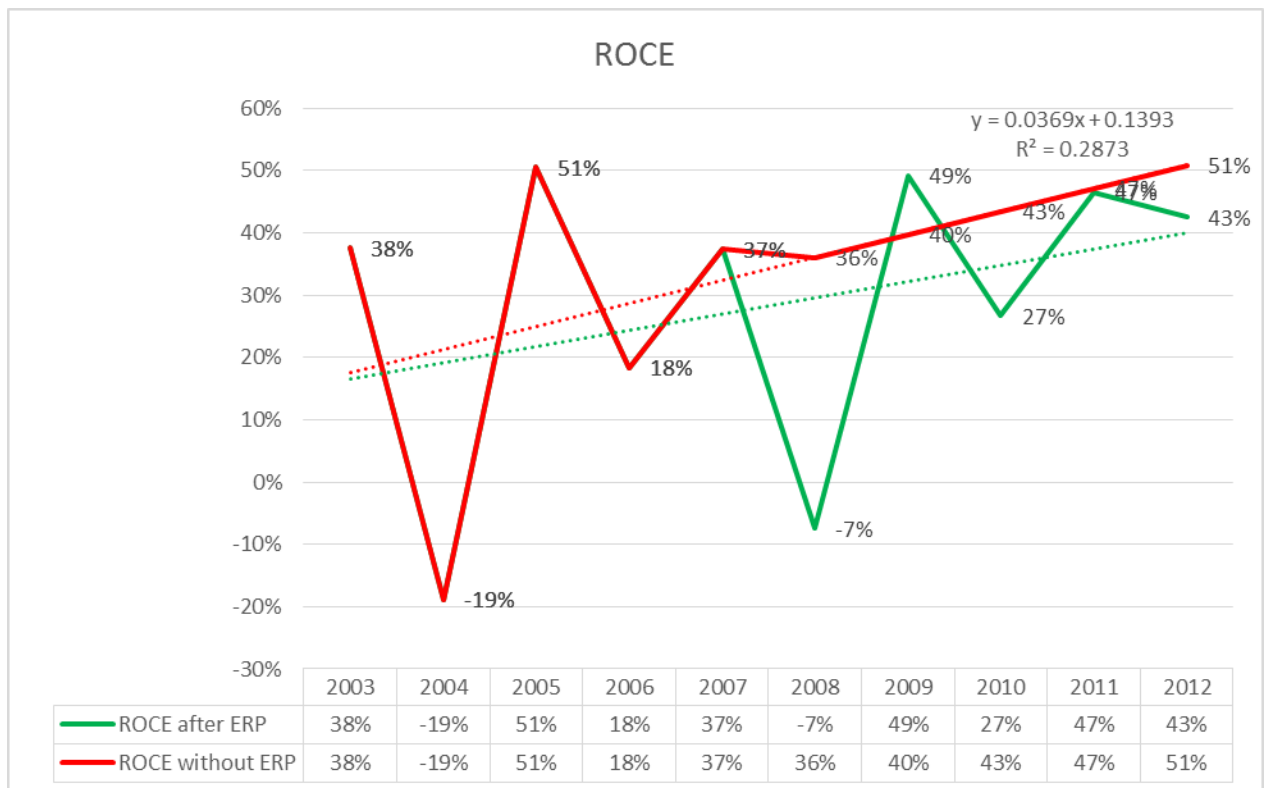
Judging from the predicted trend, the development of the ROCE is very similar with the actual trend. Again, a significant fall appeared in 2008, due to impact of unpleasant global situation on the market.

ROS

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
8%	-1%	6%	2%	5%	-1%	6%	5%	6%	7%	5%
8%	-1%	6%	2%	5%	3%	2%	2%	2%	1%	2%
					Prediction of the trend (forecast)					

ROS

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROS after ERP	8%	-1%	6%	2%	5%	-1%	6%	5%	6%	7%
ROS without ERP	8%	-1%	6%	2%	5%	3%	2%	2%	2%	1%

$y = -0.0038x + 0.05$
$R^2 = 0.1766$
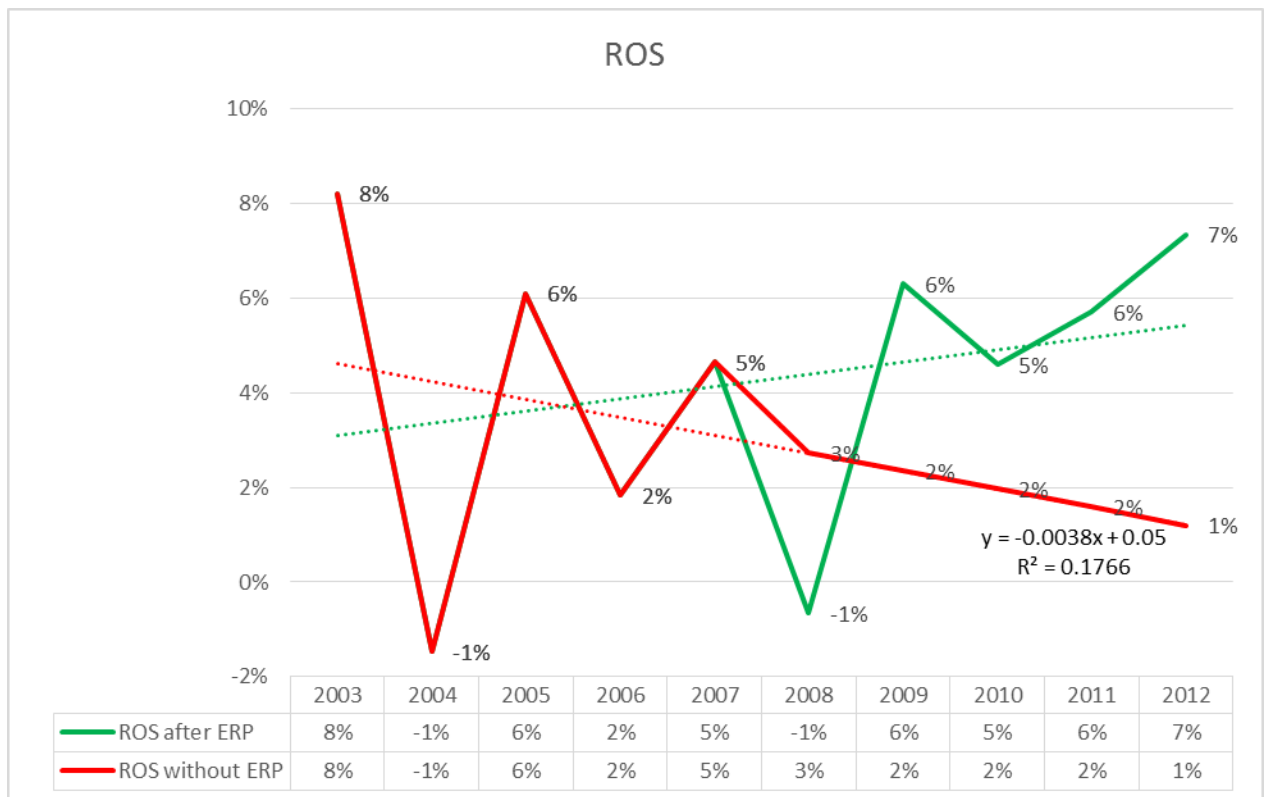
Situation of the sales has visibly improved, building on the real results. If the SL was not implemented, the expected return on sales would be much lower.

- *Activity indicators*

Assets turnover

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
3.01	1.94	2.12	2.03	1.23	2.36	2.63	2.20	2.00	1.99	2.24
3.01	1.94	2.12	2.03	1.23	1.03	0.68	0.33	-0.01	0.05	0.41
					Prediction of the trend (forecast)					
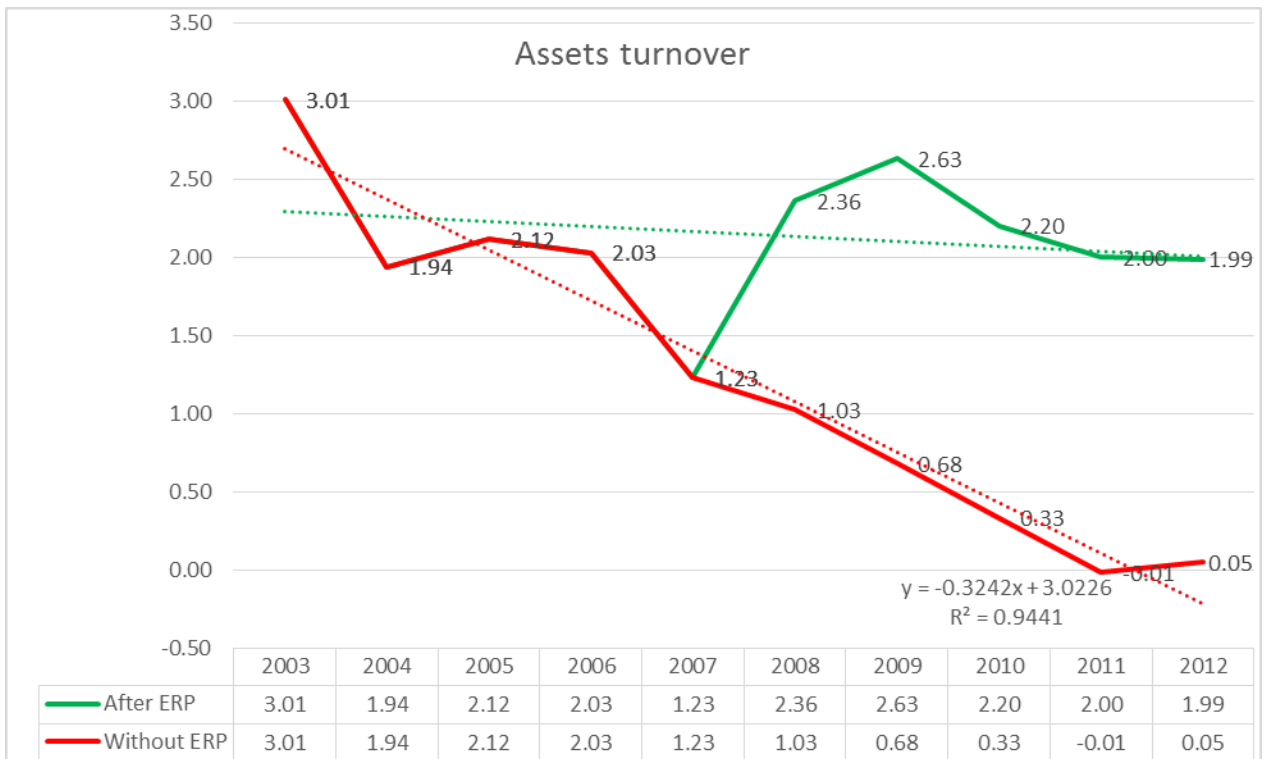
The activity indicators prove the benefit of the SL the most. In case of assets turnover the real values are almost four times higher than the expected situation. Determination coefficient is very high, which proves the high reliability of the prediction.

Inventory turnover

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
9.70	5.15	5.21	5.46	**6.23**	7.42	9.82	8.10	7.58	8.94	8.37
9.70	5.15	5.21	5.46	**6.23**	4.36	5.17	5.17	5.28	5.35	5.06
					Prediction of the trend (forecast)					
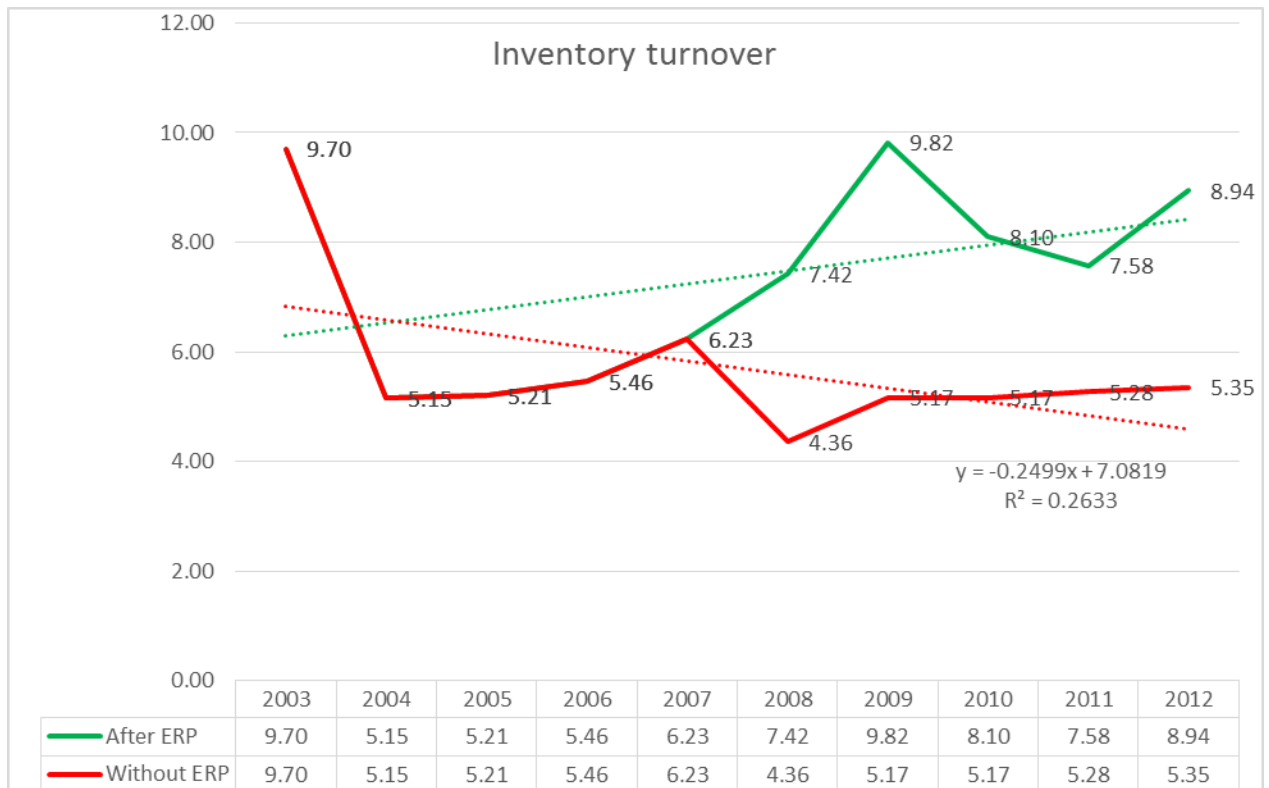
Inventory turnover, as expected, increased in a big scale. This outcome was presumed by the owners of the company, and is one of the reasons for purchasing the SL at the first place.

Inventory turnover time

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
38	71	70	67	**59**	49	37	45	48	41	44
38	71	70	67	**59**	72	66	66	66	65	67
					Prediction of the trend (forecast)					
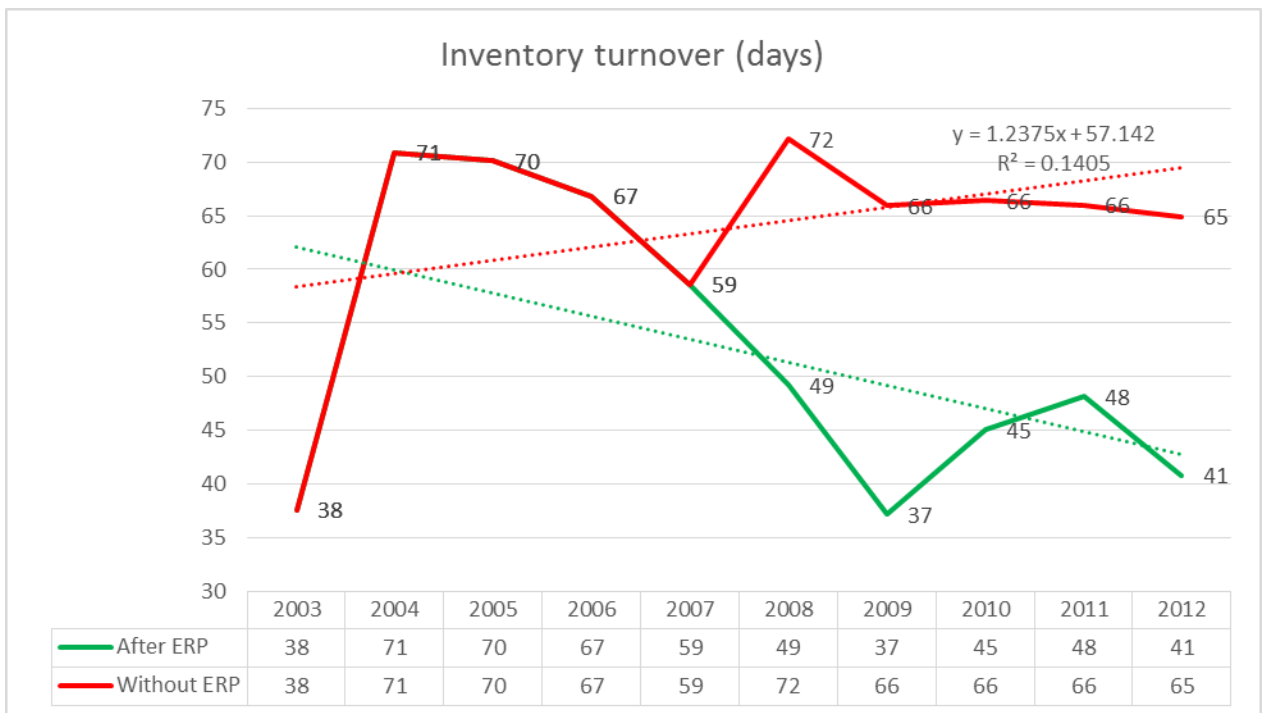
Inventory turnover time has decreased significantly. Alongside with the inventory turnover itself, it is one of the key indicators of successful functioning of the chosen ERP system.

Turnover of trade receivables

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
11.12	9.98	11.48	10.06	**10.16**	12.15	13.91	15.77	17.31	15.88	15.00
11.12	9.98	11.48	10.06	**10.16**	10.01	10.08	10.07	10.08	10.09	10.07
					Prediction of the trend (forecast)					

Turnover of trade receivables

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
After ERP	11.12	9.98	11.48	10.06	10.16	12.15	13.91	15.77	17.31	15.88
Without ERP	11.12	9.98	11.48	10.06	10.16	10.01	10.08	10.07	10.08	10.09

$y = -0.0954x + 10.837$
$R^2 = 0.2969$
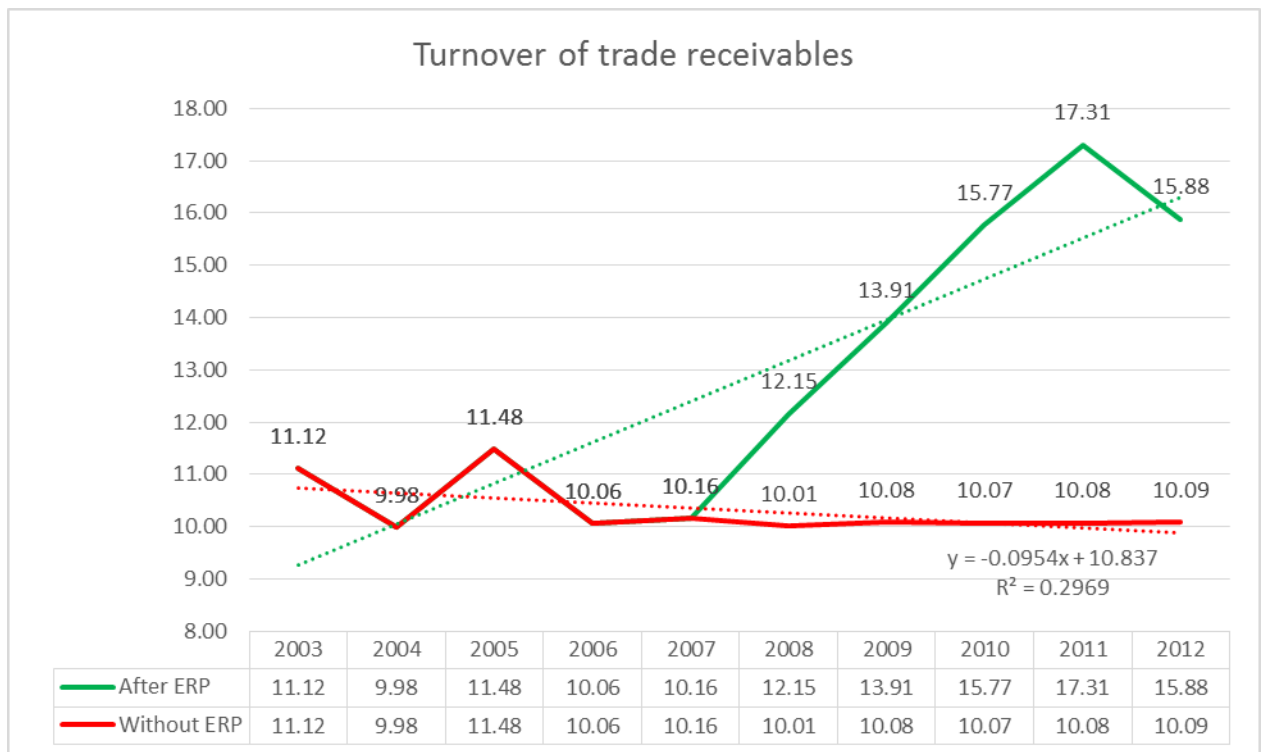
Same as in case of inventory turnover, the receivables turnover has proven a very positive influence of the SL. Steep rise of the variables in comparison to expected trend, show that investment into ERP was a right choice.

Time of turnover of trade receivables

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
33	37	32	36	**36**	30	26	23	21	23	25
33	37	32	36	**36**	36	36	36	36	36	36
					Prediction of the trend (forecast)					

Turnover of trade receivables (days)

$y = 0.3038x + 33.797$
$R^2 = 0.2956$

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
After ERP	33	37	32	36	36	30	26	23	21	23
Without ERP	33	37	32	36	36	36	36	36	36	36
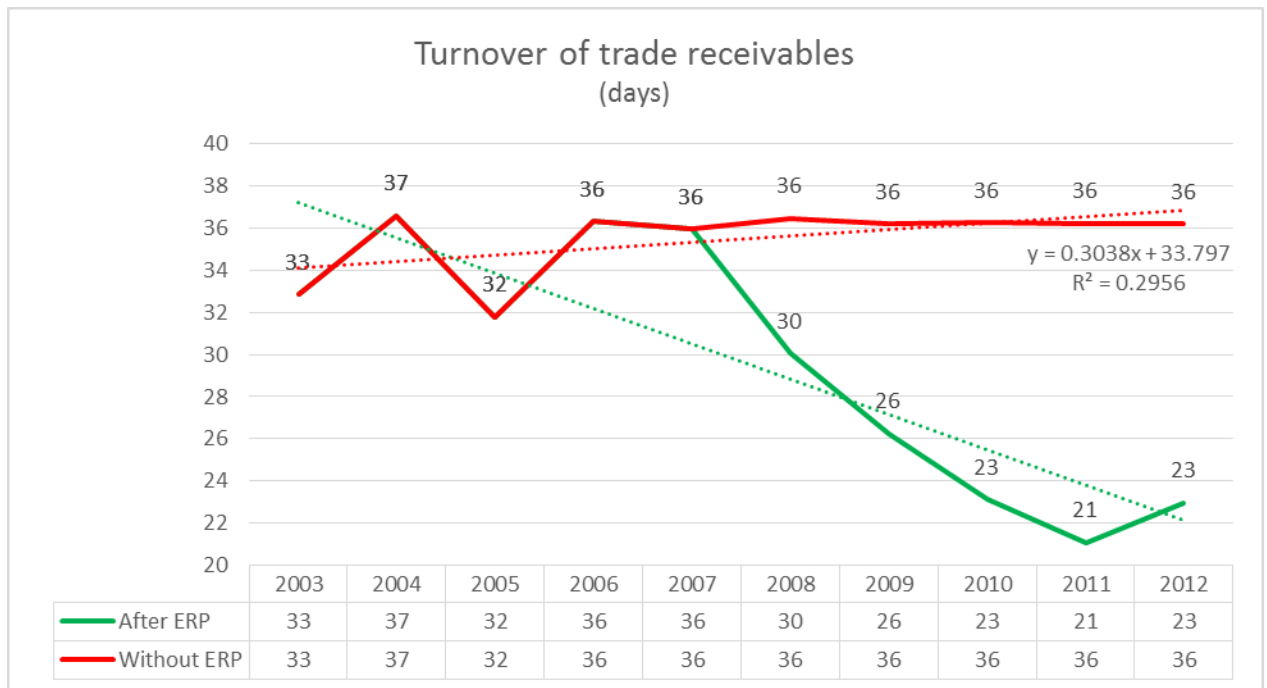
Average collection period decreased alonside with the turnover of the receivables. A visible difference between the actual values and the expected ones prove the well-functioning managemnt of business.

- *Productivity*

Work productivity

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
409,209	232,548	333,921	328,416	**400,068**	425,800	563,200	457,741	433,470	520,991	480,241
409,209	232,548	333,921	328,416	**400,068**	364,108	397,665	381,153	374,282	386,908	380,823
					Prediction of the trend (forecast)					
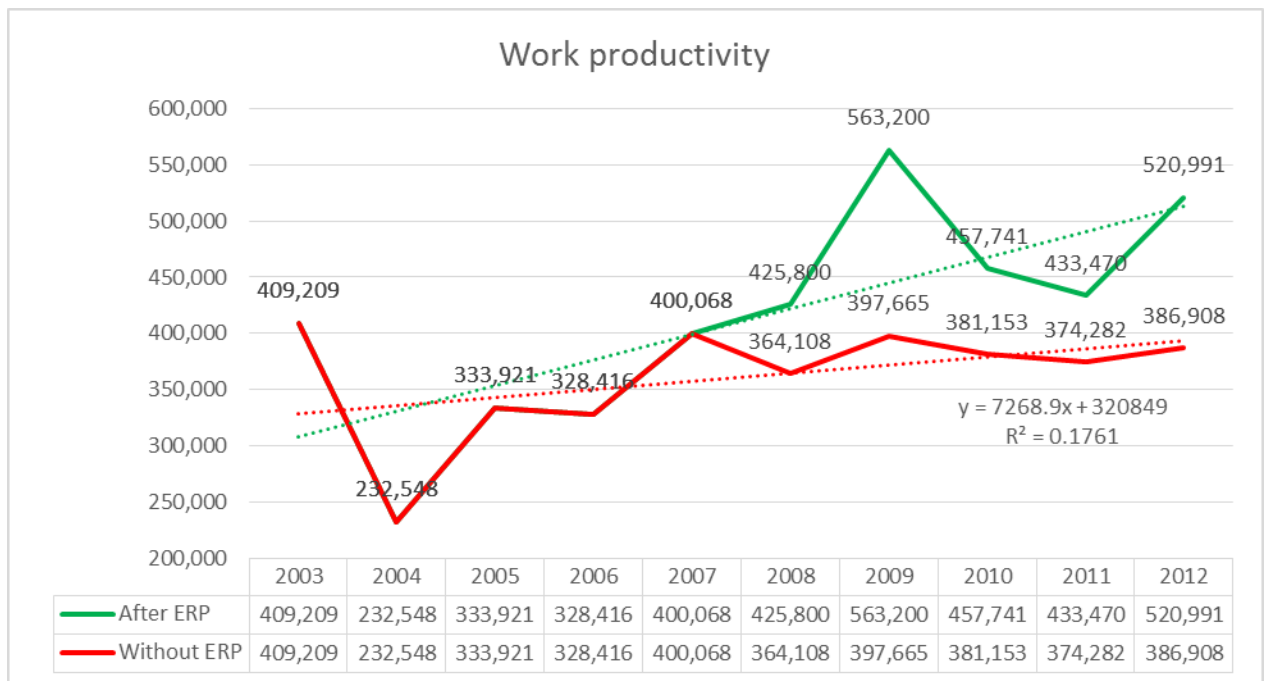
Expected work productivity is distinctly lower, than the actual one. System optimized all production factors, and generated higher efficiency. This is a result of quality assessment of the customer's requirements by company ITeuro, and customizing the final SL solution to fit well into production.

Wage costs

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
0.37	0.75	0.56	0.66	**0.62**	0.68	0.48	0.60	0.65	0.55	0.59
0.37	0.75	0.56	0.66	**0.62**	0.71	0.66	0.67	0.66	0.66	0.67
					Prediction of the trend (forecast)					
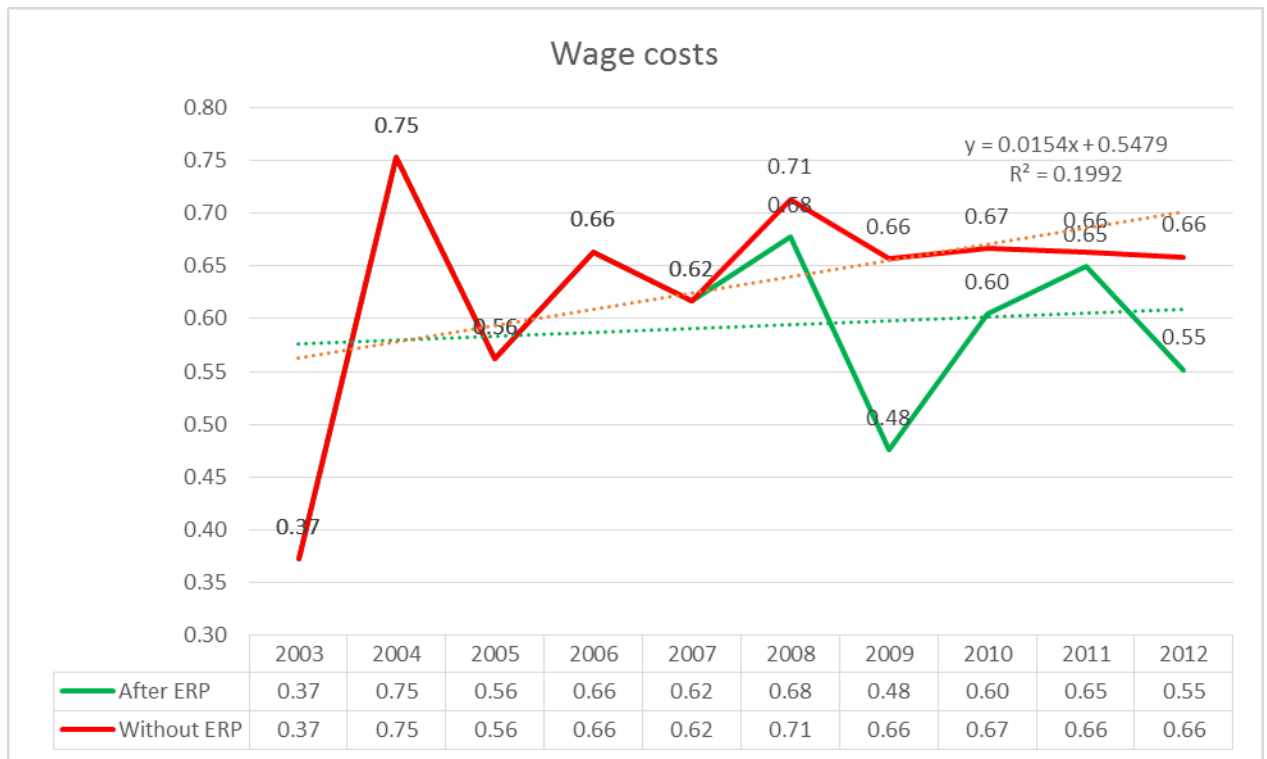
Wage costs have decreased with the SL usage. Same as number of employees decreased, while level of production increased. Estimation considered higher wage costs.

Average wage per employee

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
160,345	178,669	188,473	218,362	247,678	288,281	269,756	276,556	281,427	287,940	280,792
160,345	178,669	188,473	218,362	**247,678**	263,013	264,817	256,203	250,015	256,559	258,121
					Prediction of the trend (forecast)					
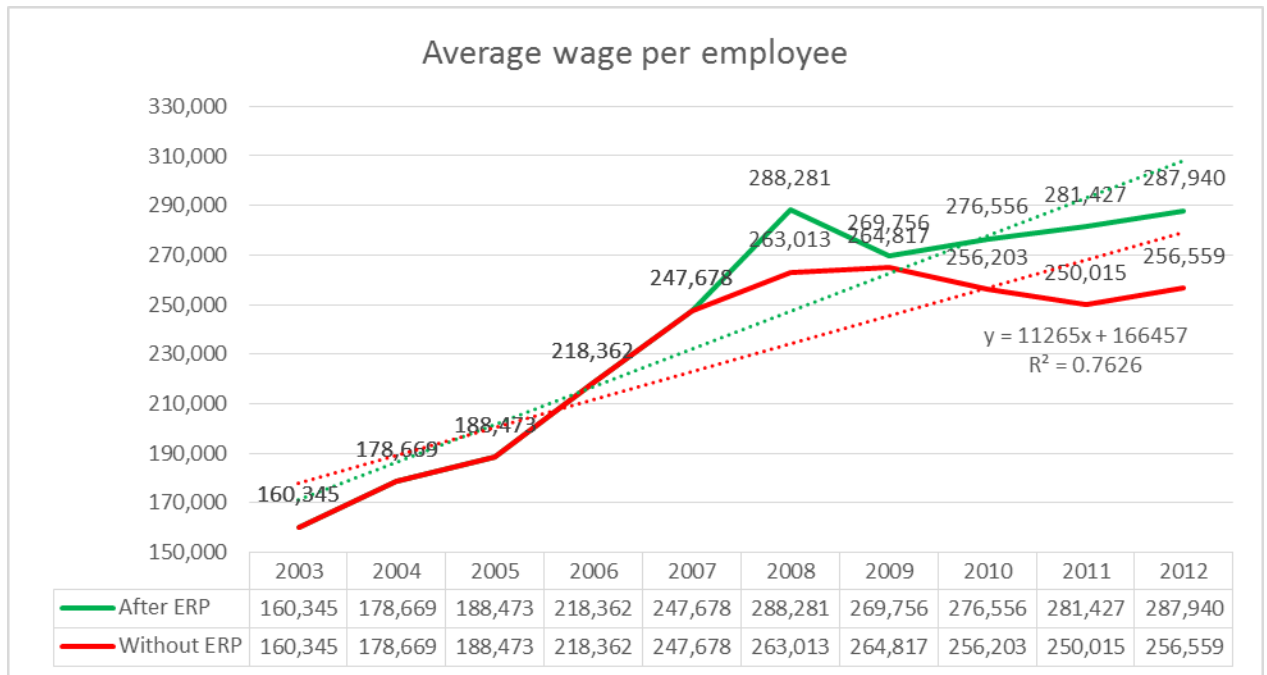
With the more productive company, the higher wages can be afforded. The average rate has increased contrary to the situation without the SL system.

Net income per employee

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
108,133	-14,269	69,456	23,874	72,004	-10,945	107,533	68,517	80,819	113,564	71,898
108,133	-14,269	69,456	23,874	**72,004**	41,605	61,393	53,827	50,541	58,945	53,262
					Prediction of the trend (forecast)					
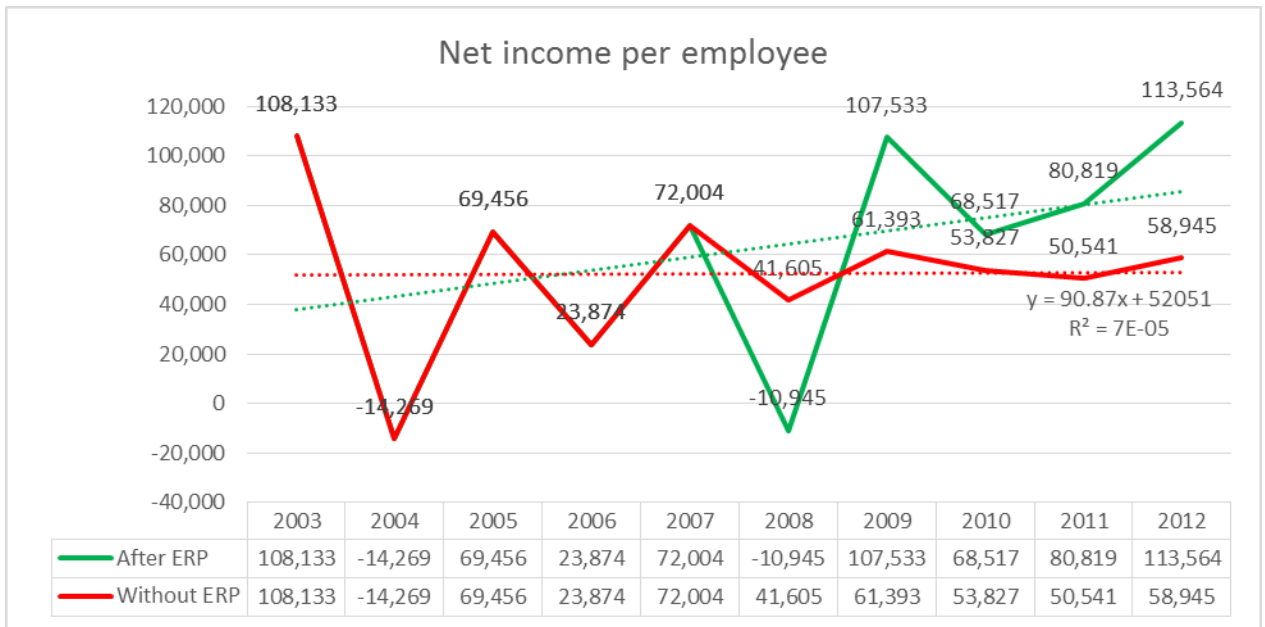
Net income raised with the growing sales rate. Except for the year 2008, where the actual performance decreased, the following years have showed a positive raise, higher than expected.

Sales per employee

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average (2008 +)
1,318,433	971,747	1,139,590	1,304,126	1,547,716	1,652,366	1,708,664	1,490,491	1,415,961	1,546,937	1,562,884
1,318,433	971,747	1,139,590	1,304,126	**1,547,716**	1,493,606	1,581,726	1,520,728	1,489,581	1,535,586	1,524,245
					Prediction of the trend (forecast)					

Sales per employee

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
After ERP	1,318,43	971,747	1,139,59	1,304,12	1,547,71	1,652,36	1,708,66	1,490,49	1,415,96	1,546,93
Without ERP	1,318,43	971,747	1,139,59	1,304,12	1,547,71	1,493,60	1,581,72	1,520,72	1,489,58	1,535,58

$y = 50082x + 1E+06$
$R^2 = 0.5582$
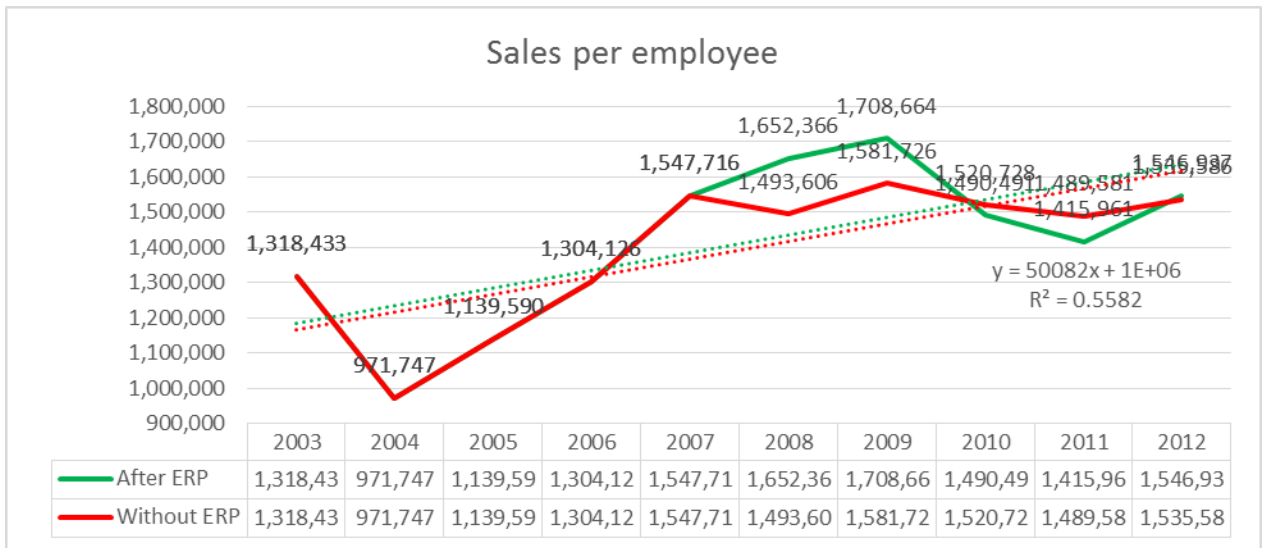
Increasing trend of growing sales has fullfilled the expectations. It is nearly the same as the actual rate. Nevertheless, it is important to imply, that the same numbers were achieved with the lower amount of emloyees, which indicates a higher productivity of the company.

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5. CONCLUSION

There are many ways how to approach company's productivity. Many actions can be taken to improve business performance and thus promote the higher value of the firm. ISAN Radiatory decided to engage in technology innovation. They have chosen an ERP system Infor SyteLine, and made it a part of their company's strategic management. They have decided for this system because of the following system's features: simple viewing of production cycles, fast problem resolution, high availability of the data and their easy retrieval, streamline the flow of information, broad database of products, specified bills of material, processing of atypical products upon customer's demand etc.

After system deployment, company has registered positive changes in all aspects of their business. Especially big impact was visible in the area of production management and inventory management, where inventory turnover increased by 30% in average. Receivables turnover increased by 42%, and overall productivity increased by 40%.

Nevertheless, even though the company's productivity increased, and the ERP system met the expectations of the owners – it is difficult to quantify the actual contribution of the system. Changes in operating ratios reflect the benefit of the system only indirectly. There are various factors that could have also influenced company's performance. Although, judging from the current global position of the ICT industry, and its growing trend, it is natural to believe, that there is an obvious benefit of ERP usage.

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2. ZIKMUND, Martin. *CEO of IT solutions consulting company Nitana s. r. o*. Consultation over the phone in May

3. KRUBNER, Lubos. *Executive Project Manager of HELIOS Green system, Asseco Solutions, a.s.* Consultation over the phone in May

7. LIST OF TABLES

8. LIST OF ATTACHEMENTS

Attachment 1: Selected values from Balance sheet

	ASSETS	2003	2004	2005	2006	2007
	TOTAL ASSETS	115,463,000	122,735,000	128,742,000	152,649,000	296,520,000
B.II.	**Tangible fixed assets**	10,806,000	19,447,000	23,569,000	32,723,000	38,377,000
C.I.	**Inventories**	35,803,000	46,239,000	52,294,000	56,708,000	58,647,000
8	Deffered Tax Receivables	0	0	0	0	0
1	Trade receivables	38,052,000	24,453,000	23,243,000	24,188,000	37,404,000

	EQUITY & LIABILITIES					
A.	**Equity**	25,838,000	18,528,000	29,228,000	28,197,000	43,691,000
B.II.	**Long-term liabilities**	50,000,000	40,000	3,637,000	2,707,000	1,679,000
10	Deferred tax liability	0	40,000	535,000	1,007,000	1,179,000

	ASSETS	2008	2009	2010	2011	2012
	TOTAL ASSETS	164,250,000	151,472,000	157,004,000	164,001,000	180,189,000
B.II.	**Tangible fixed assets**	51,071,000	53,491,000	59,992,000	73,158,000	85,864,000
C.I.	**Inventories**	52,345,000	40,621,000	42,674,000	43,344,000	40,036,000
8	Deffered Tax Receivables	0	0	0	0	0
1	Trade receivables	34,513,000	29,386,000	27,986,000	15,864,000	22,102,000

	EQUITY & LIABILITIES					
A.	**Equity**	33,539,000	50,274,000	58,815,000	38,494,000	61,182,000
B.II.	**Long-term liabilities**	901,000	725,000	705,000	1,756,000	578,000
10	Deferred tax liability	901,000	725,000	705,000	1,756,000	576,000

Attachment 2: Selected values from Income statement

		2003	2004	2005	2006	2007
I.	Revenue from goods	9,643,000	8,249,000	9,193,000	8,237,000	7,644,000
II.	Revenue from production	311158000	227,855,000	261,107,000	290,393,000	346,156,000
1	Revenue from own products and services	316,049,000	228,384,000	260,875,000	290,330,000	345,350,000
B.	Cost of sales	199,290,000	170,941,000	182,647,000	213,467,000	246,951,000
1	Materials and consumables	158,042,000	128,203,000	144,925,000	168,047,000	196,203,000
	Added value	113,351,000	58,137,000	80,141,000	78,163,000	94,816,000
1	Wages and salaries	42,251,000	43,774,000	45,045,000	51,861,000	58,452,000
E.	Depreciation of intangible and tangible fixed assets	6,819,000	-905,000	442,000	794,000	3,089,000
III.	Proceeds from disposals of fixed assets and raw material	26,606,000	1,974,000	2,062,000	11,100,000	11,461,000
G.	Change in provisions and adjustments relating to operating activity and change complex prepaid expenses	9,301,000	-3,981,000	-4,512,000	1,016,000	-3,549,000
VI.	Proceeds from sale of securities and ownership interests					
N.	Other financial revenue	3,321,000	3,774,000	2,238,000	2,244,000	2,510,000
XIII.	Extraordinary revenue		4,206,000	0	0	0
R.	Extraordinary expenses		0	0	72,000	0
***	**Profit (loss) for accounting period**	14,956,000	-7,310,000	10,979,000	1,459,000	11,011,000
****	**Profit (loss) for accounting period before tax**	25,172,000	-7,270,000	14,362,000	3,426,000	14,483,000
	SALES	347,407,000	238,078,000	272,362,000	309,730,000	365,261,000
	EBIT	28,493,000	-3,496,000	16,600,000	5,670,000	16,993,000

		2008	2009	2010	2011	2012
I.	Revenue from goods	512,000				
II.	Revenue from production	380,663,000	393,235,000	337,210,000	322,482,000	355,784,000
1	Revenue from own products and services	375,935,000	397,023,000	333,198,000	319,777,000	359,413,000
B.	Cost of sales	285,883,000	260,883,000	231,014,000	221,917,000	234,914,000
1	Materials and consumables	226,529,000	205,686,000	181,032,000	178,526,000	193,104,000
	Added value	100,063,000	132,352,000	106,196,000	100,565,000	120,870,000
1	Wages and salaries	67,746,000	62,988,000	64,161,000	65,291,000	66,658,000
E.	Depreciation of intangible and tangible fixed assets	3,929,000	1,194,000	-1,750,000	-7,331,000	-896,000
III.	Proceeds from disposals of fixed assets and raw material	7,131,000	5,738,000	8,584,000	2,821,000	2,332,000
G.	Change in provisions and adjustments relating to operating activity and change complex prepaid expenses	-4,124,000	7,689,000	399,000	8,787,000	-1,135,000
VI.	Proceeds from sale of securities and ownership interests				3,200,000	
N.	Other financial revenue	2,815,000	1,612,000	1,065,000	1,282,000	1,478,000
XIII.	Extraordinary revenue	0	0	0	0	0
R.	Extraordinary expenses	0	0	0	0	0
***	**Profit (loss) for accounting period**	-5,109,000	16,813,000	12,541,000	12,377,000	20,990,000
****	**Profit (loss) for accounting period before tax**	-5,387,000	23,497,000	14,831,000	17,468,000	24,812,000
	SALES	388,306,000	398,973,000	345,794,000	328,503,000	358,116,000
	EBIT	-2,572,000	25,109,000	15,896,000	18,750,000	26,290,000