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Pricing Dividend Protected Options Listed on the Warsaw Stock Exchange

Abstract

Due to the contingent dividend protection feature of the stock options listed on the Warsaw Stock Exchange, the standard Black-Scholes option price formulae do not apply in this case. We derive closed form price formulae and the put-call parity relationship for WSE stock options, and discuss the price differences between the standard and the modified formulae.

1. Introduction

In October 2005 stock options were traded on the Warsaw Stock Exchange for the first time. The stocks of five Polish blue chip companies[1] belonging to the WIG20 stock index were selected as the underlying instruments. Initially there was a lot of interest in the new options, and the stockbrokers who did not even offer index option trading[2] at the time, in fear of being left behind the competition, hastily included index and stock options trading in their offer. In some cases quick adjustments were made to existing futures trading platforms, which led to erroneous information being reported to the traders. On one ocassion the Author of this paper received a margin call even though the funds in the margin account were sufficient: the stockbroker's software ignored the value of the options in the portfolio. Unfortunately, after the initial euphoria subsided, the trading volume in stock options started declining. In the second quarter of 2007 only 3 positions in June stock options were opened. In September 2007 there was no open interest in any stock option series.

It is not our aim to analyse here the reasons why these new derivatives did not turn out a great success. One of the problems, however, could have been that the options in question are not quite what they seem at first. Stock options traded on the Warsaw Stock Exchange are dividend-protected. The option strike price is decreased on the first ex-dividend day by the amount equal to the dividend. There is, however, a slight complication here: the modification takes place provided that the dividend is "large", i.e. it exceeds 10% of the last cum-dividend stock price level.[3] We will call such options in this paper WSE[4] stock options.

The outcome of this "contingent dividend protection" feature is that the pricing, and the put-call parity formulae become somewhat more complicated than those known for *standard,* or vanilla options.

The aim of this paper is to present closed form price formulae for WSE calls and puts, and the modified put-call parity relationship. The derivation is based on the price formulae for compound options. We then discuss the price differences between vanilla and WSE stock options.

2. Options on dividend paying stocks

We assume that the underlying stock pays a dividend *D* at time τ with certainty. We shall consider the standard model for the underlying asset, see e.g. Hull (2002), Chapter 12: at time $t \leq \tau$ the stock $\hat{S}_t$ is a portfolio that consists of a risky component S_t, and cash $De^{-r(\tau-t)}$ which represents the dividend. When $t > \tau$, only the risky component remains:

$$\hat{S}_t = \begin{cases} S_t + De^{-r(\tau-t)} & \text{if } t \leq \tau, \\ S_t & \text{if } t > \tau. \end{cases}$$

S_t satisfies the usual assumptions of the Black-Scholes model, e.g.

$$dS_t = \mu S_t dt + \sigma S_t dW_t,$$

where the drift *μ,* the volatility *σ,* and the risk-free interest rate *r* are constant. It will be convenient to introduce the following notation for the prices (at time *t* = 0) of vanilla options written on S_t :

$$c(S, K, T) = SN(d_1(S, K, T)) - Ke^{-rT}N(d_2(S, K, T)),$$
$$p(S, K, T) = Ke^{-rT}N(-d_2(S, K, T)) - SN(-d_1(S, K, T)),$$

and

$$d_1(S, K, T) = \frac{\ln(S/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}},$$
$$d_2(S, K, T) = d_1(S, K, T) - \sigma\sqrt{T}.$$

For simplicity we write $c(S, K, T)$ rather than $c(S, K, T, r, \sigma)$ etc. We denote by T the option maturity, and by K – the strike price; the current time is 0. We skip the time subscript if $t = 0$, so $S = S_0$ etc.

If $\tau < T$ then an option written on the dividend paying stock $\hat{S}_t$ has the same value as if it were written on S_t. But it is $\hat{S}$ rather than S we want to see in option pricing formulae, since $\hat{S}$ is the market price of the underlying stock at time 0.

Since $S = \hat{S} - De^{-r\tau}$, the values of options written on a dividend-paying stock are as follows:

(1)
$$c(\hat{S}, K, T, D, \tau) = c(\hat{S} - De^{-r\tau}, K, T),$$
$$p(\hat{S}, K, T, D, \tau) = p(\hat{S} - De^{-r\tau}, K, T).$$

Pricing dividend-protected options in this model is not difficult either: it is enough to substitute $K - D$ for the strike price K in (1).

3. WSE stock options

Problems arise, however, when we consider WSE stock options. The modification of the option strike price is contingent on the underlying stock price on the last cum-dividend day τ. On the next trading day a WSE option becomes a standard option with strike K if $\hat{S}_\tau > 10D$ *(small dividend),* or $K - D$ if $\hat{S}_\tau < 10D$ *(large dividend).*

It is clear that a WSE stock option is equivalent to a portfolio of two *binary* compound options. We shall use this fact to write down formulae for WSE option prices. Of course the formulae can be derived directly; for example one can use the exotic option pricing method in Skipper and Buchen (2003).

The following two sections are devoted to compound options and pricing formulae in the standard Black-Scholes setup, where the underlying asset St is a stock that pays no dividends.

3.1. **Compound options.** These are options written on options; so there are four possibilities: one may write calls on calls, calls on puts, puts on calls, and puts on puts. The holder of a compound call (put) has a right to buy (sell) at time τ the underlying vanilla option for κ (compound option strike price). The underlying option has maturity $T > \tau$ and strike K.

The price formulae in the Black-Scholes environment are due to Geske (1979). Details can be found e.g. in Hull (2002). The type of the underlying option will be marked by a subscript, so c_p is the price of a call written on a put etc. Then

$$c_c = SN_2(a_1, b_1, \rho) - Ke^{-rT}N_2(a_2, b_2, \rho) - \kappa e^{-r\tau}N(a_2),$$
$$c_p = Ke^{-rT}N_2(-a_2, -b_2, \rho) - SN_2(-a_1, -b_1, \rho) - \kappa e^{-r\tau}N(-a_2),$$
$$p_c = Ke^{-rT}N_2(-a_2, b_2, -\rho) - SN_2(-a_1, b_1, -\rho) + \kappa e^{-r\tau}N(-a_2),$$
$$p_p = SN_2(a_1, -b_1, -\rho) - Ke^{-rT}N_2(a_2, -b_2, -\rho) + \kappa e^{-r\tau}N(a_2).$$

Here $\rho = \sqrt{(\tau/T)}$, and $N_2(x_1, x_2, \rho)$ is the cumulative bivariate normal distribution with correlation coefficient ρ. The parameters a_1, a_2, b_1, b_2 correspond to d_1 and d_2 in the standard Black-Scholes formulae:

(2)
$$a_i = d_i(S, S^*, \tau), \qquad b_i = d_i(S, K, T), \qquad \text{for } i = 1, 2.$$

S^* is the so-called *critical asset price.* This is the stock price for which the underlying option is worth κ at time τ: $c(S^*, K, T - \tau) = \kappa$, if the underlying option is a call, and $p(S^*, K, T - \tau) = \kappa$, if it is a put. Thus, the compound option holder will exercise it if $S_\tau > S^*$, provided that the option he holds is a call on a call, or a put on a put. For calls on puts, and puts on calls, the condition is $S_\tau < S^*$.

3.2. **Binary compound options.** The holder of a binary compound call receives the underlying vanilla option *for free,* provided that on maturity τ it is worth at least κ. A standard compound call is then equivalent to a portfolio consisting of a long binary compound call and a short cash or nothing call, so the formula for its value follows immediately from the price formula for the standard compound call:

$$bc_c = SN_2(a_1, b_1, \rho) - Ke^{-rT}N_2(a_2, b_2, \rho),$$
$$bc_p = Ke^{-rT}N_2(-a_2, -b_2, \rho) - SN_2(-a_1, -b_1, \rho).$$

In analogy to standard binary asset or nothing puts, the holder of a binary compound put *receives* the underlying option for free if at time τ its value is *at most κ.* This leads to a different relationship than the one above: A standard compound put is equivalent to a portfolio containing a *short* binary compound put and a *long* cash or nothing put. In effect

$$bp_c = SN_2(-a_1, b_1, -\rho) - Ke^{-rT}N_2(-a_2, b_2, -\rho),$$
$$bp_p = Ke^{-rT}N_2(a_2, -b_2, -\rho) - SN_2(a_1, -b_1, -\rho).$$

3.3. **Pricing WSE calls and puts.**

We assume that the nearest dividend has already been voted, so its value D and the last cum-dividend date τ are known with certainty.

A WSE call option is equivalent to a portfolio consisting of two long binary compound options that mature at time τ: a call written on a call_K, and a put written on a call_{K-D}; the subscripts indicate the value of the option strike price.

Note that we do not need the strike prices of binary compound options; it is sufficient to know the critical asset price. This is convenient because the compound options in our portfolio have different strike prices, but the same critical asset price $\hat{S}^* = 10D$.

We assume the notation as in Section 2. Recall that $\hat{S}_\tau = S_\tau + D$. If we consider WSE options as written on the risky component S_t of $\hat{S}_t$, then the critical price $S^* = 9D$. Note also that at time $t = 0$ we have $S = \hat{S} - De^{-r\tau}$. In effect, we have the following formula for the price of WSE calls:

$$c_{\text{wse}} = (\hat{S} - De^{-r\tau})N_2(a_1, b_1, \rho) - Ke^{-rT}N_2(a_2, b_2, \rho)$$
$$+ (\hat{S} - De^{-r\tau})N_2(-a_1, b'_1, -\rho) - (K - D)e^{-rT}N_2(-a_2, b'_2, -\rho).$$

Similarly, a WSE put is a portfolio consisting of a long put on a put (K) and a long call on a put $(K - D)$, so

$$p_{\text{wse}} = Ke^{-rT}N_2(a_2, -b_2, -\rho) - (\hat{S} - De^{-r\tau})N_2(a_1, -b_1, -\rho)$$
$$+ (K - D)e^{-rT}N_2(-a_2, -b'_2, \rho) - (\hat{S} - De^{-r\tau})N_2(-a_1, -b'_1, \rho).$$

Here

$$a_i = d_i(\hat{S} - De^{-r\tau}, 9D, \tau), \qquad b_i = d_i(\hat{S} - De^{-r\tau}, K, T),$$
$$b'_i = d_i(\hat{S} - De^{-r\tau}, K - D, T), \qquad \text{for } i = 1 \ldots 2.$$

Note that if we set $D = 0$ then $b_i = b'_i$ and the standard Black-Scholes equations can be recovered by using the identity

$$N_2(a, b, \rho) + N_2(-a, b, -\rho) = N(b).$$

3.4. **Numerical calculations.**

It is not difficult to implement the above formulae in order to calculate numeric results (see Footnote 6). One needs, however, an implementation of the bivariate cumulative normal distribution. This, in turn, relies on the univariate cumulative normal distribution. A very interesting discussion of the accuracy issues that arise, and implementations of the distributions can be found in West (2004).

3.5. **Pricing errors.** The official documents that specify margin requirements for the derivatives traded on the Warsaw Stock Exchange contain Black-Scholes formulae in the version where the spot price is adjusted for dividends, as in Formula (1). This is sufficient in most cases. After all, dividends are usually *small*.

However, there was an exception in the past when the dividends were high enough to affect option prices significantly. Table 1 shows the dividends per share paid by KGHM in the last three years.[5]

Table 1. KGHM dividends

Last cum dividend day	Stock price (close)	Dividend value
5 July 2005	34.10	2.00
4 July 2006	112.00	10.00
20 June 2007	124.00	16.97

The relevant year is 2006, in the period when September and December options were traded. Graph 2 shows KGHM stock prices between 27.03.2006 and 7.07.2006. The prices kept oscillating around the critical value $\hat{S}^* = 100$, and it was uncertain till the last moment whether KGHM options would be modified.

Graph 2: KGHM stock prices (close) in 2006
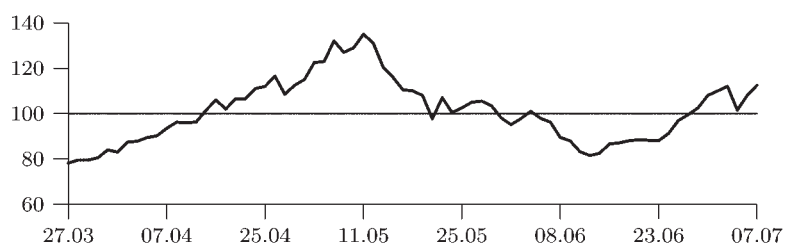
The theoretical[6] vanilla and WSE put prices are shown in Graph 3. In some periods the difference between the prices was significant, with the vanilla put price exceeding the WSE put price by more than 50%. Similar plots can be made for call options.[7]

Graph 3: Vanilla and WSE put prices (strike = 100)
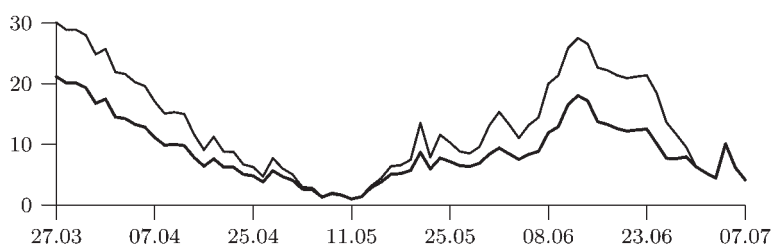
Let us fix the time to maturity and see how vanilla and WSE option prices depend on the stock price. Graph 4 shows the prices of WSE call$_{100}$, vanilla call$_{100}$ and vanilla call$_{90}$ as a function of the underlying stock price (calculated 9 days before the last cum-dividend day). It is clear that WSE call prices converge to call$_{90}$ or call$_{100}$ prices depending on the stock price level, or — on the probability of the WSE option being modified.

Graph 4: Vanilla and WSE call prices as functions of S
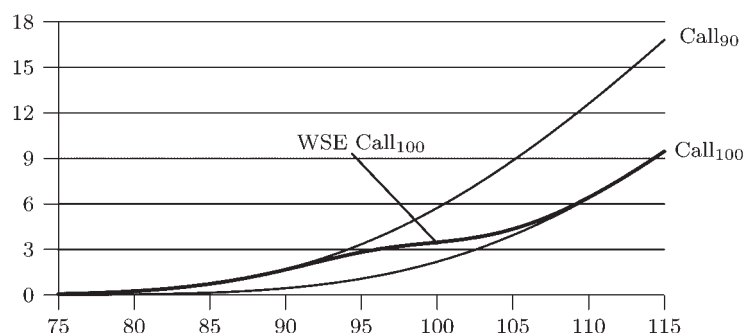
4. Put-Call parity

The standard put-call parity relationship relies on the fact that the portfolio consisting of a long call$_K$ and a short put$_K$ replicates a forward contract with delivery price K:

(3)
$$c - p = \hat{S} - De^{-r\tau} - Ke^{-rT}.$$

4.1. **Put-call parity for WSE stock options.** In this case Formula (3) is no longer valid: if the dividend turns out *large,* then the strike prices are modified, and the long call-short put portfolio turns into a long forward with delivery price $K - D$. Note that in this case the value of both components of the portfolio increases. The total gain at time T is equal to D, provided that $S_\tau \leq 9D$. Consequently, the put-call parity formula should be adjusted by the value of a binary cash or nothing put:

$$c_{\mathrm{wse}} - p_{\mathrm{wse}} = \hat{S} - De^{-r\tau} - Ke^{-rT} + De^{-rT}N(-a_2).$$

This means that (if there are dividends) there is no simple way of replicating WSE calls with futures and puts, nor – to replicate puts with futures and calls. This hurts liquidity: with large bid-ask spreads (the market-makers operating on WSE are obliged to keep bid-ask spreads at 20% or less) it was sometimes advantageous to close a position in a call option with a put and a futures contract etc. With large dividends around, this could generate additional risks. The same problem appears in put-call parity arbitrage trades.

4.2. **Put-Call parity and "risky arbitrage"**. Trading in WSE stock options has never been particularly active, and ocassional arbitrage opportunities did occur. The most common case was when the put-call parity relationship was not satisfied. Consider the put-call parity formula for vanilla options, written in terms of the futures price F:

$$c - p = (F - K)e^{-rT}.$$

There are two possibilities. If $c – p < (F – K)e^{-rT}$ then the arbitrageur sells a futures contract, buys a call$_K$ and writes a put$_K$. If the opposite inequality holds then the arbitrageur buys a futures contract, writes a call$_K$ and buys a put$_K$. These transactions work fine for vanilla options (e.g. the index options listed on the WSE), or when no dividends are paid during the lifetime of a WSE stock option.
If a dividend D is paid at time $\tau < T$, then the first "arbitrage" position in WSE stock options is in fact a long binary cash or nothing put, so it will generate extra profit D at time T, if $\hat{S}_\tau \le 10D$. On the other hand the "arbitrage" position of the second type is a short cash or nothing put, and the investor risks that the strike price would be modified.

Example. The following table presents one of the arbitrage trades carried out by the Author on 3.01.2006, at 12.45:

Transaction	Security	Price	Position
buy	FPEOM6	181.0	Long futures
buy	OPEOR6180	13.2	Long put
write	OPEOF6180	19.0	Short call

Each option/contract is written on 100 PKO S.A. stocks, strike price 180, maturity 16 June 2006. The put-call parity formula is not satisfied and the transactions generated profit (with commissions and opportunity costs taken into account). But the position, being a short binary cash or nothing put, was not riskless.

To make the transaction a proper arbitrage, one could try to delta hedge the position. Delta hedging binary options can prove difficult (in some cases the option delta can get out of control), but this case was worse: In 2006 the last cum-dividend date was 19.05.2006. The dividend of 7.40 was voted on 04.05.2006 — so its value was not known at the time when the "arbitrage" transactions were carried out. For this reason it was neither possible to price the position correctly, nor to delta hedge it.

In the years 2002-2005 the dividend to the stock price ratio (on the close of the last cum-dividend day) ranged between 3.4 to 5.2 per cent, well below the 10% limit, so it seemed likely that the PKO S.A. options would not be modified (this indeed turned out to be the case). But the unexpected may happen. The additional risk factor, due to the uncertain dividend value, is best illustrated by the KGHM dividends paid in recent years.

4.3. **The KGHM** case. The dividend paid by KGHM in 2005 was just PLN 2 per share (see Table 3.5), but by July 2006 the KGHM stock price more than tripled, one of the reasons being the increase in the price of copper.

So was it possible to predict the value of the dividend paid in 2006? The knowledge of the 2005 profit would not have helped much: the KGHM Management Board recommended (23.03.06) in the 2005 annual report that a dividend of 3.50 per share be paid. This was later (26.04.06) adjusted to 5.50. Eventually (14.06.06) the main shareholder (the Polish Treasury, which owns just over 40% of KGHM stocks) managed to wrestle a PLN 10 dividend (87.36% of the 2005 profit).

In 2007 a PLN 7.0 dividend was recommended (20.03.07) but the Treasury had its way again and on 30.05.07 a dividend of 16.98 was voted. This was supposed to constitute 100% of the 2006 profit but some time later it was realised that the dividend figure was wrong: the PLN 16.97565 profit per share (approx.) had been rounded up. In effect the actual dividend payment would exceed the company's profit by some PLN 870,000! A new meeting was called on 9.07.07 (after the last cum-dividend day!) and the dividend was adjusted to 16.97. It was to be paid in two installments (in July and in September 2007).

If nothing else, shareholders do not go for large dividends for tax reasons. But in this case the main shareholder, being the State Treasury, not only pays no tax, but it receives tax payments from the other shareholders. No surprise that not all were entirely happy. The decision of the shareholders' meeting has been challenged in court by a shareholder who owns just one KGHM stock. He was unhappy that the company was completely stripped of its earnings. In September 2007 the court blocked the payment of the second part of the dividend[8].

In the meantime the KGHM stock price stayed well below the massive critical price $\hat{S}^* = 169.7$, and in fact all KGHM options were modified on 26 June 2007: the strike prices were reduced by 16.97 and rounded to the nearest integer. The WSE adjusted

the option codes and stockbrookers had to follow suit by reprogramming their trading software. For example OKGHU7120 turned into OKGHU7103D and so on. All this in vain: so far (October 2007), not a single September nor a December stock option has ever been traded!

Interestingly, this was the only case when WSE stock options were modified. What is more, it coincided with the first case in the WSE history that a dividend payment was challenged in court, and blocked. This shows that the additional risk factor of uncertain dividends can exceed the risks that arise from inappropriate pricing models.

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(Footnotes)

[1] KGHM, PKN Orlen, PKO S.A., Prokom, and TP S.A.

[2] WIG20 index options appeared on the Warsaw Exchange in September 2003.

[3] More precisely, what matters here is the arithmetic average of the transaction prices, weighted by the respective trading volumes, on the last cum-dividend day. The settlement price on maturity is calculated in the same way. In this paper we simplify things by considering spot prices on the close of the respective trading days, rather than the averages.

[4] Warsaw Stock Exchange.

[5] The information about the dividends paid by companies listed on the Warsaw Stock Exchange can be found in http://mojeinwestycje.interia.pl.

[6] In the numeric calculations $\sigma = 32\%$, and $r = 4.16\%$.

[7] An Excel file with the calculatons for this paper can be downloaded from http://www.wsb-nlu.edu.pl/~kobak.

[8] Added in print: KGHM appealed against the court decision and won the case (28 November 2007). The second dividend installment was finally paid out on 12 December 2007.

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Enterprise Strategy Implementation Methodology

Introduction

One of the fundamental determinants of success of an enterprise is to have good operational strategy and to implement it readily and skillfully. As evidenced in the economic practice, the enterprises which concentrate on developing strategy tend to pass over the aspect of effective implementation of that strategy. Consequently a huge gap remains between the readymade strategy and practice, since even the best plan or strategy will not guarantee success of an enterprise on the market if they are not efficiently and effectively implemented[1].

Yet another obstacle lies in poor theoretical recognition of the issue of strategy implementation. The majority of publications on strategic management take up the question of formulating strategy, while its implementation is covered by few studies only; still, the existing works lack terminological coherence in describing the process, hence the ambiguity in defining the scope of the matter.

Moreover, analyzing implementation from the angle of strategic management seems rather insufficient. The issue of putting into practice certain changes, new solutions or improvements in an enterprise has been described in the methodologies of various management concepts. Their output can be used to facilitate the development of a general strategy implementation model.

This paper is an attempt at producing methodology of implementing strategy in an enterprise, the task itself being preceded by an overview of the literature on the course of implementation processes, followed by the presentation of the author's approach to the problem.

1. The essence of implementing enterprise strategy

In his formulation of strategy, C. von Clausewitz defined it as the art of coordinating the actions undertaken by military, political, economic and moral forces during a conflict or when preparing to defend a nation or a group from an act of aggression[2]. The notion has also been applied in other fields of study ever since.

Strategy was introduced into organizational management by A. Chandler, an American economist who in his fundamental study from the 1960s, *Strategy and Structure*, described strategy as 'the determination of the basic long term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals'[3]. When defined as such, strategy is approached as a specific lodestar for an enterprise, showing the direction in which to proceed in order to achieve the desired position of that enterprise. Strategy gradually became a tool used to maintain equilibrium between an enterprise and its increasingly turbulent surroundings, which was reflected in the successive definitions of strategy, emphasizing that strategy is a combination of decisions or a concept of action intended to maintain balance between the enterprise and its external environment, both current and future[4]. M. E. Porter defined strategy as an effective program formulated for each sphere of activities of the organization and coordinating a variety of functions[5]. P. Wright, Ch. D. Pringle and M. J. Kroll pointed out that strategy refers to the planned outcomes (determined by the management of the enterprise) in relation to the mission and goals of the enterprise[6].

As evidenced by the examples given above, the literature on the subject offers a range of definitions of strategy which provide for an overview of the essence of strategy, as well as of the different methods of defining strategy. It is rather difficult to point to a single definition which would grasp the substantial intentions of the authors[7]. Those defining the notion of strategy either emphasize varying elements and components of strategy or approach the defined term from diverse perspectives[8].

When attempting at capturing those essential elements, it must be concluded that strategy is an operational concept adopted by the management for implementation in order to guarantee the fulfillment of the assumed long-term goals. Strategies are mostly general plans targeted as the possibly full utilization of the productive potential of the system to achieve the assumed objectives[9].

A strategic plan stems directly from strategy as its materialization. The plan, like any other, must have the following three characteristic features: it must refer to the

future, it must refer to action, and it must be a determinant of either individual or collective identification or causality[10]. A strategic plan is a collection of decisions which determine the goals and their modifications resulting from the requirement to adjust to the changes in the surroundings, the resources inevitable to achieve the assumed goals and the methods to acquire, distribute and utilize these resources[11]. The strategic plan covers the following elements[12]:

- Mission and vision statement
- Precisely defined strategy, including the long-term objectives
- Evaluation of resources, organizational structure and external surroundings of a firm
- The list of target benchmarks, used as the reference base in evaluating the degree of fulfillment of the long-term objectives
- The major planes which require modifications in order to achieve the long-term objectives
- The set of forecasted income and financial outcomes

Same as strategy, implementation is difficult to define. The term itself comes from Latin *implementum* which means 'filling up', 'fulfillment'[13]. Implementation is understood here as an act of fulfilling something, its expression in practical terms, ensuring its realization using specific means. In the field of management, A. Stabryła defines implementation as introducing in practice certain theoretical models or functional projects which include a range of innovations and improvements[14].

When this notion is reflected in strategic management, several approaches to the position of implementation in the process of strategic management can be pointed out based on an analysis of the relevant literature. In the first approach, implementation is not taken into account in strategic planning, and the limits of strategic management are restricted to strategic choice[15]. In this case, implementation is considered as the current tasks, i.e. those included in operational management. In the second approach, implementation is positioned between planning and control[16], thus developing a system which complies with the cycle of an organized action: plan – fulfillment – control. However, in most cases strategic planning is divided into two stages only, i.e. strategic planning and strategy implementation[17]. The planning stage is intended to define strategy of the enterprise, while the implementation stage covers putting strategy effectively into practice. Control, limited in this case to controlling and considered as a system, supports the two processes. Control has the form of strategic controlling if it refers to formulating strategy, or operational controlling when used to support implementation of the strategy.

Assigning implementation to different positions in the structure of strategic management results in diversifying the functions of the process. The stage is also attached

various names. In its minimum scope, implementation corresponds with strategy ful-
fillment[18]. The process is intended to fulfill the assumptions behind the strategic plan
and to have the structure or the information and decision-making processes adjusted
to it. Some of the authors mention strategy implementation and regard this stage as
planning and allocation of the resources required for the implementation, determin-
ing modifications to the organizational structures based on the assumed strategy,
and introducing the new system of: incentives and information, in-service training,
management style[19]. The tasks fulfilled at this stage were discussed in detail by A. A.
Thompson and A. J. III Strickland, who formulated them as follows[20]:

- Developing capacity to achieve the assumed goals by means of the strategy;
- Allocating resources with preference for the critical areas;
- Drawing up fulfillment budgets;
- Defining operational procedures and policies;
- Motivating people to fulfill individual tasks, group tasks or tasks for wider sec-
  tions within the enterprise;
- Influencing modifications to the organizational culture which enable successful
  implementation of the strategy;
- Developing the communication system, including the information system,
  which enables efficient flow of information;
- Maintaining adequate level of leadership in order to implement the strategy.

Putting strategy into practice is described in the literature as well. This process is
based on preparing functional strategies and adjusting organization to the intro-
duced strategy[21].
From a wider perspective, implementation means preparing to implement, fol-
lowed by the fulfillment of the planned tasks and the assessment of the achieved
results. This approach to strategy implementation is presented, among others, by J.
M. Lehner, who mentions preparing the implementation tasks and their fulfillment
– establishing structures, appointing workgroups, preparing resources, realization
targeted at the optimum fulfillment of the production programs[22]. The notion of
implementation is approached in a similar manner by M. Lisiński, who divided the
implementation stage into *initiating and fulfilling strategy*[23]. The stage of initiating
strategy includes a diagnostic analysis of the organization, intended to assess the
degree of adjustment of that organization to the assumed strategy. The following
stage is undertaking improvement measures intended to adjust the organization to
the strategy. The successive stage covers the fulfillment of the strategic plan and the
assessment of the obtained results.

An analysis of the notion of implementation in strategic management shows the
diversity of approaches to the position of implementation and its function in the

management structure, ranging from the narrow approach to implementation, cor-responding only to the fulfillment of the tasks provided for in the plan, to consider-ing implementation as the process which guarantees preparation of implementa-tion, its fulfillment and control of the course of the tasks. A group of the authors believe that the control process is included in that procedure, while others consider control as the stage which follows implementation. Seemingly the control stage should refer directly to the strategy implementation process, since the course of the implementation must be monitored continuously to provide for remedy measures when deviations occur. Apparently this role is played by controlling.

J. Rokita pointed out that implementation equals introduction, the latter being understood as adjusting organization to strategy, and the fulfillment process is included in operational management. According to the author, the problem of implementation is not solved completely by strategic management. Therefore it seems purposeful to place implementation in the structure of managing enterprise as shown on Figure 1 (see Fig. 1).

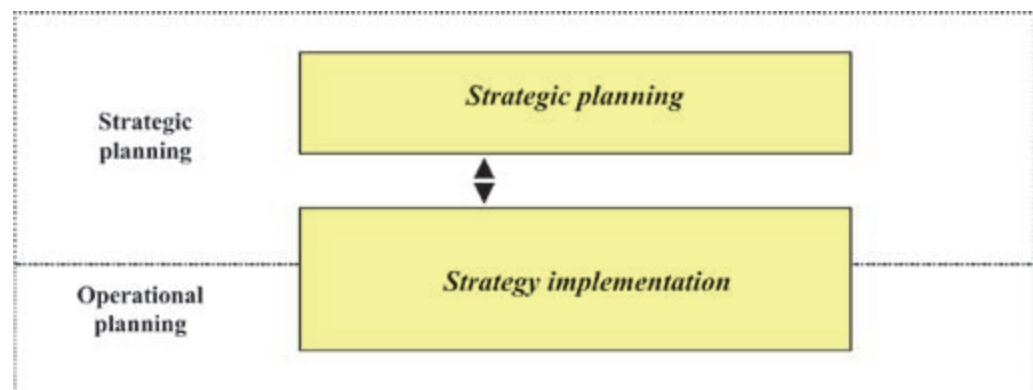Figure 1. The position of strategy implementation in the structure of managing enterprise
From: the author's concept

2. An overview of the implementation processes in the light of the litera-ture on the subject

When analyzing the issue of implementation, it does not suffice to look into it in the aspect of strategic management; its analysis from the perspective of other manage-ment concepts must be undertaken as well.

The literature on the organization and management studies touches upon the problem of implementation by reference to *putting new solutions into practice*. K. Mreła pointed out in his works that putting an organizational project into practice is the most difficult stage in the cycle of improving organization of the enterprise. The author concluded that '…effectiveness of an organizational undertaking depends on correct preparation and efficient realization of the planned solutions'[24]. He proposed dividing the implementation stage into the following five steps:

- drawing up and approving of the schedule for the preliminary works and the organizational start-up,
- preparing technical conditions,
- preparing the executors,
- proper start-up,
- control and analysis of results[25].

The issue of implementation is also discussed widely in *project management*. A. Stabryła described the module of completing an undertaking as narrowed down to the implementation stage and the operational stage. The implementation stage includes:

- executive planning and organization of implementation,
- fulfillment,
- start-up and preliminary operation.

In turn, the operational stage includes:

- the course of direct production processes,
- the course of logistic processes,
- the course of management processes.[26]

The implementation stage includes preparing an undertaking, the stage of proper implementation and control. The operational stage is the process of full operation of the system.[27]

Yet another important management concept relevant for implementation is *change management*. The procedural methodology in change management as defined by Z. Mikołajczyk presents the following sequence of actions[28]: the preparation stage, the implementation stage, and the assessment stage. Having regard to the notion of implementation, the components of the relevant two of these stages are described below – the implementation stage and the assessment stage. The implementation stage includes[29]:

1. Developing detailed change and implementation projects.
2. Preparing implementation: informing the staff of the arranged schedule of changes and obtaining resources to carry out the project; developing the schedule of implementation and trainings for the staff.
3. Putting the change project into practice with regard to the structures, the resources, the HR policy and employee behavior.

4. Appropriate piloting of the implementation process and of elimination of the obstacles.

The assessment stage includes the following tasks[30]:

1. Assessment of the results of changes from the perspective of economic effectiveness and social consequences.
2. Enhancement of the achievements made hitherto by further adapting to the changes in the surroundings.

When referring to the contemporary management concepts, it is worthwhile to look at the methodology of 'Lean Management' offered by M. Lisiński, the last three stages of which are interesting from the viewpoint of implementation, i.e.[31]:

I. The stage of drawing up improvement project
    1. Choosing the form of improvements
    2. Pointing to the list of auxiliary techniques
    3. Planning improvements
    4. Preparing the improvement project implementation plan
II. The stage of preparing improvements for implementation
    1. Determining the rules and methods of monitoring restructuring undertakings
    2. Defining the process of managing restructuring undertakings
    3. Defining the methods of staff trainings
III. The stage of applying improvement project
    2. Implementing solutions
    3. Control of the implemented solutions

Another contemporary management method which covers the question of implementation is 'benchmarking'. A number of methodologies are proposed in the literature, all of them including the implementation stage. W. M. Grudzewski and I. K. Hejduk[32] pointed out that this stage begins with defining the goal to be achieved by the organization by implementing improvements; the other tasks include preparing the fulfillment plan, the operational schedule, the calculation of costs, implementing the fulfillment plan by means of full involvement of the management staff in the works related to introducing changes and monitoring progress of the implementation works, and drawing up final report.

In the methodology of 'Reengineering', yet another management concept[33], implementation is included in the transformation stage. The stage involves carrying out pilot tests, evaluating personnel, preparing implementation, training personnel, putting the solution into practice, embed the mechanisms of ongoing process improvement.

An overview of the selected and briefly discussed methodological concepts related to implementation leads to the well-founded conclusion that implementation should be preceded by appropriate preparation of the organization (its organizational structure, the employees). It is necessary to develop action plan and schedule their fulfillment. It is also essential to pilot implementation and undertake remedy measures on an ongoing basis. When developing the methodology of strategy implementation, it is worthwhile to make use of all the concepts in which the implementation process is defined, even though it differs between the particular ideas (Fig. 2).
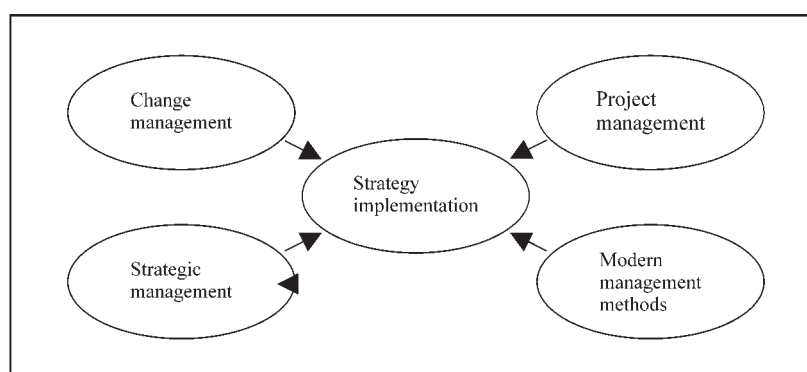
Figure 2. The concepts of organization and management studies which can be applied in developing strategy implementation methodology.

3. Suggested strategy implementation methodology

An analysis of the output of strategic management and other methodologies pro-posed with regard to organization management can be used as a basis to suggest enterprise strategy implementation methodology which is presented on Figure 3 (see Fig. 3). This concept obviously covers all the tasks which should be included in strategy implementation.

It has been assumed in the proposal that the strategy implementation process in-cludes three interrelated and coherent modules[34]: preparing to implements strate-gic plan, implementing and implementation assessment. The system of operational controlling is built into the modules to guarantee proper course of the strategy implementation process.

Strategic plan

Stage I: Defining project task

Is it required to develop preliminary project of implementing the strategic plan?

No → End

Yes

Stage II: Preliminary project of implementing the strategic plan

Is it required to develop detailed project of implementing the strategic plan?

No

Yes

Stage III: Detailed project of implementing the strategic plan

Is it possible to develop detailed project of implementing the strategic plan?

No

Yes

Stage IV: Implementing strategy project

Are there deviations in the development of the plan?

Yes → Undertaking remedy measures

No

Stage V: Strategy assessment

Have strategic goals been achieved?

Yes

No

Operational controlling system

PREPARING TO IMPLEMENT STRATEGIC PLAN

IMPLEMENTING STRATEGIC PLAN

ASSESSMENT OF STRATEGIC PLAN FULFILLMENT

Implementation process modules

Figure 3. Structure of enterprise strategy implementation process
From: the author's concept

The major modules included in the strategy implementation process are discussed briefly below.

Module I – Preparing to implement strategic plan
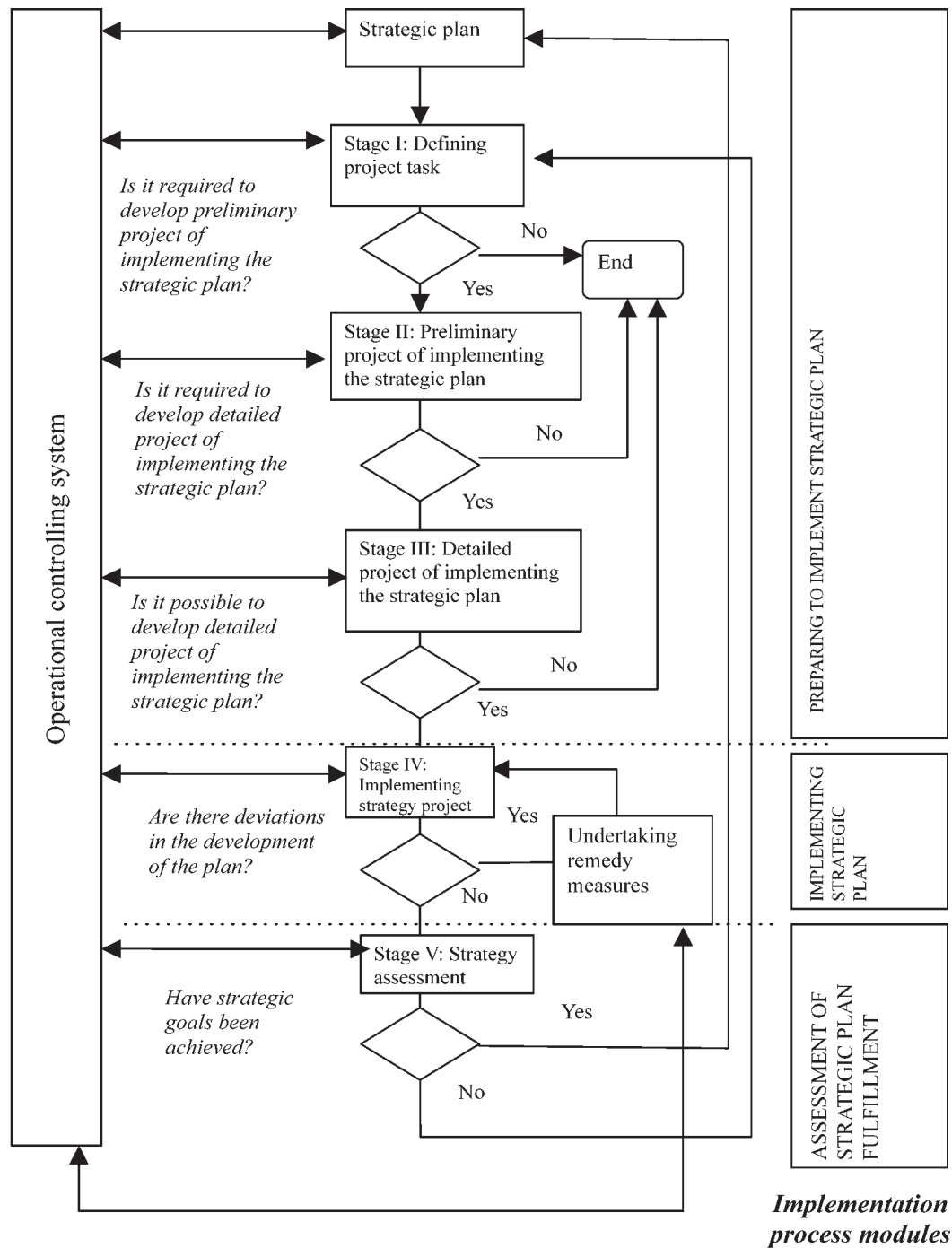*Stage I: Defining project task* aims at forwarding for fulfillment and approval by the executive department of the objective of the undertaking concerned with strategy implementation. It covers the following sequence of actions:
1. Defining the goal, materialized by a sequence of characteristics which describe the goal fulfillment degree.
2. Defining the terms and criteria of assessment used as a basis to determine the degree of goal fulfillment.
3. Specifying the resources which should be at the disposal of the enterprise to implement the strategy.

After the last step is fulfilled, it must be decided whether the implementation process is to be continued or not. If we conclude from the analysis of the acquired information that we are unable to effectively carry out the implementation process, the proceedings related to implementation should be ceased; otherwise we can proceed to the successive stage.

Stage II: Developing preliminary project of implementing strategic plan
This stage is aimed at developing preliminary implementation project, which in this case comes down to producing framework concept of the strategic plan implementation project. This concept is understood as a general draft of changes in the components of internal structure of the enterprise and its surroundings and the requirements regarding the resources necessary to implement the strategy. It consists in the following sequence of actions:
1. Determining the preliminary solutions regarding the degree of adjustment of the static organization (organizational structure) and the dynamic one (organizational courses) to the strategy. The scope of the solutions should correspond with all business functions of the enterprise.
2. Defining the scope of changes in the surroundings of the enterprise.
3. Analyzing accessibility of resources in the context of the above scope of changes in the enterprise and its surroundings.

Upon concluding the tasks undertaken within this stage, the preliminary project needs to be verified. This verification refers in particular to confirming feasibility of the changes provided for in the project with regard to the terms and criteria of assessment defined in the previous stage. A positive result of verification of the preliminary project is the determinant of proceeding with the works on developing the detailed project; otherwise the works must be stopped at this point.

Stage III: Developing detailed project of implementing strategic plan
The major objective behind this stage is to specify the preliminary project and to present it in its usable version as documentation in the form of a strategic plan. This stage is divided into the following steps:

1. Determining the detailed project of operationalization of the goals, assigning resources to these goals and defining the methods of their fulfillment.
2. Producing detailed description of the organizational structure of the enterprise which is to be implemented in order to ensue that the goals are fulfilled. Preparing detailed structural solution, including detailed harmonization of the tasks in time and in space.
3. Defining the information system for given enterprise; the system must ensure efficient reporting on progress in strategy implementation.
4. Developing functional strategies in the form of functional strategic plans.

Developing detailed project referred to in the sequence of actions given above will also apply in the cases where the third strategy level is defined for given enterprise, i.e. the level of strategic business unit. In this case the strategy of the unit must be coherent with the strategy of the enterprise as a whole.

Module II – Implementing strategic plan
Stage IV: Implementation stage which comes down to effective implementation of the developed strategic plan. It covers the following sequence of actions:

1. Fulfillment of the strategic plan means undertaking the actions targeted at applying the strategy. Effective realization of this sequence of actions depends on the proper completion of the tasks in all the previous modules.
2. Implementation control intended to supervise the completion of the planned tasks.
3. Piloting implementation and overcoming obstacles, including psychological barriers.

The implementation stage is essential. The implementation process must be monitored continuously during the completion of the tasks. Remedy measures must be undertaken, if deviations occur; otherwise proceed to the last module.

Module III – Strategy assessment
Stage V: Strategy assessment is based on measuring and assessing the degree of strategy fulfillment. The stage includes the following sequence of actions:

1. Strategy measurement, which in this case comes down to measuring organizational efficiency, carried out by means of selecting the factors important for the fulfillment of the strategy, defining their condition, and the assessment of these factors.
2. Assessment of results refers to the assessment of the achieved results. It informs whether the strategic goals have been fulfilled or not. When this partial problem

is solved, it is necessary to refer to the assessment terms and criteria assumed in the first stage.

The implementation process includes operational controlling, i.e. the system of supporting the management staff of the enterprise in the process of strategy implementation. The system utilizes management accounting to make operational decisions.

Summary

The issue of developing strategy implementation process methodology touched upon in this paper is an attempt at finding solution to this essential question. Looking at the problem in the context of structuring actions, i.e. analyzing the method of procedure undertaken with regard to applying the strategy neither clears out all the ambiguities nor offers explanation to all the doubts. Still, it enables looking at strategy implementation from a research perspective which somewhat differs from the commonly adopted procedures.

This approach to the concept of implementation emphasizes other problems as well, the solution of which shapes the final efficiency of that process. One of them is the instrumental aspect, narrowed down to analyzing and classifying the strategy implementation methods. Another one is the problem of organizational conditions which determine fulfillment of the process by means of developing infrastructure.

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(Footnotes)

[1] As confirmed by a number of studies carried out in Poland and abroad, such as the study by D. Norton showing that 90% of the US-based enterprises are unable to effectively implement the as-sumed strategy. Merely 5% of the employees understand the vision and mission of their enterprise, and 85% of the heads devote less than one hour in a month to discuss the effects in this area. In 60% of the companies the budget is not interconnected with the strategy, and only 25% of the managers are remunerated with regard to strategy fulfillment (A. Szablewski, R. Tuziemek, *Wycena i zarządzanie wartością firmy*, Poltext, Warszawa 2005, p. 95)

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31 M. Lisiński, B. Ostrowski, *Lean Management w restrukturyzacji przedsiębiorstwa*, Antykwa, Kraków 2006, p. 174

32 W. M. Grudzewski, I. K. Hejduk, *Metody projektowania systemów zarządzania*, Difin, Warszawa 2004, p. 191

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34 Module is understood as a group of typical actions and steps included in a part of the research process the completion of which is related to solving specific practical task or performing a component of the project. (Doskonalenie struktury organizacyjnej, A. Stabryła, J. Trzcieniecki (eds.), Wydawnictwo AE Kraków, Kraków 1988, p. 195)

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Public-Private Partnerships in Toll Motorways in Poland: A Comparision of Financing Exploitation and Fiscal Risk

1. Introduction

There are different forms of involving private capital in infrastructure development. Poland has only three toll motorways and as many as three different development and operating public-private partnership (PPP) models. The aim of this paper is to compare them focusing on the financing, exploitation and fiscal risks expected at the moment of contracting.

In section 2, we give an insight into the three different models implemented in Poland, attempting to qualify and quantify the financial exposure of the State. The national road policy and a summary of the financial mechanisms and fiscal risks related to toll motorways are presented in section 3. Conclusions are given in section 4.

Two major circumstances have to be taken into account while comparing toll motorways in Poland. Firstly, when contracted each of the existing motorways had its own peculiarities regarding geographic conditions, constructed stretches and adjacent infrastrucutre, and long-term traffic forecasts. Secondly, construction costs –both materials and labor– went sharply up during the years 2005–2007. Both circumstances make it very difficult to compare costs of development of roads at different moments in time and place, and limit the scope of the analysis.

2. PPP road projects developed or on track at the national level in Poland

PPP projects concluded at the national level in Poland are limited to toll motorways. At present, there are two toll motorways (A2 and A4[2]) and one

contracted for development in the near future (A1). The national plan foresees the development of 700 km of new motorways and 1,990 km of express roads by 2011[3].

A1 Motorway
Despite the fact that the first tender was made public far in December 1995, the contract with Gdansk Transport Company (GTC) for the development and exploitation of A1 Motorway was signed on August 31st, 2004.

The concessionaire –GTC– finances and develops one stretch of the A1 Motorway (Gdańsk–Nowe Marzy). Tolls will be also collected by the GTC. The National Road Fund covers the difference between tolls collected and the sum of debt service, return on capital and maintenance costs, whereas the rate of return is 8%–20% (14% on average) and is subject to the traffic volume (incentive for GTC). Maintenance costs are fixed in real terms and are corrected according to the inflation rate. Therefore, the government is committed to make availability payments (independent of traffic volumes) and pay a kind of shadow tolls (dependent on traffic volumes) due to the expected low traffic though A1 Motorway.

The contract has been strongly criticized for the development costs: EUR 504 million for a 89.5 km segment, i.e. EUR 5.63 million per km, the highest price ever contracted in Poland at that time (with the exception of the construction of bridges and the like). Moreover, the contract has been questioned since in its annexes it seems to transfer major risks to the government.

Fiscal GTC-related risks and their assessed severity[4] are listed in Tab. 1.

Tab. 1. Fiscal risks related to A1 development

Risk	Assessed Severity
If the contract with GTC is cancelled, the government must repay GTC EUR 27.5 million as indemnification	Medium[5]
Input risk (or traffic volume risk) lays totally on the government, i.e. if revenues do not achieve economic profitability, the government has to compensate GTC. According to some assessments, this may represent public annual payments of PLN 100 million[6]	High
GTC can also claim indemnification if it happens to change the planned route of the motorway, even if it is not the government's fault	High
Government is responsible for delays in the delivery of necessary permissions for the motorway construction, even if those delays are legally motivated	Medium
Government has to pay the difference between tolls collected and debt service	High

Source: own estimations.

The magnitude of the risks and their probability suggest that the final cost per km may be higher than EUR 5.63 million. However, the construction risk remained entirely on the private investor's side at a time when construction prices went up.

A2 Motorway
A2 Motorway was developed by a consortium of 18 firms called Autostrady Wielkopolskie SA (AWSA) that own the concession to build and operate the motorway as part of the Paris-Berlin-Warsaw-Moscow corridor. The concession term is 40 years and the total development costs of Phase I amount to almost EUR 1 billion. Funding came from three sources:
- EUR 235 million from commercial banks in the form of senior secured project loan
- Mezzanine debt – a 17-year loan from EIB of EUR 275 million
- EUR 235 million in subordinated debt and equity from AWSA shareholders[7]

The EIB loan was structured with deferral of all interest and principal for 17 years (to be matured in 2018). Therefore, from AWSA's perspective, the EIB loan is essentially equivalent to a zero coupon bond. The loan is guaranteed by the government for a face amount at EUR 800 million[8]. This guarantee, together with the buyback of land, is the only financial involvement of the state in this investment and its value is reported by the government in the guarantees' accounts prepared by the Ministry of Finance.

The revenue for AWSA comes from toll payments. Under the base case projections, AWSA will be able to repay only a fraction of total amount of the guaranteed debt outstanding at maturity, leaving the remainder to be refinanced. On the other hand, some experts criticized the A2 for absorbing more than its fare share of the total PLN 5.5 billion (or 0.7% of GDP) authorized for guarantees of all kinds in 2000.

Other fiscal risks related to AWSA and A2 development and their assessed severity are listed in Tab. 2.

Tab. 2. Fiscal risks related to A2 development

Risk	Assessed Severity
Government benefits from A2 through regional economic development, annual lease payments (annual fee of PLN 5.5 million), VAT on commercial tolls (PLN 14 billion estimated yield in tax revenues to the Polish government), and profit sharing (the government is entitled to receive 20% of distributable cash once the shareholders had received a cumulative real return of 10% or more on their invested capital, and 50% once they had received a return of 15% or more)	High
In the case the government terminates the contract in the public interest, without cause, it must repay AWSA's debt and NPV of expected shareholder returns for life of concession	Medium
Government agreed not to build competing transportation systems and to compensate AWSA for lost revenue if it does build competing roads	Low
Government is responsible for construction of the Poznan Bypass, interchanges, and feeder roads with specified damages for lost revenues resulting from delay	Medium[9]
Government responsible for providing land at no cost except annual lease payment of PLN 5.5 million	Low
Government guarantees EIB loan for a face amount at EUR 800 million due in 2017.	Medium[10]

Source: Esty (2000) and own estimations.

A4 Motorway
Available data on A4 Motorway is very limited. The concession segment consists of 67 km toll motorway linking Cracow and Katowice, two major cities in the south of Poland. A4 was developed under a different scheme. The government was the main investor. By 2004 the government had built and refurbished the motorway for PLN 225 million financed by European Bank for Reconstruction and Development (EBRD). This debt will be refunded by the concessionaire – Stalexport SA[11]. As of now the concessionaire has adapted the road to the requirements of a toll motorway and maintains it. Its revenue comes from the tolls collected, which consequently will service the outstanding debt.

Stalexport has incurred investment costs for PLN 195 million mostly for the construction of the toll collection stations. The assumed investment requirements in the next stages amount to a total of PLN 310 million to be financed by the government, mostly for increased ecology and safety standards[12]. The concessionaire raised credits without government guarantees. In the A4 motorway agreement, there is a mechanism forbidding upgrading competing roads. If the Ministry of Infrastructure decides to do so, there are stipulated compensations. However, no

execution of such liabilities has taken place. There is no other involvement of the State or public funds.

3. National road policy

The NRF collects funds for the preparation, development or redevelopment and maintenance of roads. Its sources of income are fuel tax, interests yielded on free funds, revenues from the sale of shares and estates, dividends, tolls collected by the Directorate-General National Roads and Motorways, transfers (mainly from the EU) and debt. The funds collected by the NRF can also be used to complement the financing of land acquisition for roads, make availability payments and pay shadow tolls[13].

The Main Statistical Office and the Ministry of Finance are responsible for the national accounting system (including ESA95, which at the date not is applicable in Poland). The governmental entity directly responsible for the guarantees is the Ministry of Finance. However, the final decision must be made by the Council of Ministers acting upon the Ministry of Finance's direct application.

The total amount of guarantees is set up on an annual basis. Regarding the new "Toll Motorways and National Road Found Act" guarantees are granted according to the "Guarantees Act" dated on May, 8th, 1997. Every year, the government estimates the risks influencing the level of guarantees.

Fiscal accounts do not consolidate accounts of the State and the NRF. According to the "Toll Motorways and National Road Fund Act", the NRF is an off-balance (extra-budgetary) organization. It is not even included –in contraposition to other funds– as an exhibit to the National budget. Other parafiscal liabilities are registered by the National Road Found in its forecasts of accounts with concessionaires.

The main characteristics of the toll motorways in Poland are summarized in Tab. 3.

Tab. 3. Summary of the toll motorways' arrangements

	A1	A2	A4
Who finances the construction?	Concessionaire from credits from European Investment Bank and Nordic Investment Bank with National guarantees to payments from National Road Fund	Concessionaire from credits from European Investment Bank, Commerzbank, Calyon Bank, equity	Built with budget funds. Since the "Concession to adapt to toll motorway standard and maintenance" was given to concessionaire, there is only private financing
Responsibilities of the concessionaire (construction, maintenance)	Risks of construction and maintenance are on concessionaire's side	Risks of construction and maintenance are on concessionaire's side	Risks of construction and maintenance are on concessionaire's side
Tolls paid by users	Toll level can be set by the Minister of Infrastructure	Toll level due to concession agreement (5 vehicle categories)	Concession agreement fixes highest toll level. Concessionaire can set toll level up to this quote
Shadow tolls (government)	Shadow toll system is aimed on maintenance of the road and depends on traffic level (one of three scenarios)	Initially, no shadow toll. Since 2005, compensations for truck traffic.	Initially, no shadow toll. Since 2005, compensations for truck traffic
Long term purchase agreements (i.e. take-or-pay liabilities)	National Road Found covers the difference between tolls and debt service + return on capital + maintenance costs	No	No
Who bears the traffic risk?	Government in mechanism of payments from National Road Found	Concessionaire	Concessionaire
Debt Guarantees	Granted by Ministry of Finance for payments from National Road Found to concessionaire. There are no direct debt guarantees.	Government guarantees EIB loan (up to EUR 800 million)	No

Source: interviews at Directorate-General National Roads and Motorways (January, 2005).

4. Conclusions

The three toll motorways are being developed under different models of coopera-
tion between the public and private parties. While A1 is a typical BOT, A4 bases on
a concession model (also known as asset-exploitation or French model) and A2 is
more likely to be seen as a partnership with mixed public-private capital expendi-
tures, and risk and revenues sharing. It is too early to perform a deep analysis based
on currently available data, determining which of the implemented schemes of
financing and exploitation is the most efficient and/or less risky for the State. Initial
evidence indicates that, on one hand, the BOT scheme (A1 Motorway) takes too
long to contract and involves the public partner in larger fiscal risks. On the other
hand, taking into account the poor budget conditions, the inviability of tax raises
and the deep current indebtedness (close to the Maastricht restrictions) make it
almost impossible to finance infrastructure (solely or mainly) from public sources
(as in A4 Motorway) without the support of EU structural funds.

The solution seems to be the engagement of private capital supported by public
guarantees and risk mitigation transfers (as is the case of A2 Motorway). Doubt-
lessly, the fact of having three different solutions implemented in the same sector
and country unveils the lack of a common infrastructure development policy at the
Government level. However, in the future –for the same reasons–, it may constitute
a very fruitful field of research for welfare economics and comparative institutional
analysis.

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(Footnotes)

1   **Acknowledgements:** Valuable contributions were received from interviews with Polish officials held during a research project for the CASE Foundation and the World Bank in November, 2004 – February, 2005. The paper also benefited form remarks to the draft made by Piotr Sawicki from the Ministry of Finance.

2   In fact, none of these toll motorways is finished completely: only some stretches are in use.

3   Ministry of Transport, www.mt.gov.pl, access July 2007.

4   The risks severity was assessed using a qualitative assessment based on the probability of an occurrence (from low to high) and the potential economic damage assuming there is an occurrence (from low to high). When both factors are high, the risk can be considered high. Similarly, when both are low, the risk is low. Risks in the other two cases are classified as medium severity under this scheme.

5   Partially materialized: on January 16th, 2007, the Minister of Transport cancelled part of the contracted with GTC and calculated it will have to pay an indemnification of EUR 10 million to GTC.

6   EUR 1 = PLN 3.7615 (National Bank of Poland, 18.07.2007).

7   Esty B., *Poland's A2 Motorway*, Harvard Business School Publishing, Note #5-202-031, 2002.

8   EUR 275 million x 1,065^17 = EUR 800 million (i.e. 6.5% interest rate on a 17-years loan with no debt service).

9   This risk did not materialized as the Poznan Bypass was delived on time.

10 The risk related to the repayment of the EIB loan guaranteed by the Government was initially assessed as medium. After a short period of time, it came out that the traffic was lower that estimated and the fiscal risk shifted to high. In 2005, the Government introduced vignettes for trucks and compensations for motorways's operators according to EU directives. Consequently, the loan repayment risk is now low, however the problem remained on the public side, as compensations are paid from the National Road Fund (KFD) and increasing year on year with truck traffic and the vignette collection system is not tight.

11 www.autostrada-a4.pl, access July 2007.

12 www.autostrada-a4.pl, access July 2007.

13 Ustawa z dnia 2 7 pazdziernika 1994 r. o autostradach platnych oraz o Krajowym Funduszu Drogowym (DzU z 2004 r. Nr 256, poz. 2571 i Nr 273, poz. 2703) [Toll Motorways and National Road Fund Law Act].

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Value Added as a Measurement of the Effectiveness of Business Enterprises

1. Introduction

The success of today's business depends heavily on the investment in the development of intellectual capital (knowledge-based intangible assets), that is professional trainings tailored to employees' needs, information infrastructure and software, research and development, including novel patents, copyright, creating breakthrough products (process innovations), as well as relationship establishment based on the global customer data base. Each company possesses unique knowledge, skills, values and solutions, which can be transformed into value added on the market. Intellectual capital enables a company to achieve a competitive advantage, productivity growth, as well as market value, and the ability to manage intellectual capital becomes a must in today's business. Closely related to intellectual capital management is its measurement, results of which allow for more effective allocation of resources within the company as well as better understanding of the relationship between intellectual capital, competitive advantage, and profitability of the company, including its operational effectiveness.

The primary purpose of this article is to evaluate the operational effectiveness of the company from the angle of the generated value added in relation to its tangible resources (physical capital) and intangible resources (human capital) compared with the financial success of its European competitors. The measurement of value added and matching indicators, which will be presented here, are based on the financial data of *Budimex*, a company operating in the construction and engineering industry, listed at the Warsaw Stock Exchange. The results obtained will then be analysed in the context of the competitive construction industry in Europe, which will then enable the author to state whether the company is operating on the effectiveness level that is higher or lower than the average level.

2. Value added as a measurement of the company's success.

Value added constitutes the fundament of the Porter's value chain[1], which views the company as a system of providing the customer with value. Value creation takes place with the aid of basic functions (that is supply and distribution logistics, procurement and sales, services and production) as well as support functions (that is human resources management, technology development, supply), related to the so-called organizational infrastructure[2]. Organizational infrastructure is understood here as specific processes and business activity systems, which transform tangible and intangible assets into a bundle of assets that enable the company to create value from all the above-mentioned types of assets, establish a competitive advantage, as well as ensure stable cash flows.

The source of value added for the company is the price that a customer pays for the benefits gained from the purchase. In order to obtain value added it is imperative to connect that value with the physical, financial, and intellectual capital that is necessary to create this value. The growth of value added results from the productive employment of the tangible and intangible resources of the company. Finally, value added is the difference between the revenue obtained from the sales of the company's products to the target customer and the expenditures incurred. By offering its customers new products highly valued by them on the market the company increases its sales volume, on the condition that the purchased goods and services needed for the production have been used effectively (provided that production processes have been efficient and losses have been minimal). One has to be aware that it is the essence of the company's existence to create value added, and not to sell, which reflects the resale of expensive components that the company had purchased earlier.

Thus, value added understood in this way is at the same time a sort of the richness of the company distributed to all providers of the capital: shareholders and stockholders, in the form of dividends and interest; the government, in the form of taxes; and employees, in the form of salaries as the employees' contribution in the generation of value (profit division). It is important to point out that today's company should focus on creating value, should know who is responsible for its creation and where it is created (or destroyed), as well as which resources (tangible and intangible) contribute most to added value creation.

Value added can be calculated in the following way[3]:

$$VAi = OPi + ECi + A + D$$
where:
VAi – value added of a company
OPi – operational profit of a company
ECi – employment costs of a company (salaries and social security costs)
A – amortization (depreciation and impairment charges on acquisition goodwill and intangible assets
D – depreciation (depreciation and impairment charges on owned assets)

In order to measure the effectiveness of creating value, all company's resources, physical and intellectual capital, which create human capital and structural capital[4], are related to value added. Structural capital is explicit knowledge, the company's skills reflected in the form of intellectual property, data bases, management processes, technical infrastructure as well as corporate culture. B. Lev[5] views structural capital in a similar way, stating that it enables the company to effectively create significant economic value from physical, financial, and human capital as well as from intangible assets.

Value added grows with the effective employment of the company's resources; therefore, the company should create as much value added as possible, having specific physical and intellectual capital at its disposal. Both forms of capital are viewd as investment and constitute a function in creating value. The company can create bigger or smaller value from the same resources.
One of the basic value-added-based indicators is the measurement of labour efficiency on the micro or macro scale, namely[6]:

$P = VAi / ENi$
where:
VAi – total value added of a company (national economy)
ENi – number of employees of a company (national economy)

This indicator is used to a limited extent by companies operating in different monetary zones (sensitivity to currency exchange rate fluctuations[7]) and in cases of the lack of precise data related to the number of part-time employees. It describes labour efficiency or the amount (monetary) of value added created per one employee.

Other indicators of the effectiveness of creating value added (P_2) and human capital (HCE):
$P_2 = VAi / HCi + A$ or
$HCEi = VAi / HCi$[8]
where:
HCi – human capital of a company
Ai – amortization

According to L. Edvinnson[9] and K. Sveiby[10], the value of human capital stands for the total expenditures connected with salaries, training (total payroll salaries and labour costs). This indicator (in percentage) allows for the comparative analysis irrespective of currency exchange rate fluctuations. The indicator of the effectiveness of human capital shows the amount of value added created by spending a mon-

etary unit on one employee. The relationship between value added (VA) and human capital (HC) expressed by the accumulation of expenditures incurred on employees describes the capability of human capital to create value in the company.

Because intellectual capital comprises human capital and structural capital, the value of structural capital, which is the difference between value added (VA) and human capital (HC), must be computed first as:
$SCi = VAi - HCi$[11]
where:
SCi – structural capital of a company

The effectiveness of structural capital (SCEi) in creating value added is described by the ratio of the value of structural capital (SC) to value added (VA):
$SCi = SCi / VAi$

Human capital is inversely proportional to structural capital in creating value added, which means that if the share of one capital increases, the share of the other decreases. The less human capital participates in the creation of value, the more structural capital is involved in creating this value. Thus obtained indicator indicates the share of structural capital in creating value added. If added value is totally ascribed to human capital, then, the value added from structural capital equals zero. If half of the value of intellectual capital is ascribed to human capital, the remaining part will belong to structural capital. The reverse will be true if human capital does not create value added; then, the added value of the company's intellectual capital will be totally ascribed to structural capital.

Summing two indicators: the effectiveness of human capital (HCEi) and the effectiveness of structural capital (SCEi), a measurement of the effectiveness of intellectual capital (intellectual capabilities) of the company (ICEi) results:
$ICEi = HCEi + SCEi$

The calculation of the company's intellectual capabilities provides a general picture of the level of involvement of human capital and intellectual capital in the company's operations. Thus obtained result indicates the amount of value the company created from intellectual capital for each invested zloty; it evaluates the quality of the company's operations, which is assessed on the basis of the effectiveness of creating value in relation to the invested resources. It is not sufficient, however, to evaluate the company on the basis of obtained results. It is necessary to pay attention to the relationships between the results and the invested resources. In today's business value is created if the effectiveness of resources is increased. If the effectiveness of creating value decreases, value is destroyed.

3. Case study companies

The object of the analysis is *Budimex PC*, a brand that has been very well-known both in Poland and abroad for over thirty years now. The group *Budimex*, comprising *Budimex PC*, is continuing the operations of the Trade Headquarters of Foreign Construction Industry Budimex, founded in 1968. The Group was established for the purpose of exporting construction services, particularly to the developing markets of Asia and Africa, as well as to the countries of the former socialist block. The political changes of the 1980s and 1990s have contributed significantly to the leading position of *Budimex* on the Polish market. In 1992 the company was privatized, and two years later it was transformed into a joint-stock company. Since 1995 *Budimex* has been a listed public company – its shares are traded on Warsaw Stock Exchange.

Pursuing the strategy of creating a strong construction group, *Budimex PC*, has been investing its capital in several leading Polish companies in the construction industry, gradually increasing its shares, until a complete merger. Today, it constitutes one of the few construction groups operating throughout Poland, represented in the regions of the highest level of construction investments, imcluding *Budimex Poznań*, *Budimex Unibud*, *Dromex*, *Mostostal Kraków*, and *Budimex Olsztyn*. *Budimex Group* has around 5 percent of the Polish construction market.

Since 2000 a Spanish group *Ferrovial* has been *Budimex*'s strategic investor, owning over half of the share capital and votes in the AGM. The strategic partnership with *Ferrovial* has enabled *Budimex* to become the leader on the Polish construction market and to considerably extend the range of its operation. The combination of the investment potential of *Ferrovial*, its know-how, as well as its position on the international market, with the experience and business connections of *Budimex* both on the Polish market and on the Middle and Eastern Europe markets, offers new possibilities of expansion.

During a period of over 30 years of its history, *Budimex* has concluded over 3000 contracts in 23 countries of Europe, Asia and Africa. The erection of complete buildings or their parts as well as land and water engineering (classification according to PKD 45.2) constitute the core of the Company's activity. *Budimex* serves as a counseling, managing and financial center in the Group. The following are the main aims resulting from the three functions:
– fast communication flow within the Group structure;
– reinforcement of financial and monetary economy of a particular company;
– strengthening the Group's position on the market.

According to the statute, the following are the subjects of activity of the dominant unit:
– architecture and engineering;
– preparing the area for construction works;
– erecting complete buildings or their parts; land and water engineering;
– fixing building system installations;
– finishing works;
– renting real estates at the company's cost;
– ordered real estate services;
– ordered wholesale;
– wholesale of personal and home use products;
– retail sale in shops with no specialization;
– the remaining retail sale of new products in shops with specialization;
– performing research and technical analysis;
– legal services, accounting, counseling, holding management;
– gravel, sand and clay mining;
– hotel services;
– other services, not classified elsewhere.

The performance of other 44 construction & building companies in Europe constitute a base for comparison with the performance of *Budimex*. The quoted records[3] include data concerning the performance of 600 companies from 34 sectors and 22 European countries. Obviously, value added or the number of employees in each of the companies cannot be the subject of comparison, which are incomparably bigger. What needs to be compared is the efficiency rates of the value added from invested resources.

4. Results and their analysis

Building industry is one of the more important sectors of national economy. During the years 1997-1998[12] it was evident that the building and installation production became much higher. At that time the rate of increase of building and installation production was significantly higher than the production dynamics of industrial sold production in the whole industry. The share of this section in GDP raised from 6,4% in 1995 to 7,4% in 1998. Nevertheless, from the year 1999 there was a slump in the economic situation in building industry, which was influenced by the decrease in the investment demand. For the first time since 1994 the building and installation production was lower than in 2000 year. The economic situation of the building industry is significantly influenced by the amount of capital expenditure for erecting or modernizing buildings, as well as for machines equipment installation.

Significant fragmentation of its economic subjects is the characteristic feature of building sector. Only two capital groups: *Exbud* and *Budimex* are able to obtain more than 3% share on the market. As it comes to the amount of their own capital, Polish building companies are usually small, which prevents them from contesting the greatest and most prestigious contracts. Companies belonging to this sector of industry experience high competition, from other companies both national and international (e.g. *Skanska*, *Porr International*, *Hochtief*, *Strabag*). As a result the tendency of decrease in margins on executed contracts is being observed.

The years 2000 – 2003 constitute the time span for analysis of *Budimex* and the years 2001/2002; 2002/2003; and 2003/2204 for the European sector of construction & building. The following table shows the performance of Budimex:

Table1. **Budimex** financial results (PLN)

	2000	**2001**	**2002**	**2003**
1. Employees number	1222	1189	1260	916
2. Net income from sales of goods and products	600815	498232	690133	555554
3. Value added	253282	122156	147865	113418
4. Operating profit (loss)	121271	2156	9290	(12385)
5. Wages and salaries	102804	93545	107844	97182
6. Social security costs	21724	21902	28248	24877
5 + 6	124528	115447	136092	122059
7. Amortisation	7483	4553	2483	3744
5 + 6 +7	132011	120000	138575	125803

Source: calculation made on company's materials

The unstable economic situation of the building sector in Poland can be observed together with the fluctuations in the number of employees in *Budimex*. These meant the rise in the number of employees in the year 2002 (up to 1260 people) in comparison with 1222 in 2000, and the following fall in their number to 916 people in 2003. The company experienced the increase in income in 2002, which amounted to 690.133 thousand PLN, and fell to 555.554 thousand PLN in 2003. Although the number of employees as well as its income differed at that time, the overall efficiency of the company seems to be increasing systematically (Table 2):

Table 2. Efficiency of the **Budimex** company

	2000	**2001**	**2002**	**2003**
P_1: VA/Employees number (PLN)	207,3	102,7	117,4	123,8
P_2: VA/Wages and amortisation (%)	191,9	101,8	106,7	90,2
VA/Sales (%)	42,2	24,5	21,4	20,4
HCE=VA/HC	2,03	1,06	1,09	0,93
SC=VA – HC	128754	6709	11773	-8641
SCE=SC/VA	0,51	0,05	0,08	-0,08
ICE=HCE+SCE	2,54	1,11	1,17	0,85

The efficiency of employees (P_1) decreased from 207.3 PLN in 2000 to 123.8 PLN in 2003, measured by value added per one employee.

A similar downfall was recorded while efficiency in obtaining value added was measured (P_2). It meant that value added amounted to 192% in 2000, decreasing to 90% in 2003. The sales share in value added amounted to 42.2% in 2000, falling down to merely a half of this in 2003, i.e. 20.4%. On the other hand, the efficiency of (HCEi) constitutes 2.03 PLN of the value added obtained from investment in human capital in 2000, but in 2003 the value added obtained from aech invested PLN in the human capital amounted to almost 1 PLN (0.93).

Intellectual capital efficiency of *Budimex* (ICEi) shows 2.58 PLN of the produced value added from the invested intellectual capital in 2000 and a very significant decrease to 0.85 during the negative efficiency of the structural capital of the company in 2003.

All of the above mentioned values have steadily been going down during the last 3 years, however, the decreases does not seen to be significant. It is worth noticing that the Polish building sector is tying to keep up with the growing degree of national and foreign competitiveness and to adjust to EU standards.

European building companies of this sector do not have the above mentioned problems, as they have been active in this sector from several years, which makes them stronger and more successful due to their *know how* abilities when it comes to concluding profitable contracts. As compared to the performance of Budimex, the performance of 44 European companies belonging to the construction & building section are the following (Table 3):

Table 3. Financial results of the European construction & building sector (GBP)

	2001/2002	2002/2003	2003/2004
1. Employees number	1463999	1533568	1556751
2. Net income from sales of goods and products	165528	193769	197526
3. Value added	54561	60911	62406,7
4. Operating profit (loss)	12445	12461	12554
5. Wages and salaries	33951	38386	40252
6. Amortisation	6834	7645	7343
5 + 6	40242	46031	47595

Source: based on *The top 800 UK & 600 European companies by value added*, Departament of Trade and Industry, Great Britain 2003, 2004 i 2005.

The results shown in Table 3 are optimistic, showing regular increase in all of the values presented in the table. Lets think of how the performance of Budimex look in comparison with the European building sector.

In 2002 this sector's share in total value added of 600 European companies was 4.3%, which means that it increased by 10% in comparison with the previous year. In 2003 the construction & building sector produced 4.6% of value added (an increase of 5%), being seventh out of 10 sectors, producing over 2,6% of this value. The degree of concentration of the sector amounted to 20% [5]. In 2004 the sector's share in creating the value added was 4,4%, reaching the 6th position (with 19%degree of concentration). The remaining rates are shown in Table 4.

Table 4. Efficiency of the European construction & building sector

	2001/2002	2002/2003	2003/2004
P_1: VA/Employees number (PLN)	37,3	39,7	40,1
P_2: VA/Wages and amortisation (%)	135,6	132,3	131,1
VA/Sales (%)	33	31,4	31,6
HCE=VA/HC	1,61	1,59	1,55
SC=VA – HC	20610	22525	22154,7
SCE=SC/VA	0,38	0,37	0,36
ICE=HCE+SCE	1,98	1,96	1,91

The efficiency of employees (P_1) and its increase (decrease) is connected with human capital investment. The increase (decrease) of human capital investment measured by the costs of employment per year (salaries, working costs and other

benefits for the employees), meaning increase (decrease) in efficiency, that is ineffective usage of facilities or materials for production by the workers. We notice this type of dependence in *Budimex* as well as in the whole sector.

The efficiency of the work force in the given sector fluctuates from £ 37.3 to £ 40.1, which forms an average level of efficiency in the given sector. A high level of workers' efficiency means £ 65 per employee, and a low one - below £ 35 - of the produced value added per person. The produced value added by a company or sector is evaluated relatively according to the tangible and intangible resources (human capital) used in the course of production processes. During the years 2002-2004 an average value of P_1 for 600 European companies amounted respectively to the following: £ 47.6; £ 48.5, and £ 51.5, which means regular growth, somewhat bigger in annual rate than in case of the sector investigated.

For 600 European companies the efficiency of added value (P_2) amounted to the following: 141%, 135%, and 144%. The P_2 level fluctuated between 135.6 and 131.1% for the investigated sector. This means that the European construction & building sector did much better in creating value added from the invested resources than the investigated *Budimex* company, whose P_2 rate was on a low level of 191.9% in 2000, 101.8% in 2001, 106.7% in 2002, and 90.2% in 2003, which is in relation to a low lever of operational activity of the company. Reducing investments can help achieve a high level of P_2 in a short time. Nevertheless, companies which are able to effectively form a high level of value added and are able to retain it in the future thanks to the increase in value added can maintain their domination in the market. Their strategy is based on innovation and R&D.

The ratio between value added and sales refers to the level of vertical integration of a given company (sector), on which components and materials are transformed into ready for sale products is measured by the relation of value added to the sold value. The pharmaceutical and bio-technological sectors are most integrated vertically (over 60%), meaning that such functions as production, research and product development, and marketing are internalized inside of the company. The level of vertical integration of the investigated sector fluctuates between 31 and 33%, indicating on the fact that the companies of this sector must divide the produces value added between suppliers and cooperators. The similar situation takes place in case of Budimex, which makes use of services of external cooperators and suppliers at a greater degree than its European competitors, especially in 2003, when value added amounted to 20 % in relation to sales.

Value added as a percentage share in the sales differs greatly from company to company which have to pay great sums of money for materials and external serv-

ices (small share). Nevertheless, the companies who are integrated vertically have a much greater share of value added in the sales.

The rate of value added compared to the operating profit shows how effectively the companies transform value added into the operating profit. If P_2 is lower than 100%, a company cannot get any profit. This means the loss of operational activity. Otherwise the produced value added wouldn't cover the depreciation and employment costs.

The effectiveness of the human capital in producing value added (HCEi) of the construction & building companies shows a slight downfall each year. However, during the years 2001, 2002, and 2003 this sector produced respectively 1.61; 1.59; and 1.55 of value added from the invested resources which is more than Budimex did in the similar period (1.06; 1.09; 0.93 respectively). The calculation of the intellectual capabilities of a company (ICEi) shows how much of the intellectual capital *Budimex* has produced from the invested resources (human and structural capital). The results for the years 2001-2003 are the following: 1.11; 1.17; 0.85. Intellectual Capital Efficiency (ICE), on the other hand, levels at 1.98; 1.96; and 1,91 for the given sector, that is much better results than the analysed company.

5. Conclusions

The aim of this research was to compare the results achieved by companies belonging to the building sector in Europe with the *Budimex* company, active on both Polish as well as on international markets from the perspective of value added. We were concerned with the results especially in the areas where the comparisons were possible. The building sector does not seem to belong to the companies "based on knowledge", like the pharmaceutical, biotechnological or software sectors, however, a contemporary company should increase value added as much as possible in order to achieve competitive advantage, and use its knowledge for innovations of products or processes. In order to obtain a fuller view of the presented rates the efficiency of creating value added from the human capital (HCE) and from structural capital (SCE) should be measured and evaluated basing on the whole population of 44 companies of the investigated sector both in Poland and Europe.

I would like to highlight the fact that the compounding factors have not been fully analyzed here. Due to the lack of available data I was forced to downgrade the presentation and analysis of the results to the ones shown above. It would be worth to widen the scope of investigation to measuring the efficiency of producing values from different resources: physical (financial) capital and various products and

services; to identify creation of values as it comes to the search of processes, activities and projects which referring to products and services making a value for the company, or not; to determining the weakest point of value creation. On the other hand, it is not easy to find and analyze the place where the value is being destroyed. Detecting the place would help raise the efficiency of the physical capital in this place. Unfortunately, the cause and effect do not go together in the contemporary economy, and possible weak points are the effect of the chain (or rather net) reaction of destroying values. Some independence must be defined in order to seek the causes, meaning also the improvement of efficiency in the company. Therefore, an intro-functional cooperation could play a crucial role here, especially in monitoring the efficiency by the processes of product production, services, and (marketing and logistical) activities.

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(Footnotes)

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5   B. Lev, S. Radhakrishnan, *Structural capital*, http://www.baruch-lev.com 26 April 2005.

6   *The top 800 UK & 600 European companies by value added*, Departament of Trade and Industry, Great Britain 2004, p. 33.

7   Sensitivity to currency exchange rate fluctuations is mentioned here because the financial results of *Budimex* are expressed in Polish zloties (PLN) while the financial results of the European companies in the construction industry are expressed in British pounds (GBP).

8   A. Pulic, *Intellectual capital*…, op. cit.

9   L. Edvinsson, *Developing intellectual capital at Skandia, "Long Range Planning"* 30/3, 1997, pp 266-373.

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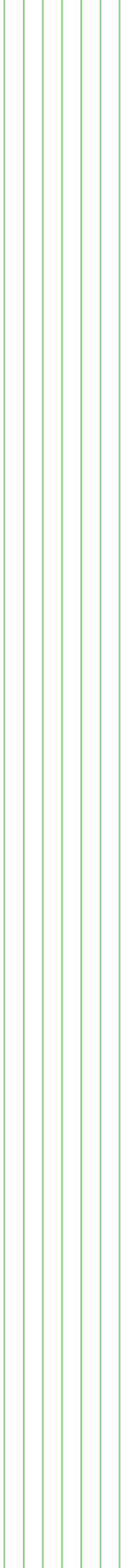
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Threshold Management in an Enterprise

1. Introductory remarks

This paper outlines the problems connected with threshold manage-
ment, based on threshold analysis. The starting point of the threshold
analysis is the fact that enterprises, in their activities and time and spatial
development, encounter some constraints resulting from various reasons.
Analyzing the influence of these constraints, defined as thresholds, we can
assume that they lead to the disturbance of their functioning and create
discontinuity of their development processes. A very important feature
of these constraints, which are by no means absolute, is the fact that they
can be eliminated, but at additional, often quite huge, costs. These costs
can be called threshold costs.

As a result of basic assumptions of the threshold analysis, costs can be
divided into normal (NC) and additional (AC) ones. Normal costs determine
standard conditions, whereas additional costs usually define unconven-
tional (of new quality) conditions in which an enterprise functions. It is
determined by the following definition: the threshold for the system in the
period from 0 to t is such an effect of its functioning e, at which the next unit
cannot be produced at present unit cost [Kozłowski 1974, p11 and next].
In this context, the basic aims of this paper can be formulated as:
–   to single out the areas of threshold management,
–   to formulate the methodology of threshold management,
–   to show the specific application of the tree of threshold analysis of raw
    material costs.

2. Classification assumptions of the management areas

A series or classifying description is a vital aspect of the characteristics of
a research problem. The former consists in placing the elements of a set in
rows or series, comparing them in some aspects and defining the order of

their occurrence. The latter is characterized by the fact that the elements of an analyzed set are subordinated to some concepts and are included in categories which constitute ranges of these concepts. The scales similar to those used in logics are applied here, namely: nominal, ordinal, sectional and quotient ones [Steczkowski, Zeliaś 1977, p.27]. Moreover, the classification methods of defining and describing the elements of a set are well placed in the logics of predicators, whereas the logics of relations is necessary to explain the structure of a series arrangement [Ziemski 1967, p.46].

Classification as a concept can be analyzed in semantic, logical, and set-theoretic aspects. Professional literature provides various definitions of this concept. Below, some of them are presented:
– "division of a set of objects into subsets so that there are no objects which do not belong only to one subset and each object from the divided set belongs to some subset" [Pszczołowski 1978, p.96].
– the process of dividing a set of objects into classes (categories), where the concept of a class means a set of objects characterized by some common properties [Gatnar 1998, p.13],
– the process of categorizing objects or events into separate classes, or the result of this process [Reber 2000, p.301].

Classification is also considered as a section of general methodology, and, together with information gathering and modeling of phenomena, it is one of basic tools of researching the reality. This concept is also understood as a set of principles on the basis of which the division is made. Finally, it is considered as an outcome of the classification process [Lisiński 2004, pp.297-298].

In our further analysis it is vital to understand this concept as a process of dividing-connecting, which, through multifunctional reshaping of the structure of an analyzed set or object leads to the arrangement of its elements [Statystyczne metody… 1998]. In order to carry out the classification we must apply a specific course of a scientific process, and especially [Grabiński, Wydymus, Zeliaś 1989, p.12; Grabiński 1992, p.25; Steczkowski, Zeliaś 1997, p.31]:
– determine the classification space,
– define the criterion of grouping
– choose a proper taxonomic or classification method.

In order to carry out a proper classification it is also necessary to observe logical postulates, such as: the clarity of formulated criteria, the possibility of making inductive generalizations and the creation of many classification systems of the collectivity depending on the area of observation. Thanks to them it is possible to learn

the reality by means of reducing entropy and creating scientific theories [Gatnar 1998, p.13].

The subject of classification here is the modified set of decision and information courses (areas), called statistical objects (C). Each of these courses will be analyzed as a so-called taxonomic operational unit.
The basic aims of the classification process will be [Wdowiak w. 2007]:
– to differentiate the types of decision and information courses (areas) in the aspect of the threshold analysis of an enterprise,
– to indicate the methods of cost calculation and corresponding threshold measures,
– to indicate appropriate kinds of thresholds adequate to the differentiated threshold types.

The classification space will be the set of features of the division of decision and information courses, typical of analyzed decision areas in the aspect of threshold analysis of an enterprise. In this way they become the evaluation criteria. When choosing the criteria, structural and functional aspects of the analyzed objects were taken into account, special attention was paid to:
– general aims,
– typical features of an analyzed object,
– the range, specific methodology and method of management,
– particular aims, methods of cost calculation and threshold analysis measures,
– threshold costs, kinds of thresholds, and
– the sphere of effects.

3. Registration of management areas and their classification.

As we could see, it was very difficult to establish complex classification criteria of decision and information courses (areas) in the aspect of threshold analysis. It is equally difficult to univocally, comprehensively and separately define the set of these decision areas as a full initial set for classification. The viewpoints of theoreticians of enterprise and management as well as the opinions of managers are not unanimous.

In the language of taxonomy, the objects and the subjects of the analysis are the information-decision areas (courses). They are characterized by statistical features, such as general and specific criteria of classification. Therefore, we can say that the areas (courses) are the subject of classification, and criteria constitute the space of classification. To group the subjects of classification in classification space, the Ward method was used [Ward J.H. 1963], which assumes gradual joining of single objects

(and then their groups) until all objects belong to one group. At each stage two subgroups which give the lowest increase of general variance inside the group are joined. This process is called the agglomeration. It is vital to choose the moment at which we break the agglomeration process so that we reach the final division. The professional literature provided over thirty various methods of finding the final division. However, good results can be usually obtained using the analysis of a "dendrogram", that is the connection tree. It is also important to assume the measure of distance. In our case, from the statistical perspective, all criteria are quality variables, and a proper choice of a criterion is the so-called percentage inconsistency. Therefore, the distance is the percentage of features, in which two objects did not take the same variant [Statistica PL…1997].

On the basis of the above assumptions, regularities and relations, relying on the opinions of enterprise, management, and management accountancy experts, the matrix of values of information-decision areas (courses) division criteria was built [Wdowiak W. 2007].
After presenting the initial, synthetic and author's own version of the list of information-decision areas and outlined tendencies, and after numerous consultations with enterprise, management and management accountancy experts – on the level of 0.8051 measured by Kendall and Babington-Smith concordance coefficient [Wdowiak W. 1980], a 52-element detailed list of these areas, covering elements C1-C52 in the classification tree of information-decision areas (courses), was established.

It became the basis of statistical calculations, using the Ward method, as a result of which the classification tree shown in figure 1 was obtained.
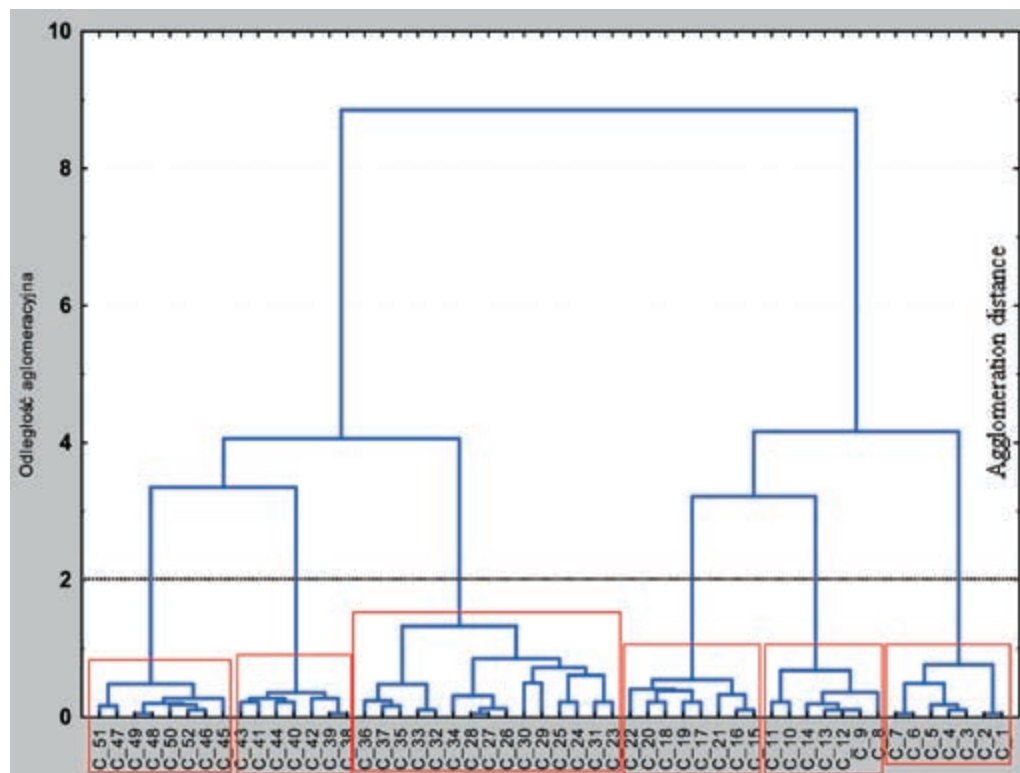
Figure 1. The classification tree of information-decision areas (courses)

This tree enables us to differentiate six synthetic information-decision areas (courses), such as [Wdowiak W. 2007]:

I. Preparing the strategy of actions and development
II. Designing strategic management
III. Management organization and development restructuring
IV. Reorganization and reparation restructuring,
    a) Vertical reorganization
    b) System reorganization
    c) Reparation restructuring
V. Operational activity management
VI. Evaluation of operational, strategic and development activities.

A detailed tree of synthetic information-decision areas (courses) takes the following shape [Wdowiak W. 2007]:

I. Preparing the strategy of actions and development
    1. Defining the mission and the vision,
    2. Defining strategic aims,

3. Segmentation and forecasting the market share,
4. Forecasting the product assortment,
5. Pricing policy,
6. Forecasting the network of distribution channels,
7. Public relations and promotion.

II. Designing strategic management
8. Marketing designing and planning,
9. Financial designing and planning,
10. Employment planning,
11. Logistics designing and planning,
12. Research and development designing and planning,
13. Production designing and planning,
14. Technical and technological designing and planning

III. Management organization and development restructuring
15. Project and innovation management,
16. Diversification and winning new markets
17. Rationalization of employment
18. Starting activities in new spheres
19. Technical and technological progress and innovations,
20. Upgrading the assortment and the product designs,
21. Diversification of supplies and markets,
22. Rationalization of finances and prices.

IV. Reorganization and reparation restructuring
a) Vertical reorganization
    23. Planning the range and management of changes,
    24. Certification of quality systems and efficiency management,
    25. Perfecting the organizational and legal system,
    26. Designing and perfecting the organizational structure,
    27. Upgrading and perfecting the production systems,
    28. Logistics of supplies and markets
b) System reorganization
    29. Improvement of problem-solving and decision-making,
    30. Improvement of information and communication system,
    31. Improvement of administration procedures,
    32. Improvement of work organization,
c) Reparation restructuring
    33. Restructuring of employment and improving the staff,
    34. Modification of motivation and payment systems,

35. Restructuring finances and finance management,
36. Modernization of supervision and controlling systems,
37. Reorganization of administration and management,

V. Operational activity management
38. Maintaining technical efficiency of fixed assets,
39. Ensuring the compliance of technological processes with documentation and norms,
40. Managing the personnel and the human factor,
41. Production management
42. Maintaining the organizational efficiency of the administration,
43. Securing the supplies and the markets,
44. Finance management

VI. Evaluation of operational, strategic and development activities.
45. Modern technologies,
46. Use of assets,
47. Economic efficiency of the activity,
48. Rationality of personnel management and motivation,
49. Efficiency of production servicing,
50. Effectiveness of management and administration services,
51. Rationality and modernity of production,
52. Effectiveness of marketing and supplies and sales logistics.

4. The outline of methodology of management in the threshold aspect.

The method of threshold management is a formalized method of management, supported by the threshold analysis of the organization. It is characterized by the democratic and integrative style of management, based on cooperation between the manager and his/ her subordinates. It relies on identification, decomposition, observation, analysis and realization of the complex and partial threshold aims (tasks), formulated by means of threshold measures in the context of all or some methods of calculating the total, variable, final costs of the process or tasks, within the management function. It uses the operational controlling principles, integrating the enterprise activities aimed at the increase, profit and development of workers, taking into account the present or projected organizational structure. In this system of management, the environmental context is essential, referring both to the environment of the organization, as well as to the ethical, social and global aspect of management.

This method seems to be more useful and concretized through the system of set main goals and decomposed partial aims, expressed in quantitative measures, specific for the cost calculation methods, than the traditional system of management

by objectives, for which it is more proper to formulate descriptive aims, rather of the qualitative than quantitative type. Therefore, the method of threshold management enables us to answer more concretely, precisely and systematically the following questions [see: Humble 1975, pp.15-16]:

1. Are the adopted aims of the enterprise and the existing plans based on solid foundations and are they real enough to create conditions enabling us to reach the perspective goals, while at the same time securing temporary increase of profit?
2. Do the companies and the managers know exactly what to do to realize these plans?
3. Do the managers let the precious, high-quality resources be engaged into activities which do not promise achieving high or even average effects?
4. Is the executive team well-motivated to work and are they personally involved in striving to reach the set goals?
5. What kind of economic activity does the company intend to lead in the future?
6. From what sources will the company make its profits in the future, if we take into account the predicted external difficulties as well as strengths and weaknesses inside the company?

We should also pay attention to the fact that in the western countries, apart from traditional, organizational methods and techniques, they also use, as the auxiliary methods in management by objectives, the following ones: budgeting, cost planning and long-term planning. Taking all these aspects into threshold management, we can claim more precisely, that, apart from organizational methods and techniques, the additional methods consist of specific methods of cost calculation, budgeting, and the analysis of the break-even point, which are covered by the threshold analysis of the enterprise.

The method of threshold management also takes some models from various management techniques. For example, in spite of the above remarks, certain elements of applications can be taken from management by objectives [Zarządzanie przedsiębiorstwem…2000, pp.126-137], such as those referring to the key result areas (KRA), the influence on result card (IRC), the executive's task card (ETC), the company improvement plan (CIP), individual improvement plan (IIP), or the result review card (RRC). On the other hand, the process of motivating was adopted from the management by motivating [Zarządzanie przedsiębiorstwem…2000, p.210] and constitutes now an integral part of the proposed methodology of threshold management. From the management by participation the threshold management took the idea of allowing the participation of executive workers in the decision-making process, that is participation in power on the third (consultation) and partly fourth level (workers' supervision of the company activities), especially in planning activities

and meeting the plans [Zarządzanie przedsiębiorstwem 2000, p.182]. The threshold management also uses those elements of management by delegating which refer to delegating some formal authority to the person on a lower position together with the responsibility for carrying out certain tasks [Zarządzanie przedsiębiorstwem…2000, p.210]. As far as the management by tasks is concerned, the elements referring to generating ideas and tasks by executives should be adopted [Zarządzanie przedsiębiorstwem…2000, p.220], as these tasks in threshold management can result from the threshold analysis of an enterprise. This process should consist in preparing a set of period tasks by the executive, delegating them to the workers at the briefing and controlling the realization of these tasks. If we adopt formalization from management by formalization, this can result in developing standards and norms to be used in the company in similar situations. This can also stimulate us to prepare a relatively complete and coherent operational documentation of an organization [Zarządzanie przedsiębiorstwem…2000, p.232]. The threshold management borrows a lot from the management by controlling, for example in complex planning of material, financial and cost tasks, steering its activities by the so-called responsibility centers, as well as supporting the top management with new versions of the strategy of company development, which take into account the observed and expected changes in the environment [Zarządzanie przedsiębiorstwem…2000, p.262].

As a result, taking over some elements of the above management methods, and above all, a novel threshold approach to the enterprise determines specific methodology of threshold management, which should proceed along the following modified stages:

1.   Defining the aims of the organization.
    1.1.   Building the strategy and formulating assumptions.
        1.1.1.Analysis of the environment and systemizing external aims.
        1.1.2.Identifying opportunities and threats.
        1.1.3.Identifying needs.
        1.1.4.Pointing out strengths and weaknesses of an enterprise.
        1.1.5.Setting the system of internal aims and necessary input data.
        1.1.6.Agreeing the assumptions and developing the strategic plan.
    1.2.   Identification of system levels of efficiency (organization, process, work post).
        1.2.1. Building the hierarchy of efficiency levels (diversification method, analysis of preferences).
        1.2.2.Choosing the method of cost calculation (total, variable, process, task, outcome costs).
        1.2.3.assuming the threshold evaluation measures (cost, quantitative not cost, qualitative measures).

1.3. Setting the threshold aims of an organization.
    1.3.1. Assessing extreme thresholds.
        1.3.1.1. Identification of thresholds pointing at the kind of general border constraints.
        1.3.1.2. Laying out the area of the analysis through aggregating the values of border constraints.
    1.3.2. Assessing the intermediate thresholds.
        1.3.2.1. Creating the list of indirect threshold factors and their division.
        1.3.2.2. Showing the aggregate first and indirect threshold in the analyzed area (aggregation of results).
        1.3.2.3. Isolating the main research areas through aggregation of indirect threshold areas.
        1.3.2.4. Pointing out critical thresholds.
1.4. Calculating the threshold costs.
    1.4.1. Drawing up the factors causing direct threshold costs in main threshold areas.
    1.4.2. Calculating direct costs of main threshold areas.
    1.4.3. Calculating indirect threshold costs of the main areas of the analysis.
    1.4.4. Establishing the critical development thresholds of the analyzed area.

2. Planning (budgeting) and improving management.
2.1. Preparing the plan (budget) of action.
    2.1.1. Analysis and variation of the threshold values of the organization.
    2.1.2. Establishing key tasks for the management and planned results.
    2.1.3. Planning tasks for executive posts.
    2.1.4. Developing operational and financial plans (budgets).
2.2. Organization and controlling system levels of efficiency.
    2.2.1. Evaluation of the strategy of the organization (product and service offer, markets as groups of clients, product and market priorities, strategic advantages).
    2.2.2. Evaluation of the process management (realization of aims, monitoring results, allocation of resources, relations between departments).
    2.2.3. Evaluation of the posts (division of tasks and responsibility, order of activities, principles of rewarding, procedures, ergonomics and working conditions).
2.3. Motivating workers.
    2.3.1. Identification of predispositions, needs and aspirations of the workers.

2.3.2. Showing a set of motivators.

2.3.3. Constructing a system of motivation.

2.3.4. Adjusting the motivation system to the system of organization's aims.

3. Supervising the execution of the plan and improving management.

    3.1. Current supervision of tasks and planned results.

    3.2. Periodical check of execution of operational and financial plans (budgets).

    3.3. Periodical analysis of the execution of the plan, focusing on the values of extreme, indirect and critical thresholds.

    3.4. Periodical analysis and correction of the organization's strategy, process management, and the functioning of posts.

    3.5. Preparing periodical reports.

    3.6. Determining deviations of periodical results from the planned values and threshold values.

    3.7. Periodical analysis and modification of the motivation system.

    3.8. Analysis of the execution of external (strategic) aims.

    3.9. Adjustment of external and internal aims, threshold values and planning assumptions.

5. The tree of threshold analysis of the costs of raw material use.

The problem of accepting the costs of using raw bristle and raw horsehair used in production of paintbrushes, brushes and brooms as the cost of acquiring revenue can be presented by means of the tree of threshold analysis, similar to a decision-tree. In order to do so we have to make a small modification of a classic decision-tree, introducing the following changes and principles typical of this problem:

– the threshold (decision) knot should be market not with a square but with a symbol of an envelope, in its left quarter we should write the value of the calculated profit (real or planned), and in the other three quarters the calculated or planned profit in accordance with the variants of accepting the costs of acquiring the revenue, shown in the random knots,

– the random knot should be marked with a circle and divided into four quarters by means of two diameters, assuming that in the left diameter we should write the value of costs (real or planned) and in the other three quarters the figures accepted as the costs of acquiring revenue, in accordance with the created real variants, connected with the real situations which took place,

– above the decision knot we can write the value of achieved or planned revenue, necessary to calculate the profit in appropriate quarters of the envelope,

– the branches coming from the threshold knot describe the alternatives to the threshold analysis,

– the branches coming from the random knot describe the potential conditions or results of the threshold analysis, determined by appropriate measures and the likelihood of these events happening and obtaining these results.

The tree of the threshold analysis referring to the analyzed case of tax control regarding proper documentation of raw material purchase is presented in figure 2.
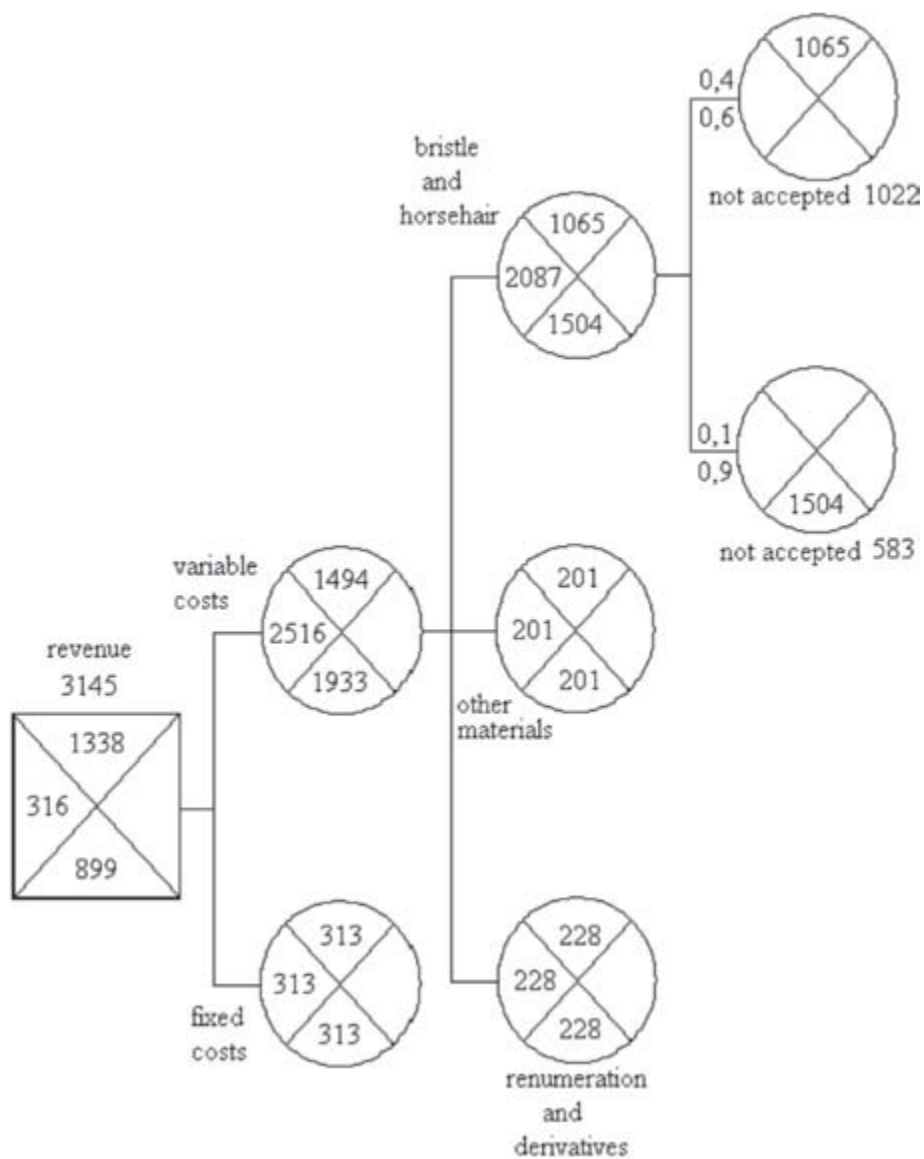

Figure 2. The tree of the threshold analysis of accepting the use of raw materials as the costs of acquiring revenue.

The structure of the tree of the threshold analysis from the left to the right enables us to determine the initial situation. In our case, the calculated financial result amounting to 316,000 zlotys, placed in the left quarter of the envelope results from the difference between the revenue of 3,145,000 zlotys from sales of paintbrushes, brushes and brooms, placed above the envelope and the sum of variable costs 2,516,000 zlotys in the left quarter of the upper random knot and the sum of fixed costs in the left quarter of the lower random knot of the first column. The total sum of variable costs 2,516,000 zlotys, consists of the costs of raw horsehair and raw bristle, 2087 zlotys, in the left quarter of the upper random knot, the costs of other materials, 201,000 zlotys, in the left quarter of the middle random knot and the costs of remuneration and derivatives, 228,000 zlotys, in the left quarter of the lower random knot of the second column. In the upper branch coming from the random knot we show the costs not accepted in the first version by the Tax Office, amounting to 1,022,000 zlotys, due to their improper documentation in light of the Bill on Accountancy, assuming the likelihood of its correctness at 0.4 (incorrectness – at 0.6). Therefore the figure of 1,065,000 zlotys represents the costs of used raw horsehair and raw bristle accepted by the Tax Office. This sum, that is 1,065,000 zlotys, was transferred to the upper quarter of the upper random knot, as well as the sum of 201,000 zlotys was transferred to the upper quarter of the middle random knot and 228,000 zlotys to the upper quarter of the lower random knot of the second column, because the latter two sums did not change.

Having built the decision tree, the solution to the threshold problem can be found going backwards from the final results. That is why the sum of variable costs in the upper quarter of the upper random knot, amounting to 1,494,000 zlotys is the sum of costs transferred respectively to the upper quarters of random knots of the second column (1,065,000+201,000+228,000). The financial result of 1,338,000, as a result of not accepting the part of used raw material for the production as the cost of acquiring revenue (2,516,000-1,494,000=1,022,000) is the difference between the revenues 3,145,000 zlotys (above the threshold knot) and the sum of variable costs, 1,494,000 zlotys and fixed costs 313,000, written in the upper quarters of random knots of the first column. A similar course and method of calculating should be applied to the second variant of not accepting the use of raw bristle and raw horsehair as the costs of acquiring revenue at the amount of 583,000 zlotys (the second branch from the top, coming from the upper random knot of the second column). Moreover, we should add that the likelihood defined in the analyzed threshold case results from the assessment of the legal conditions.

Summing up, we must admit that the financial result calculated by the taxpayer (316,000 zlotys) differs from the financial results of the two presented variants (1,338,000 zlotys and 899,000 zlotys), resulting from the sums questioned by the Tax

Office, representing the costs of use of raw horsehair and bristle, documented by internal notes. As a result of questioning these costs, in the first case, the profit rose by 1,022,000 zlotys (1,338,000-316,000), which forces the taxpayer to pay the tax of 408,800 zlotys (40% from 1,022,000 zlotys), which together with penalty interest amounts to over 700,000 zlotys to be paid to the budget, whereas in the second case, the profit rises by 583,000 zlotys (899,000-316,000), which forces the taxpayer to pay the tax of 233,200 zlotys (40% from 583,000 zlotys) and together with penalty interest it amounts to over 350,000 zlotys to be paid to the budget.

It would seem that the problems of using raw bristle and raw horsehair bought from farmers to be used in the production of paintbrushes, brushes and brooms do not exist, but the method of documenting these purchases in case of unclear regulations, and especially unclear interpretation of these, can cause problems of a threshold type, which can even lead to the bankruptcy of the company. We should add here, that the time scope of the check was 2001, the time when the 40% rate of income tax from the profit was valid, and the tax was calculated on the so-called "general principles". At the moment of purchasing these raw materials on the basis of internal notes, a legal problem of a threshold type existed, referring to the amount of the final profit, the problem that could even lead to the bankruptcy of the company. Only cautious actions saved the company from this danger, but the taxpayer had to undergo a difficult, 2-year period of problems with the Tax Office, which luckily were unsubstantiated and which were finally solved. This situation could wreck the efforts of the taxpayer to develop his company and could question the effectiveness of his methods of managing the overheads costs.

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Role of ICT Training in Closing Digital Divide among SMEs

Introduction and Literature Review

Study of Digital Divide spans across many disciplines - from sociology and political science to economy, business and information systems. Consequently, some of the most popular definitions of the Digital Divide concept are very broad. Holmes defines it broadly as "the great disparities between and within societies in the use of digital technology" – (Holmes, 2003). This is also a definition used widely with United Nations literature. There were numerous attempts to create a complex index identifying an overall scale of Digital Divide. Dolnicar,Vehovar, and Sicherl (2004) proposed two forms of advanced methodological measurements: a composed measure - the digital divide index (DIDIX) and the time distance methodology, which offers a significant improvement at both conceptual and application levels. In another study completed in Germany (Husing, Selhofer, Korte - 2001) attempt to measure Digital Divide was based on four dimensions: gender, age, education and income. Authors concluded that education was an area of the largest discrepancy whereas gender had a negligible impact. Digital Divide was defined in this study as "the gap between individuals, households, businesses and geographical areas at different socio-economic levels with regard to both their opportunities to access information and communication technology (ICT) and to their use of Internet for a wide variety of activities."

Out of three major levels of Digital Divide discussed in the literature: individual, business, and region (Warschauer – 2003), it is business aspect that is the focus of this paper. It has been shown in many studies that existence of Digital Divide may have a profound impact on operations of business in this information driven century. A typical example could be possible failure or limited growth of e-commerce ventures due to the limited level of computer literacy of broad market participants. Dynamic growth of e-commerce economy which we have enjoyed over the last

decade could turn out to be very deceiving. Its growth is still fueled by specific section of society that is positioned on the right (knowledgeable) side of Digital Divide. However, as it was discussed by Gregorio, Kassicieh, and De Gouvea Neto (2005) drivers of e-business activity in developed and emerging markets may encounter a major limitations and barriers associated with existence of Digital Divide in terms of large sections of the market incapable to utilize this technology driven offer.

As globalization is leveling the field for economic opportunities opened to variety of businesses, it uncovers at the same time a great disparity between IT driven productivity levels attainable by these businesses – especially between small business and large corporations. We will call this disparity – a business Digital Divide. Increasing number of research studies (Wielicki, 2006) attribute this disparity to lack of knowledge and education among small and mid size business (SMEs) and not to lack of funds and access to technology. As computer hardware and software becomes more affordable, and at the same time more powerful – it is knowledge (both – business and IT related), which becomes a key to closing business Digital Divide between SMEs and large corporations.

Knowledge has been for years recognized as a key resource of a modern company (Peters - 2004). Knowledge Management concepts and tools have been designed and implemented in many large corporations contributing significantly to enhancement of business processes. Knowledge capturing, codification, storing and distribution usually require sophisticated IT driven system. This is where most of SMEs were left behind. Two primary ways in which SMEs may acquire knowledge are through hiring of knowledgeable employees (which is usually very expensive) and by initiating internal learning process.

Therefore, it is learning that became a focus of this study and its impact on different aspects of SMEs' performance.   Since learning can be performed at many levels and in different forms – as it was shown by Ackoff and Rovin (2003), we have looked at variety of formats in which training is delivered among SMEs – from 1-one-1 training, through traditional classroom session to e-learning. Our study looked at the subjective evaluation of learning outcomes as perceived by the employees but compared it with more subjective measure of level of knowledge exhibited by number of business processes supported by IT based solutions. A new measure of IT competence proposed in this study with respect to SMEs is relying on a count and proportion of business processes, which are clearly supported by IT solutions and moves away from simplistic measures like number of PCs or number of hours of class training delivered to employees. As it has been shown in some recent studies (Bassi and McMurrer, 2007) plain number of hours of empolyed training turns out to be a very bad predictor of overall organizational performance.

Research Problem and Methodology

Our study of Digital Divide between SMEs and large corporations was clearly focusing on major barriers to implementation of IT identified by the respondents (Wielicki - 2006).
In the first survey of over 600 SMEs in the Central California top three barriers identified were:
- lack of IS plan
- lack of knowledge and skills
- lack of funds

Since the top two identified barriers were clearly associated with lack of knowledge and understanding of business processes and lack of funds was only number three barrier, the focus of our search for roots of business Digital Divide shifted naturally from capital based factors to knowledge based factors.

The second survey of 160 SMEs in addition to levels of used IT and barriers investigated also issues of number of hours of training, training formats and learning outcomes.

Statement of a Research Problem

There were two specific problems that we focused on in this study. The first one had to do with the size of the business and its impact on actual learning and training process going on within the business. Since we had determined already that surprisingly many SMEs had come to conclusion, that it was lack of knowledge and skills that kept them from reaping benefits of ICT supported business solutions and not just access to technology, we wanted to find out how this translated into their real commitment in the area of professional training.

The second problem was related to more reliable measure of ICT application involving detail count of specific business processes supported by ICT within a small business. It was expected that an SME with more extensive record of internal training and education both in terms of hours as well as variety of forms and more positive learning outcomes would exhibit significantly higher level of ICT implementation across its business processes.

Two null hypotheses have been formulated:

Ho: Size of a business (measured in number of employees and revenue) has no impact on ICT related professional training and learning activities measured in hours of training and diversity of formats.

Ho: There is no correlation between intensity of ICT training and number of business processes within SME supported by Information Technology.

We have collected our sample and conducted statistical analysis with hope of rejecting both null hypothesis and prove a strong relationship.

Sample: SMEs of Central California

The focus of this study was on SMEs – Small and Mid size Enterprises. Small and medium sized enterprises count for 99% of all businesses in the EU and about 98% in the US, and the term 'SME' consequently covers a wide range of business types, from the self-employed through to multinational public limited companies with up to 250-500 employees. This definition is not yet well developed and is used here in a broad term.

For instance – there are some difference between SME definitions used in EU countries and US. Also, the World Bank Group is defining SMEs in the following way: "*micro enterprise-up to 10 employees, total assets of up to $100,000 and total annual sales of up to $100,000; small enterprise-up to 50 employees, total assets of up to $3 million and total sales of up to $3 million; medium enterprise-up to 300 employees, total assets of up to $15 million, and total annual sales of up to $15 million.*"

Our sample included also some local businesses with number of employees above 500 even though they did not really qualify under above mention definitions of SME. We have decided to include them, especially when they constituted quite independent economic entities and were clearly not a part of a large corporation. This decision has been made for the purpose of better capturing impact of such variable like size of the business on company's learning and training activities.
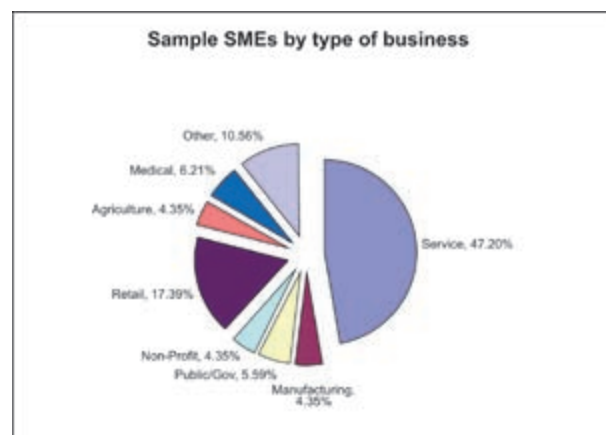

Fig. 1 Types of businesses represented in the sample of n=161 SMEs

Our sample included n=161 small and mid size enterprises located in the Central California. It represents a relative broad intersection across different type of business with Service (47%) and Retail (17%) as two largest categories (see Fid. 1 above).

Research Methodology

An instrument has been designed as an extension of a previously used ICT survey of SMEs where specific questions were added regarding: number of hours of training per employee per year, perception of learning outcomes, and forms of professional training used by the company. The survey was conducted as a mandatory assignment of business students during a graduate MIS course. This resulted in a respond rate close to 95%.

In addition to learning and training related questions the survey included also numerous questions about the overall level of used ICT. Those included simple questions about number of PCs as well as questions about list of business processes supported by IT.

Descriptive statistics was used to get an overall picture of collected data. The sample was then divided into three categories by size of SMEs (micro, small, and medium) and Chi Square Analysis has been conducted to verify statistical significant of relationship between variables defined in the hypothesis described above. Correlation test was also used in this analysis to determine the strength and also type (sign) of relationship between such variables as size and quantity of provided training.

Research Results

The first part of hypothesis No.1 implying no increase in intensity of ICT training with increase of the size of the company has been partially rejected with analysis of descriptive statistics obtain from our data (see table below). No detailed test for independence has been conducted due to substantial difference in size of data subsets with most of data falling into a category "small business" with under 100 employees.   Nevertheless, analysis of descriptive statistics presented below indicates almost 50% increase in the mean number of applied ICT training hours between small and mid size businesses, with less significant increase in the number of ICT supported business processes.

Tab. 1 Analysis of IT supported BP and hours of Training by Size of Business

Size of business	Average Number of Used Business Processes	Number of ICT Supported Business Processes	Hours of Training per Employee / per Year
Small (<100)	4.6	3.67	58.4
Medium (100<n<500)	5.1	4.11	112.5
Large (>500)	6.36	5.5	120

The second part of hypothesis No.1 regarding lack of impact of size of business on diversity of formats in delivery of ICT training could not be rejected. A contingency table has been constructed with two factors: size (S, M, and L) and format of training (with 5 categories from most traditional one-on-one training to e-learning).

Tab. 2 Chi-square Contingency Table for Business Size and Form of Training

	E-Learn	Workshops	Hiring	Ed. Institute	1-on-1	Other
S	41	47	42	22	103	11
M	8	9	8	5	13	1
L	7	5	6	4	9	2
Total	56	61	56	31	125	14

Performed Chi-square analysis yield value of Chi-square = 4.40 with the p-value = 0.927 and the coefficient of contingency merely 0.113. Even though one-on-one training seemed to be more typical of smaller businesses, the difference was not statistically significant. This could be caused by today's universally broad access to a diverse professional training offer.

The second hypothesis implying lack of correlation between number of hours of training / learning offered by the small business and intensity of ICT applied to used business process had to be accepted due to obtained coefficient R-square = 0.1328 indicating a relatively weak correlation between these two variables (see Fig. 2 below). Even though an increasing trend ICT support for business process is evident as the number of training hours increase, this relationship is far from strong and statistically insignificant. One of the reasons could be that in the process of collecting data nowhere did we ask question about complexity of ICT solutions applied. This would mean that use of a simple home grown website would carry the same weight as sophisticated billing system. Whereas the latter one would most likely required extensive training, the first one could be done without or with

a minimal training. At the same time e-learning form of training, which is very eco-
nomical but requires certain minimum level of computer literacy among learners
was used in only 31.5% cases among small businesses, 42.1% of cases among mid
size and 63.3% of cases among large corporations. This puts SMEs at a permanent
disadvantage that needs to be overcome with increasing overall computer literacy
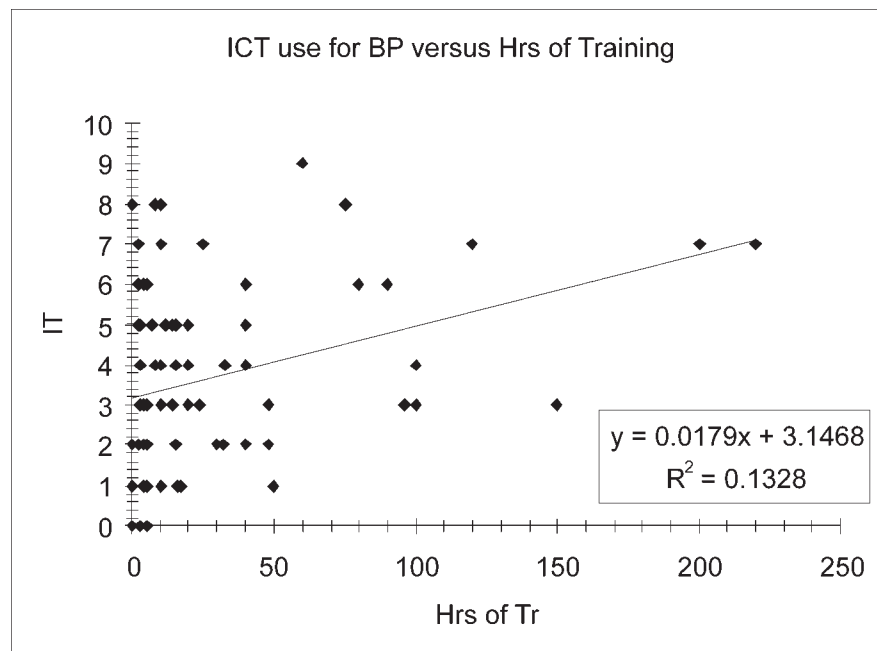of their employees to better utilize Internet technology for professional training and
development.

Fig. 2 Relationship between ICT supported processes and hours of training

Finally, it has also been noted that the larger is the number of identified business
processes in a given small business the higher is the percentage of processes sup-
ported with ICT based solution. Even though such outcome is to be expected, it is
worth of noticing that it implies an increasing need for ICT training with the growth
of business, since it means often more sophisticated operation covering more busi-
ness processes.

Conclusion

It seems evident that in this knowledge driven economy small and mid size enterprises (SMEs) are being left behind on a wrong side of Digital Divide. A shift in identification of main barriers from lack of funds and access to ICT toward lack of knowledge and education is likely to put learning and education in the center of SMEs' attention. There is some evidence of increased interest in providing learning and tanning to SME's employees with the business size increase but surprisingly, it does not necessarily transfer into statistically significant increase in number of business processes supported by ICT. This could be caused by the general definition of ICT supported business process, which does not measure level of its complexity. Additional study may be needed to explain further this relationship.

Additionally, as modern formats of learning such as e-learning are becoming increasingly popular and economic – it seems that SMEs are lagging behind in embracing it. Even though smaller samples of data about mid size and large companies prevented us from showing statically significant dependence between size and a format of training, difference in percentage use of e-learning between small and large companies warranties a need for additional detailed study.

Finally, it seems necessary to shed some light on an issue of a gap between SMEs self-admited realization regarding lack of knowledge and education as major barriers to implementation of ICT and lack of commitment to follow up with action. Whereas education and training seems to be the major means for SMEs to close Digital Divide and dramatically increase their productivity, we yet have to see some evidence of a strong commitment to continuous employees learning and training effort, which would be independent of size of the company.

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Chwila, by poczuć smak sukcesu.
Dla takich jak Tiger to kolejny dzień pracy.

Dołącz do nas, jeśli szukasz pracy, która zmotywuje Cię, żeby iść naprzód. Razem z nami będziesz realizować projekty dla globalnych klientów, pomagając im osiągać wysokie wyniki. Sprawdź się i rozwiń swoje umiejętności. Pracuj z najlepszymi, pokonuj wyzwania i odkrywaj nowe sposoby osiągania sukcesu.

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