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MANAGEMENT OF INVESTMENT PROJECTS – APPRAISAL METHODS

Almost every decision in the corporate finance is an investment decision. Thorough analysis is crucial as investment projects are of major and growing importance to the company success [2].

In the literature of the subject there is some evidence quoted based on the results of the research carried out that higher performance of the investment project is associated with the application of the rational and adequate financial appraisal process [16].

An universal and comprehensive investment project appraisal method should take into account as many assessment criteria as possible. The selection of the investment project to be executed is done on the basis of the comparative analysis of the alternative, available, investment opportunities in line with company objectives with the consideration of existing limitations in each case. The set of criteria is individualised in each case and depends on the company priorities and environmental constraints. Importance attached to various criteria, expressed by weightings in the models, differs in different circumstances. The choice of the appropriate investment project appraisal method depends on the case considered. The best method in each case is the one which assumes the same weightings of selected criteria as the importance of the factors expressed by the investor is. Not every investment project analysis requires full appraisal up front. The initial review of the projects, to eliminate unfeasible ones, (due to legal unavailability or exceeding investment outlays limits or not meeting key criterion e.g. two-year payback period) can be done with simpler methods based on the selected crucial criterion. However this approach does not provide the final answer for the investment process. It is only clear which projects to reject, as not welcome, but still it is not evident which to implement. A responsible selection of the investment project for execution requires comprehensive financial justification of the attractiveness of the project for the company (or to be precise for the shareholders) as the best of all possible actions to be taken (including also refraining from investments) facilitating the creation of shareholder value.

First, the objective should be established (or the

problem to which the solution should be sought). Next, all scenarios of the prospect solutions should be gathered with all reservations pointed out. Then comparative analysis is performed.

The most important **assessment criteria** are following:

- feasibility (e.g. legal, technical, capital availability);
- efficiency (measured with adopted company internal performance assessment measures);
- time horizon of the execution and lifetime of the investment project;
- comprehensiveness, reliability and invariability of assumptions;
- correctness of calculations of cash flow from operations (*CF*);
- sensitivity of the investment project to the fluctuations of the economic variables,
- level and type of the discount rate applied (fixed or variable);
- comparative ability of the projects;
- tax considerations;
- risk assessment of the projects.

Source: based on: R.A. Brealey, S.C. Myers, *Podstawy finansów przedsiębiorstw*, T.1–2, PWN, Warszawa 1999, J.G. Siegel, J.K. Shim, S.W. Hartman, *Przewodnik po finansach*, PWN, Warszawa 1995, H. Johnson, *Ocena projektów inwestycyjnych. Maksymalizacja wartości przedsiębiorstwa*, LIBER, Warszawa 2000, K. Milis, R. Mercken, *The use of the balanced scorecard for the evaluation of Information and Communication Technology projects*, „International Journal of Project Management” Feb 2004, Vol. 22 Issue 2.

Based on the criterion of **the time value of money** there can be distinguished two groups of methods of investment project appraisal:

- 1) static methods (simple) – ignoring this issue;
- 2) dynamic methods (discounting) – correcting values by discount factor.

The second breakdown of investment project appraisal methods results from the difference in initial data input: **accounting net profit** taken or **cash flow**

Table 1. Comparison of selected traditional investment project appraisal methods.

| | | METHODS | | | |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--|
| FEATURES | NET PRESENT VALUE | INTERNAL RATE OF RETURN | PAYBACK PERIOD | AVERAGE ACCOUNTING RATE OF RETURN | |
| code | NPV | IRR | PP | ARBV or ROI | |
| formula | $NPV = \sum_{t=1}^n \frac{CF_t}{(1+r)^t} + \frac{RV}{(1+r)^n} - \sum I$ | IRR = r when $NPV = 0$ | $PP = \frac{\sum I}{P_{Av.a.} \text{ or } CF_{Av.a.}}$ <p>there could be also discounted payback period (DPP) when discounted CF is used for calculations</p> | $ARBV = \frac{P_{Av.a.} \text{ or } CF_{Av.a.}}{\sum I \text{ or } ABV}$ | |
| result | nominal value (in adopted currency) | percentage rate (%) | period (number of years) | percentage rate (%) | |
| definition | discounted net cash surplus from all future cash flows from operations and discounted residual value to initial investment outlays (created shareholder value) | discount rate which makes NPV equal zero (it is the cut-off point to compare with the minimal r required) | number of years to recover the investment outlays | average return (measured by net profit or CF) offered by the project | |
| economic meaning | clear and very important | often wrong | clear and in some cases very important | clear but only accounting approach | |
| interpretation | quite difficult | Difficult | easy | easy | |
| calculation | requiring a lot of effort | troublesome (iteration method) | easy | very easy | |
| consideration of the time value of money (time correlation) | Yes, (dynamic method) | yes, (dynamic method) | in basic formula no, (static method), but in discounted yes (dynamic method) | no, (static method) | |
| application of the discount rate | fixed or variable | only fixed | in basic formula no, but in DPP fixed or variable | no | |
| consideration of risk | Yes | yes, but only constant | mainly time, only in DPP more | no | |
| based on CF or accounting net profit (P) | CF | CF | P or CF | P or CF | |

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| | | | | | |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| reliability of the result (correctness of the appraisal) | Yes | | in some cases wrong or misleading | fragmentary | misleading |
| completeness (the entire lifetime of the project) | Yes | | Yes | no, (ignores further years of the project after PP) | no, (no influence of the lifetime of the project and number of recurrence of P or CF) |
| universality | Yes | | Yes | no (only for cases sensitive to time variable) | no, (only for similar projects) |
| feasibility of summing up the projects | Yes | | No | No | no |
| comparative ability of the projects | yes, but in case of projects with different level of I possible only with application of profitability index -PI | $PI = \frac{NPV}{\sum I}$ | only in some cases, inadequate for projects with different lifespan | only one factor considered - time horizon | only for projects in the same sector and similar in terms of execution considerations (such as I, the lifetime, the schedule of CF) |
| the cut-off point | | 0 | IRR > r | the required period | the average for the sector |
| recommendation | project ensures recovery of investment outlays, return on the capital at the required rate of the return (i) and even an extra premium when NPV > 0 the best method comprehensive, universal and correct | | good but in many limitations, appropriate only for preliminary review | only one criterion entered, useful when time is the major consideration for decision taking (a supportive measure) | the worst method, only for crude assessment and very specific cases |

Source: based on R.A. Brealey, S.C. Myers, *Podstawy finansów przedsiębiorstw*, T.1-2, PWN, Warszawa 1999, J.G. Siegel, J.K. Shim, S.W. Hartman, *Przewodnik po finansach*, PWN, Warszawa 1995, H. Johnson, *Obecna projekty w inwestycyjnych*, *Makymolozija wartosci przedsiębiorstwa*, LIBER, Warszawa 2000, K. Mills, R. Meeklen, *The use of the balanced scorecard for the evaluation of Information and Communication Technology projects*, „International Journal of Project Management” Feb 2004, Vol. 22 Issue 2.

Symbols: I – initial investment outlays (to simplify – occurring in period “0”),
n – number of years of the lifetime of the project
ABV – average book value after depreciation
CF – cash flow from operations
r – required discount rate
RV – residual value
P – accounting net profit
Av.a. – yearly average

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from operation taken.

In each method there should also be a lot of problems considered:

- correlation of subjects;
- currency comparability;
- reinvestment opportunities at the required interest rate for cash generated by the project during the lifetime of the project.

The approach to the investment project appraisal in the company depends on the environment and perception of the problem on the local capital market, but is not related significantly to the subject of investment project or sector of company operations. There is growing importance of the investments and the full comprehensive investment project appraisal method in the market economy with the dominance of the private ownership. It's confirmed by a comparative study of the issue of investment project appraisal methods applied in respect of Advanced Manufacturing Technology – *ATM*, carried out on the group of 143 largest British manufacturing corporations (*UK*) in 1992, 117 medium/large American companies (*US*) in 1994 and 74 Czech manufacturing companies (*CR*) in 1998 [16].

It is clear from the research that companies use more than one investment project appraisal method, most often two or three, no matter what the country of the company origin is. There is some preference observed with tendency to apply *PP* or *DPP* as the most often used method and also as the method ranked first by importance. Preferences in the choice between the two most universal traditional dynamic methods: *NPV* and *IRR* are split. Only in case of Czech companies *NPV* is significantly more important than *IRR* when both number of applications used and number 1 ranking are considered. Within the samples of British and American companies the situation is just opposite. The Czech companies preference for *NPV* over *IRR* is very unique and it is one of a very rare surveys showing such a choice by relative importance between these two methods, favouring *NPV* for investment project appraisal.

The research confirms also that deep understanding of these two methods is very important. Not always do traditional investment project appraisal methods such as: *PP*, *NPV* or *IRR* favour short-term projects. The distorted short-termism can be eliminated by increasing the required payback period

Table 2. Number, type and importance of different appraisal methods used by companies under research (*UK*, *US* and *CR*) for the selection of investment project in the Advanced Manufacturing Technology – *ATM*.

| | UK (%) | US (%) | CR (%) |
|----------------------------|------------------------------------------------------------|-------------|-------------|
| Number of methods | percentage share in each national sample separately | | |
| 1 | 17,5 | 23,1 | 23,0 |
| 2 | 29,4 | 34,2 | 32,4 |
| 3 | 32,8 | 34,2 | 20,3 |
| 4 or more | 20,3 | 8,5 | 24,3 |
| Methods used | | | |
| <i>NPV</i> | 52,4 | 41,0 | 45,9 |
| <i>IRR</i> | 55,2 | 56,4 | 31,1 |
| <i>DPP</i> | 53,8 | 65,0 | 71,6 |
| <i>other DCF</i> | 4,6 | 3,4 | 5,4 |
| <i>PP</i> | 68,5 | 39,3 | 63,5 |
| <i>ARBV</i> | 20,3 | 18,8 | 35,1 |
| <i>other non-DCF</i> | 4,9 | 5,1 | 1,4 |
| Method ranked first | | | |
| <i>NPV</i> | 20,3 | 13,7 | 28,4 |
| <i>IRR</i> | 28,0 | 28,2 | 5,4 |
| <i>DPP</i> | 28,0 | 33,3 | 51,4 |
| <i>other DCF</i> | 3,4 | 2,7 | 1,8 |
| <i>PP</i> | 38,5 | 26,5 | 35,3 |
| <i>ARBV</i> | 11,2 | 3,4 | 13,5 |
| <i>other non-DCF</i> | 3,5 | 4,3 | 0,0 |

Source: F. Lefley, F. Wharton, L. Hájek, J. Hynek, V. Janecek, *Manufacturing investments in the Czech Republic: An international comparison*, "International Journal of Production Economics" Mar 2004, Vol. 898 Issue 1.

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or by reducing the discount rate.

Risk assessment is the second important issue in the investment project appraisal. There are some differences perceived between the samples analysed in this respect, too.

methods than Czech companies, in particular sensitivity analysis is very popular. The previous studies also showed the dominance of sensitivity analysis on the developed markets. The outcome of this survey results from the risk averse approach of

Table 3. Risk assessment and methods used by companies under research (UK, US and CR) for the selection of investment project in the Advanced Manufacturing Technology –ATM.

| | UK (%) | US (%) | CR (%) |
|-----------------------------------------------|-----------------------------------------------------|-------------|-------------|
| | percentage share in each national sample separately | | |
| Percentage of companies assessing risk | 88,9 | 81,8 | 83,5 |
| Number of methods | | | |
| 0 | 11,1 | 18,2 | 16,5 |
| 1 | 36,1 | 43,0 | 65,8 |
| 2 | 42,1 | 24,8 | 15,2 |
| 3 or more | 10,4 | 14,0 | 2,5 |
| Treatment of risk | | | |
| separate issue | 44,0 | 39,1 | 61,1 |
| adjustment of <i>IRR</i> | 22,7 | 28,7 | 16,7 |
| adjustment of discount rate | 17,7 | 18,4 | 20,8 |
| required payback period | 33,3 | 24,1 | 38,1 |
| certainty equivalent (<i>CE</i>) | 0,7 | 3,4 | 1,4 |
| <i>CAPM</i> | 2,8 | 0,0 | 0,0 |
| Methods used | | | |
| <i>PP risk</i> | 80,5 | 80,8 | 92,4 |
| sensitivity analysis | 63,3 | 43,4 | 12,1 |
| simulation | 11,7 | 18,2 | 7,6 |
| probability | 14,8 | 19,2 | 10,6 |
| other | 2,3 | 6,1 | 1,5 |

Source: F. Lefley, F. Wharton, L. Hójek, J. Hynek, V. Janecek, *Manufacturing investments in the Czech Republic: An international comparison*, "International Journal of Production Economics" Mar 2004, Vol. 898 Issue 1.

The evident differences refer to treatment of risk, number and complexity of risk assessment methods used. In contrast to the developed markets, such as *UK* and *US*, Czech companies apply less risk assessment methods – usually just only one. Most often risk is treated as separate issue but this approach is extreme in respect to Czech companies- about 61,1% of cases in the sample under research. They mainly rely on the assessment of risk incorporated within *PP*. On the other hand British and American companies use more sophisticated risk assessment

Czech companies and therefore the preference for short-term projects. Although other studies also confirm the popularity of *PP* on other developed markets e.g. Japan, but there is a major difference – longer payback period is accepted as it is in case of *UK* and *US*, as well. The specific situation of the Czech companies is attributed to higher long-term risk of economy going through a period of transition, to rationing of capital resources and to short-term effect orientation. Short-termism can also result from high management mobility and self interest [16].

Table 4. Comparison of different methods used for investment project appraisal by corporations under research done by different authors and in different periods and on different markets (UK, US and Australia, New Zealand – NZ) for all types of capital investments and only for investments in Information and Communication Technology projects –ICT.

| projects | ALL | | ICT | |
|---------------------|-----------------------------------------------------|-----------|-----------|------------------|
| | 1989 | 1979 | 1998 | 1990 |
| year | | | | |
| market | UK | US | UK | Australia and NZ |
| Methods used | percentage share in each national sample separately | | | |
| <i>NPV</i> | 48 | 29 | 27 | 49 |
| <i>IRR</i> | 58 | 37 | 28 | 54 |
| <i>PP</i> | 78 | 17 | 60 | 61 |
| <i>ARBV/ROI</i> | 31 | 29 | 43 | 18 |

Source: K. Milis, R. Mercken, *The use of the balanced scorecard for the evaluation of Information and Communication Technology projects*, "International Journal of Project Management" Feb 2004, Vol. 22 Issue 2.

No matter what the subject of investment project is, there are preferences for particular investment project appraisal methods noticed, correlated with the market of company operations. In case of the outdated study results (difficult to compare directly) of American companies still the importance of *IRR* is maintained. *PP* can be assumed to have replaced the worse appraisal method – *ARBV*. With reference to British companies both in case of all investments and in investments in *ICT*, and earlier mentioned investments in *ATM* as well, there is a preference for *PP*, and *IRR* is the second most often applied method. Australian and New Zealand market in respect of investment project appraisal methods used show major similarities to *UK* market (based on traditions) and significant likeness to *US* market (as that is a group of developed countries) but clearly differs from above mentioned preferences on Czech market.

Next study performed in 2002 on the sample of 10 large corporations (5 British and 5 Dutch) representing 7 different sectors also confirmed dominance of traditional appraisal methods used with no distinctive differences showed with reference to the subject of the investment project. 60% of the respondents admitted that non-Discounted Cash Flow (*non-DCF*) methods are most frequently used by them, but mixed with other methods such as *EVA* or accounting ratio analysis. *DCF* methods were rated second in terms of frequency of application. *NPV* was acknowledged to be used only by two entities interviewed. *ARBV* is not used any more in the sample questioned. Problem of risk is recognized but the approach is simplified, only half of the companies add assessed risk either to the discount rate or to the investment outlays [20].

In case of investment projects in *R&D* or *ITC* practice again appears to be different from theoretical background. Neither are recommended traditional *DFC* methods used by selected corporations nor option models. No predetermined standardized qualitative or quantitative appraisal methods are used. Investment decisions in studied corporations are based either on the “must be done approach” or “open approach” at the level of top management [20].

Although empirical differences in the approach to the investment project appraisal between sectors are insignificant there are again significant discrepancies in preferences between the markets. Financial services sector and chemical sector are most willing to use new solutions based on value management and adjusted *DCF*. In opposite traditional accounting approach is found typical for retail companies. British corporations tend to combine *DCF* methods with *EVA* whereas Dutch ones mix value-

based measures with market-related ratios [20].

It is worthwhile to analyse **the correlation between the performance of the company and used investment project appraisal method**. High performing companies were the ones which:

- used market-related measures not traditional accounting-based measures;
- frequently monitored progress of the project during execution based on cost, schedule and time – *CST*, but not only against financial ratios;
- combined value-based management techniques with adjusted *DCF* methods, rather than standard *DCF* methods with accounting measures;
- used quantitative risk assessment, not only qualitative approach [20].

It is astonishing from theoretical viewpoint that *NPV* is still relatively less popular than other commonly used methods such as *PP*, sensitivity analysis or scenario analysis, which are acknowledged to be worse, and even conceptually wrong [2,6]. There are two serious key arguments supporting the adoption of *NPV*:

- maximizing *NPV* means maximising shareholder wealth at the same time;
- *CAPM* model and option models created conditions for risk assessment.

Combination of these issues should accelerate, slow so far, adoption process of adjusted *NPV* as an investment project appraisal method. In a series of questionnaire studies conducted on the British market done by various researchers following observations were made:

- the adoption rate of *NPV* increased from 32% up to 74% within the period of 1975–1999 (in the sample of 100);
- in 2000 97% out of large, and only 62% out of small companies used *NPV* (in the sample of 96);
- in 1975 66% of companies applied only 1 or 2 investment project appraisal methods (out of 100 analysed), but in 2000 already 76% of large companies used 3 or more methods (in the sample of 96);
- the application rate of *PP* increased within the period of 1975–1992 to the level of 94% in the sample of 100 companies, but the adoption rate among the sample of 96 large companies was much lower ranging only up to 66% in 2000;
- in all samples (100 companies in 1992 and 96 large companies in 2000) there was high adoption rate of scenario analysis – 88% and 89% respectively;
- still in 1998 the study on the sample of 99 large British manufacturing companies revealed that *PP* was considered marginally more important than *NPV* [2].

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- for comparison, the survey done in 1998 on the sample of 71 motor component manufacturers representing four countries (*UK, US, Germany and Japan*) confirmed the existing differences: popularity of *NPV* was increasing on the British and American market, whereas on other markets this trend was not observed at all (table 5).

and 79% small did not prepare plans in outline more than four years ahead (sample of 96 British companies in 2000);

- additional negative result of this approach to risk observed was an excessive (from the point of view of theory) increase of the discount rate entered into the models reflecting enormous risk premiums

Table 5: Application of NPV as method of investment project appraisal.

| market | use of NPV | NPV rated as number one method |
|----------------|------------|--------------------------------|
| UK | 54% | 12% |
| US | 100% | 50% |
| Germany | 28% | 16% |
| Japan | 18% | 0% |

Source: R. Baker, R. Fox, *Capital investment appraisal: a new risk premium model*, "International Transactions in Operational Research" Mar 2003, Vol. 10 Issue 2.

Surprisingly low was the preciseness of the observed approach to the risk assessment in the companies:

- the adoption rate of *CAPM* was very low: 5% in 2000 in the sample of 96 large companies, and 20% in the 1992 in the sample of 100 companies (*UK*);

- the most popular risk assessment methods used (in the sample of 96 British companies in 2000) were:

- o probability analysis – 42%,
- o subjective assessment – 55%,
- o raising the required rate of return – 50%,
- o *PP* and sensitivity analysis – 66%,
- o scenario analysis – 89%;

- this approach to risk brought serious consequences – 36% large companies, 83% medium

expected. 34% of 96 studied British companies in 2000 demanded the discount rate over 16%, that is a risk premium over 10%. Similar results were achieved in 1998 on the sample of 71 motor component manufacturers representing four countries (*UK, US, Germany and Japan*). The survey showed the following required rates of return: 25% for *UK*, 20% for *US*, 22% for *Germany* and 11% for *Japan* [2].

It is surprising that against all theoretical considerations mentioned neither sector not subject of investment project has practical impact on the selection of the appraisal method.

The empirical evidence would suggest that all analysed methods are universal, but it is not true as it was pointed out. Further study results show significant

Table 6. The Characteristics of investment projects in selected sectors.

| Features of projects | pharmaceutical | forest | engineering | knowledge-intensive | standard services | professional services |
|----------------------------------------|--------------------------|------------------------------|----------------------------------------|---------------------------|-------------------|-----------------------|
| the scale of projects | very big | big and cyclical | small and big | medium and big | small | big |
| the main subject of investment | 20% <i>R&D</i> | 10% equipment | <i>R&D</i> , production, equipment | <i>R&D</i> , training | | 10% training |
| other areas of investments | production and marketing | <i>R&D</i> and marketing | marketing | | | |
| the time horizon | long | long | medium | medium | short | short |
| the measurability of key elements | medium | high | high | medium | medium | short |
| the visibility of strategic investment | high | high | medium | low | medium | low |
| the need to coordinate investments | low | low | medium | high | medium | high |

Source: E. Segelod, *Resource allocation in a few industries: Determinants and trends*, "International Journal of Production Economics" 77/2002.

differentiation of investment projects process and investment projects themselves in relation to various sectors (table 6). The characteristics of investment projects in different sectors is not the same. The key differences are seen in terms of value of investment outlays and they structure, as well, and other features considered as vital. The conclusions from the research made on the sample of 130 large Swedish companies within the period of 1990–1990 are presented in the table 6.

It can be suspected that the choice of the investment appraisal method is the result of long-term routine or it is the consequence of lack of full understanding of described methods. It may be the effect of convenience but the fact is that users not always are aware of the drawbacks of methods applied. Unfortunately it leads to adoption of the simplest methods, not the best ones. Additionally there is a barrier to individualise appraisal methods as to incorporate specifics and method individual features for a particular investment project. The empirical solution found was to use several different methods to eliminated doubts but it's not always right as the set of methods should be wisely matched and the application should be correct. Practice seems to be looking for shortcuts which on the other hand prove to be more costly in their consequences than rational recommendation provided.

Mainly **traditional methods** of investment project appraisal (mentioned in table 1) are used. They are based on accounting principles [13]. The main concept is the comparison of costs and benefits of the investment project. They are commonly used because they are well-known, well-understood and based on widely accepted financial rules and propositions [21].

However traditional methods have many drawbacks enabling proper assessment of feasibility, justification of execution and control of implementation of investments. It constitutes a real problem as it concerns the investment process – one of the most important in modern corporate finance [21]. There are following **concerns related to traditional methods** of investment project appraisal:

- Traditional methods not always give correct answer because intangible – non-quantifiable benefits or hidden costs are ignored.

- Theoretically speaking, although practically not confirmed, traditional methods are not suitable for soft project e.g. *ATM, R&D, ITC*. Quality-based character of these projects and high uncertainty of environment of their execution question the rationale of traditional methods application in their case, although practically they are still assessed this way [20]. Different traditional methods have different

drawbacks, therefore adoption of several methods can serve the elimination of some deficiencies. However still the reliability of the result remains doubtful and can lead to wrong investment conclusions and sub-optimal investment decisions.

- There are still many concerns about the correctness of application of traditional methods. Accurate assessment of costs and investment layouts in uncertainty and technical novelty of the project can be impossible [8]. On the basis of the research on the companies implementing investment projects in Information and Communication Technology – *ICT* following findings were stated:

- o only 18% of companies applied rigorous appraisal methods;

- o costs were significantly underestimated, on average by 40%;

- o 65% of respondents were aware of costs misjudgement;

- o 22% of investment outlays were wasted;

- o on average between 34% and 40% of projects realized no net benefits, however measured [21].

It should be noted, however, that presented results were based on the very specific type of the projects – project in *ICT*, so *IT productivity paradox* could have been observed. It means that *IT* projects fail to deliver in practice the benefits they promise in theory. This hypothesis was confirmed by the fall of productivity in manufacturing sector and services sector while substantially increased investment outlays were effected on *IT* investments. The scale of underassessment in other sectors could be expected to be lower than alarming level observed in case of *IT* projects analysed. Anyway, it should be remembered that these, troublesome to evaluate, *IT* projects are of a great importance for the companies. They are the main catalyst for change and the increasing levels of *IT* expenditure should coincide with the adequate justification of such investments [13].

- Practically it appears evident that traditional methods favour short-term projects and discriminate long-term investment projects.

- Managers appear to become too absorbed with financial appraisal, to the extent that practical strategic considerations are easily overlooked [13].

- Traditional methods now always correctly encompass objectives of all parties involved. Usually the only objective considered is the one of management – and that is the reason of the short-term view criticized. Moreover the most commonly totally neglected objective is the one of the users of the project. It inevitably has negative impact on the inherent utility of the project, and therefore the basic argument for its execution.

- Traditional methods are conservative by nature and this feature adversely affects their ability of risk assessment. Quite often risk is misjudged and based only on emotional approach. Only in 7% of companies in the study adjusted the discount rate in function of potential risk of the project under consideration [16, 21].

Reservations made about traditional investment project appraisal methods are not only based on the **drawbacks** noted. There are many **other issues attracting strong criticism e.g. under-development of methods adopted, lack of structuralized approach, under-management of the investment process**. Increasing complexity, uncertainty and difficulty of costs/benefits assessment of the projects require improvement of the investment project appraisal process. It should help eliminate the following inappropriate strategies practiced by companies in this respect:

- rejecting projects that could be beneficial only in long-run;
- investing in the projects as an “act of faith”;
- using creative accounting as a means of passing the budgetary process [13].

New non-traditional methods are still in the conceptual phase, but it's worthwhile to consider their merits and approach to the problem [21].

There can be three groups distinguished within new non-traditional methods: adjusted traditional methods, new evaluation techniques and mixed methods [21].

Adjusted traditional methods are based on the same principles as traditional methods, but there are some elements introduced to eliminate drawbacks criticised most. The adjustments are following:

- estimates of intangible benefits (e.g. minimum and maximum values);
- probability function estimation;
- sensitivity analysis [5];
- three-step approach.

The interpretation is not straightforward and can pose a problem.

New evaluation techniques are based on the strategic approach, but the framework does not give explicit attention to financial analysis. There can be following models used:

- **strategic fit** proposed by Ported, supported by value chain analysis;
- **point-rating scores** as a consensus of subjective opinions on the costs/benefits assessment of the project designed for example by Parker and Benson and called Information Economics or Oracle's CB-90 model;
- **option models** (e.g. Cox-Rubinstein equation) giving scenarios valuations and costs/benefits

assessment as the result of treatment of a project as a bet. They are not very popular as they are complicated, require a lot of additional data gathering and calculations [20,21];

- **expert systems** are based on the IF-THEN-ELSE analysis. They cannot capture erroneous, inconsistent or incomplete knowledge. As the situation is usually such the prognosis is very hard to make [20].

New evaluation techniques not only lack financial rigour but face applicability barriers. The quality of outcome highly depends on the quality of input that is often questioned. Moreover they are difficult to understand. That are the main reason of their low utility and a quest for mixed methods is under way.

Mixed methods are aimed at elimination of drawbacks of all methods by combining them, the way it gives the required selection of strengths to assess investment projects. The most interesting recommended mixed methods include:

- **multi-layer evaluation process** as a combination of strategic fit, adjusted *NPV* (with probability assessment) and risk analysis;

- **Balanced Scorecard** developed by Kaplan and Norton, giving integrated look at the company with measured items. Traditional appraisal method is covered by financial perspective, whereas other angles are aligned to the company strategy within other three approaches. Thus the strategic fit concept is stimulated [21];

- **Monte Carlo simulation** as the supplement to complete measurable model based on *DCF* (for example used by British upstream oil and gas industry). It replaces deterministic estimates (educated guesses) with probability distributions, which is much more reliable than historical data, especially in case of natural resources exploration. This way of modelling is in fact better suited to provide secure basis for future values of variables such as many uncontrollable and endogenous economic data e.g.: interest rates, exchange rates, commodity prices. Monte Carlo simulation enhances the quality of outcome by integration of different types of knowledge held by different professional backgrounds, thus developing the model of an underlying reality and even coping with inevitable gaps in information [10].

- **Fuzzy Cognitive Mapping – FCM** is used for modelling the system with inter-relationships between key dimensions: strategic, tactical, operational and financial, including thus the influence of all factors on the project. Fuzzy logic dictates that everything is a matter of degree, so the structure of the system can deal with many notions and fragmented information. Concepts and consequently

statements overlap and merge with one another giving finally a full casual picture. FCM ties facts with things and processes to values and policies to objectives. Problems can be simplified and abstracted without affecting the reliability of the final outcome. Strategic game plan is supported with tactical project critical success factors (CSFs). FCM is a dynamic system model which thrives on feedback from each concept enriching the result. FCM is essentially an artificial neural system – ANS which seems to mimic how the human brain associates and deals with different inputs [13].

The arguments presented advocate for development of mixed investment project appraisal methods as the most appropriate now adays. There is a great variety of assessment methods available, but they do not adequately accommodate important changes of the business environment, and especially the key objective of the shareholder wealth creation is often missed, although it is emerging as the number one priority [20].

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