Advances in Management & Applied Economics, vol.2, no.3, 2012, 133-162
ISSN: 1792-7544 (print version), 1792-7552 (online)
Scienpress Ltd, 2012

Identification of trend patterns related to the dynamics of competitive intelligence budgets (the case of Romanian software industry)

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Abstract

Our paper examines the challenging task of analysing the dynamics of Competitive Intelligence (CI) budgets within the Romanian software companies. The paper doesn't seek to find the optimal pattern of allocating CI budgets from the business turnover, as every organization involved in software development has different goals and requirements for CI measurement. The aim is to transpose the CI budgets dynamics in different types of trends (linear, quadratic and exponential) using the coefficient of variation method and to analyse the Romanian managers decision making processes related to CI budgets allocation, by taking into account the peculiarities of four software companies clusters: start-ups, expert-coders, utility-developers and stars.

JEL classification numbers: M15, C40
Keywords: competitive intelligence, software industry, cluster, trend patterns, coefficient of variation

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Article Info: *Received* : May 23, 2012. *Revised* : June 19, 2012
Published online : August 31, 2012

1 Introduction

Heterogeneity is a key factor in why carrying out competitive intelligence projects in Central and Eastern Europe (CEE) can become time-consuming and expensive. Few studies on competitive intelligence (CI) were undertaken in Central and Eastern Europe and this is a strong argument for the development of our survey.

A trend pattern that incorporates the CI budgets of software companies has a number of key advantages. It provides an empirically testable basis to assess the temporal evolution of relationships between the CI budgets and the turnover allocation process. The use of an adequate statistical tool (coefficient of variation) allows the determination of data homogeneity degree in the convenience sample. As well, an emphasis of the CI budgets allocated by the Romanian software companies provides a useful knowledgebase for the decision makers from software industry.

The paper is then organized as follows: in section two, dedicated to literature review, we highlighted the evolution of the CI concept and analyzed the budgets allocated for CI activities; section three is a description of our research method and instrumentation; in section four we provide the analysis and interpretation of the collected data referring to the CI budgets allocated within Romanian software industry; in section five, we presented the conclusions, the limitations of our study and its managerial implications.

2 Literature review

Jan Herring, one of the pillars of the CI field, defined intelligence as analyzed information that is made actionable [1]. This definition has been widely adopted by competitive intelligence practitioners and scholars alike [2], [3].

The key points of CI definition refers to the process of gathering, collection, and analysis of raw data as input to the CI process, including only legal and ethical activities, the purpose being represented by the support for better decision-making and better achievement of the company’s objectives [4].

Miller expands the meaning of this definition, considering that CI enables managers in companies of all sizes to make decisions about everything from marketing, R&D, and investing tactics to long term business strategies [5]. Fleisher, Wright and Tindale, note that “the field of CI and its management suffers from a variety of semantic and domain ambiguities that remain unresolved after several decades of research work” [6]

The advantages of competitive intelligence are focused on the identification of relevant information, the audit process of a company’s scientific and technical assets which allow the comparison with its competitors, the detection of market threats and opportunities and the design of winning strategies in unknown areas [7].

While most large firms in developed countries have implemented CI mechanisms, CI in small firms is practiced in an ad hoc way. In developing and transition economies CI processes are similar to those in developed countries but at lower levels of sophistication with the one exception of human intelligence networks [8].

Hughes thinks that the firm-specific and tacit knowledge of the competitive intelligence personnel can positively impact the strategy development process by ensuring that the collected intelligence gets to the decision-makers and becomes integrated into all phases of the strategic management process [9]. Casselman and Samson developed a new concept related to competitive intelligence exploitation - “Competitive Knowledge Process Capability”, which refers to effective knowledge processes related to capturing competitive knowledge and inhibiting competitor appropriation of your knowledge [10].

Competitive intelligence (CI) is also regarded as a system of environmental scanning which integrates the knowledge of everyone in the company [11]. Brody considers that CI is a process set in situations that are dynamic and in which the players are moving forward in a constantly changing business environment, the variety of definitions may be a reflection of that process of constant change [12]. According to Krummenast [13], the concept “competitive intelligence” can be often found within large companies but rarely in SME’s. In addition, many companies avoid the term competitive intelligence altogether, When they develop an intelligence function, the call it market research or business intelligence.

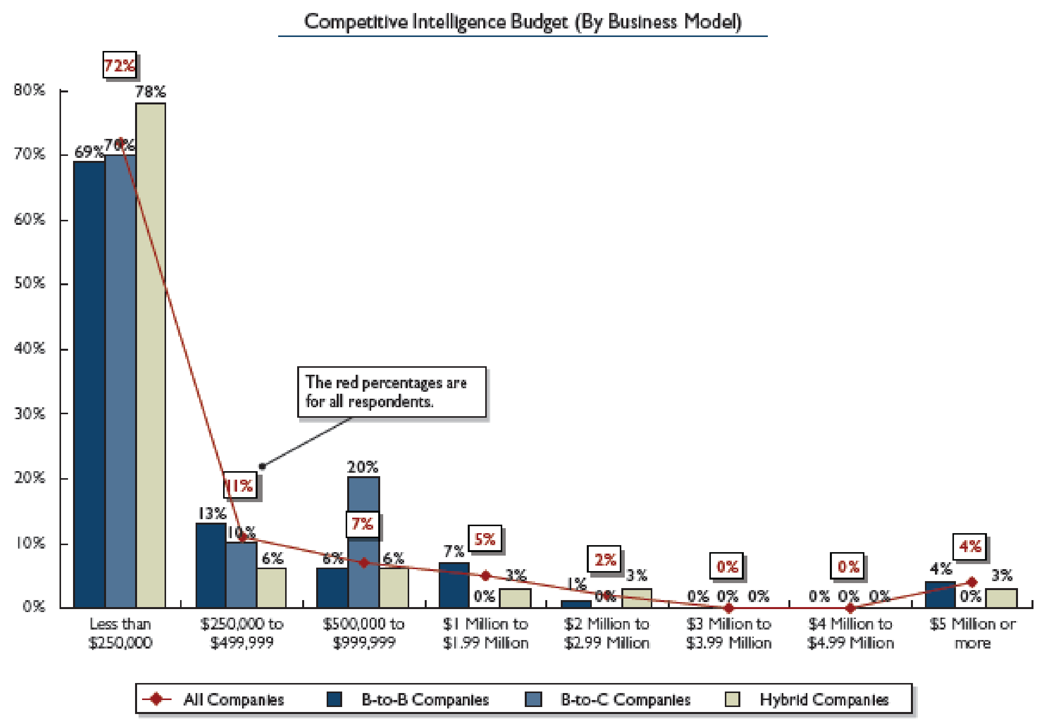
Many companies found it difficult to move their competitive intelligence function forwards during the global economic crisis. Fortunately, budget purse strings have started to loosen over the last few years as the global economy continues on its gradual road to recovery [14].

Competitive intelligence is often a relatively small function with limited budget and resources, but it receives additional support from other parts of the organization. Making the best use of these additional resources is a challenge for many competitive intelligence professionals [15]. A CI survey developed in India reveals the fact that the firms that had higher CI budgets, more dedicated staff, and request CI more frequently had a higher perceived benefit of CI than others [16].

There are a number of reasons for small CI budgets: a lack of commitment to the CI process - perhaps because the existing process has not showed its value; CI is viewed as an overhead and is perceived as a non-frontline activity; top management have the false perception that they already collect all significant intelligence due to their industry contacts and network [17].

Software for state-of-the-art business, designed to meet the business decision requirements aim at combining all distinct types of applications developed to automate the information system activities (Transaction Processing Systems, Management Information Systems, Decision Support Systems, Expert Systems) into an integrated one, where information is shared and the communication between departments is open [18].

To understand the most pressing external and internal challenges shaping market research and competitive intelligence executives' planning, a web-based survey developed by the consulting company Frost & Sullivan in cooperation with SCIP (Strategic and Competitive Intelligence Professionals) reveals the following competitive intelligence budgets allocated by the sample of 206 companies from North America, Latin America, and Europe (Figure 1).



Source: Growth Team Membership research, http://www.frost.com

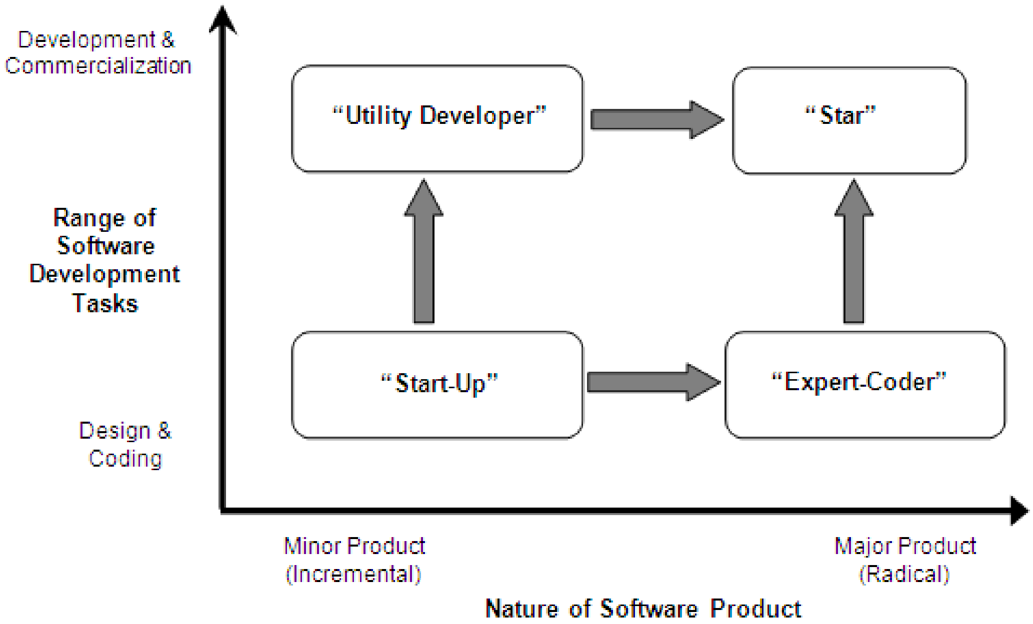
Figure 1: Competitive Intelligence budgets by business models in 2011

The results of a research developed within software industry reveal that there is a need for the adoption and growth of the competitive intelligence discipline in software development as such organizations appear not to have a structured and coordinated program for the collection and analysis of information about competitors [19].

3 Research methodology

Our research methodology involves the identification of trend patterns related to the dynamics of competitive intelligence budgets as effects of the turnover allocation, in the case of a representative sample of Romanian software companies, clustered in four categories (start-ups, utility-developers, expert-coders and stars), according to their strategic position on the market.

The main criterion used in the sampling process of the research was the framework developed by Nambisan (Figure 2).



Source: Nambisan [20]

Figure 2: Methodology used in the clustering process of the software companies

In order to determine the sample of our research, we took into account both the four clusters of software companies corresponding to Nambisan framework and other relevant criteria as firm size, type of firm and type of ownership (Table 1).

The sample of the Romanian IT firms was selected according to their managers' availability to answer to our questionnaires. We presented the research goal to the managers of 100 software companies and we finally selected 58 companies as the research sample, whose managers accepted to provide us the budgets allocated to competitive intelligence activities.

In view to achieve our research goal, we conducted a series of discussion sessions with a convenience sample of 58 managers from the Romanian software companies in order to assess their decisions regarding the allocation of CI budgets. We were particularly interested in developing the trend patterns related to the dynamics of CI budgets as effects of the turnover allocation and understanding the issues related to their business philosophy regarding the use of competitive intelligence mechanisms.

In this way, we formulated three research hypotheses:
Null hypothesis - the existence of a trend pattern for the monthly CI budgets, allocated from the turnover of the software companies, as a linear function.
First alternative hypothesis - the existence of a trend pattern for the monthly CI budgets, allocated from the turnover of the software companies, as a quadratic function.
Second alternative hypothesis - the existence of a trend pattern for the monthly CI budgets, allocated from the turnover of the software companies, as an exponential function.

Table 1: Distribution of the software companies included in the research sample

Firm size	Percentage
<10 employees	29%
10-50 employees	50%
>50 employees	21%

Type of firm	Percentage
Individual ownership	31%
Corporation	28%
Branch for international firm	41%

Cluster	Percentage
Start-ups	64%
Utility-developers	21%
Expert-coders	11%
Stars	4%

Type of ownership	Percentage
Romanian capital	40%
Foreign capital	33%
Joint capital	27%

4 Data analysis and major findings

The Romanian software industry is characterized by a large number of start-ups, which are primarily involved in the design and coding of minor software packages and are looking for collaborative projects in order to develop their business activities; the utility-developers are mainly focused on how to market their own software products, while expert-coders are involved in the design and coding of major software products on contract basis; the number of stars is quite limited, these companies having the expertise in developing and marketing innovative software products. The gradual shift from custom development towards standard packages in different sectors will be a growth driver for the Romanian software market. On the other hand, the rising competition will result in more refined and specific applications for better quality, faster delivery and optimized processes.

Table 2: The evolution of the monthly CI budgets of the software companies included in our convenience sample, in the period 2010 - 2011

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*START-UPS*) (*EURO*)	AVERAGE MONTHLY "CI" BUDGET (*UTILITY DEVELOPERS*) (*EURO*)	AVERAGE MONTHLY "CI" BUDGET (*EXPERT CODERS*) (*EURO*)	AVERAGE MONTHLY "CI" BUDGET (*STARS*) (*EURO*)
2010	January	1.810,67	3.513,23	2.045,27	5.397,66
	February	1.892,41	3.375,77	1.904,60	5.104,87
	March	1.605,80	3.337,31	2.276,36	6.445,02
	April	2.054,75	3.946,59	2.318,99	6.257,97
	May	1.654,41	4.043,41	2.623,09	7.164,95
	June	2.167,42	4.021,56	2.512,66	7.089,99
	July	1.995,31	3.616,94	2.636,13	6.940,70
	August	1.311,55	3.231,94	2.389,08	7.483,97
	September	1.634,30	3.824,22	2.858,77	7.694,00
	October	2.251,79	4.187,73	2.587,55	7.643,25
	November	2.461,42	4.523,52	2.493,06	8.278,89
	December	2.642,52	4.311,04	2.635,52	8.677,31
2011	January	1618,25	3.494,08	1.799,45	6.640,86
	February	1896,07	3.929,47	1.961,73	8.243,97
	March	1935,72	4.618,85	1.963,42	9.080,69
	April	1951,29	4.413,95	2.436,52	8.700,23
	May	2445,31	4.461,62	2.516,85	8.899,77
	June	1882,78	4.304,68	2.626,43	8.961,42
	July	1850,29	4.988,25	2.864,19	7.739,36
	August	1286,75	3.746,19	3.063,75	9.039,84
	September	1669,33	4.939,74	2.537,48	10.130,31
	October	2185,76	4.635,34	3.193,92	11.013,59
	November	2547,05	5.368,18	3.142,49	12.188,57
	December	2286,95	5.205,53	3.146,95	11.702,94

The monthly competitive intelligence budgets of the software companies involved in our convenience sample were determined by the application of the percentages assigned by their managers from the monthly turnovers. These budgets are revealed in Table 2.

We remark an increase of the budgets assigned to CI activities in 2011 in comparison with 2010 at the level of each software companies' cluster: 0,31% in the case of start-ups, 17,79% in the case of utility developers, 6,73% in the case of expert coders and 33,45% in the case of stars.

4.1 Analysis of the trend pattern related to start-up firms

Using the data from table no. 2, we firstly presented the statistical pattern that we developed in view to identify the trend patterns of the monthly CI budgets of the start-ups, in the period 2010-2011. In this way, we applied the coefficient of variation method as the selection criterion for the optimal trend pattern.
The coefficient of variation is among the most commonly used statistics for assessing the consequences of group-based differences in organizations. It has been used by organizational researchers to index and compare the internal variability of the research variables on numerous dimensions [21].

The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from each other; in our approach, the budgets allocated to competitive intelligence actions significantly differ from a cluster to another within the research sample.

In the conditions of null hypothesis H_0, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the start-ups) as a linear function $x_{t_i} = a + b \cdot t_i$, the parameters "*a*" and "*b*" will be calculated by means of the following system of equations:

$$\begin{cases} n \cdot a = \sum_{i=-m}^{m} x_i \\ b \cdot \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} t_i \cdot x_i \end{cases} \tag{1}$$

Consequently,

$$a = \frac{\sum_{i=-m}^{m} x_i}{n} \tag{2}$$

and
$$b=\frac{\sum_{i=-m}^{m} t_i \cdot x_i}{\sum_{i=-m}^{m} t_i^2} \tag{3}$$

Using the statistical data calculated in view to fit the linear function (Table 3, in Appendix), we will be able to determine the following values for the parameters "*a*" and "*b*":

$$a=\frac{47.037,92}{24}=1.959,91 \quad \text{and} \quad b=\frac{13.244,42}{1.300}=10,18$$

Thus, the coefficient of variation in the case of the linear function will be:

$$v_I=\left[\frac{\sum_{i=-m}^{m}\left|x_i-x_{t_i}^I\right|}{n}:\frac{\sum_{i=-m}^{m} x_i}{n}\right]\cdot 100 \Rightarrow v_I=\frac{\sum_{i=-m}^{m}\left|x_i-x_{t_i}^I\right|}{\sum_{i=-m}^{m} x_i}\cdot 100 \tag{4}$$

$$v_I=\frac{6.763,68}{47.037,92}\cdot 100 \Rightarrow v_I=14,38\%$$

In the conditions of the alternative hypothesis H_1 , which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the start-ups) as a quadratic function $x_{t_i}=a+b\cdot t_i+ct_i^2$, the parameters "*a*", "*b*" and "*c*" will be calculated by means of the following system of equations:

$$\begin{cases} n\cdot a+c\sum_{i=-m}^{m} t_i^2=\sum_{i=-m}^{m} x_i \\ b\cdot\sum_{i=-m}^{m} t_i^2=\sum_{i=-m}^{m} t_i\cdot x_i \\ a\cdot\sum_{i=-m}^{m} t_i^2+c\sum_{i=-m}^{m} t_i^4=\sum_{i=-m}^{m} t_i^2\cdot x_i \end{cases} \tag{5}$$

Consequently,

$$a=\frac{\sum_{i=-m}^{m} t_i^4\cdot\sum_{i=-m}^{m} x_i-\sum_{i=-m}^{m} t_i^2\cdot\sum_{i=-m}^{m} t_i^2\cdot x_i}{n\cdot\sum_{i=-m}^{m} t_i^4-(\sum_{i=-m}^{m} t_i^2)^2} \tag{6}$$

$$b=\frac{\sum_{i=-m}^{m} t_i\cdot x_i}{\sum_{i=-m}^{m} t_i^2} \tag{7}$$

and
$$c = \frac{n \cdot \sum_{i=-m}^{m} t_i^2 \cdot x_i - \sum_{i=-m}^{m} t_i^2 \cdot \sum_{i=-m}^{m} x_i}{n \cdot \sum_{i=-m}^{m} t_i^4 - (\sum_{i=-m}^{m} t_i^2)^2} \tag{8}$$

Using the statistical data calculated in view to fit the quadratic function (Table 4, in Appendix), we will be able to determine the following values for the parameters “*a*”, “*b*” and ”*c*”:

$$a = \frac{121.420 \cdot 47.037{,}92 - 1.300 \cdot 2.543.420{,}95}{24 \cdot 121.420 - (1.300)^2} = 1.964{,}65$$
$$b = \frac{13.244{,}42}{1.300} = 10{,}18$$
$$c = \frac{24 \cdot 2.543.420{,}95 - 1.300 \cdot 47.037{,}92}{24 \cdot 121.420 - (1.300)^2} = -0{,}08$$

Thus, the coefficient of variation in the case of the quadratic function will be:

$$v_{II} = \left[\frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{II} \right|}{n} : \frac{\sum_{i=-m}^{m} x_i}{n} \right] \cdot 100 \Rightarrow v_{II} = \frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{II} \right|}{\sum_{i=-m}^{m} x_i} \cdot 100 \tag{9}$$

$$v_{II} = \frac{6.779{,}7}{47.037{,}92} \cdot 100 \Rightarrow v_{II} = 14{,}41\%$$

In the conditions of the alternative hypotheses H_2, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the start-ups) as a exponential function $x_{t_i} = ab^{t_i}$, the parameters “*a*” and “*b*” will be calculated by means of the following system of equations:

$$\begin{cases} n \cdot \ln a = \sum_{i=-m}^{m} \ln x_i \\ \ln b \cdot \sum_{i=-m}^{m} t_i^2 = \sum_{i=-m}^{m} t_i \cdot \ln x_i \end{cases} \tag{10}$$

Consequently,

$$\ln a = \frac{\sum_{i=-m}^{m} \ln x_i}{n} \tag{11}$$

$$\ln b = \frac{\sum_{i=-m}^{m} t_i \cdot \ln x_i}{\sum_{i=-m}^{m} t_i^2} \tag{12}$$

Using the statistical data calculated in view to fit the exponential function (Table 5, in Appendix), we will be able to determine the values associated to "ln *a*" and "ln *b*":

$$\ln a = \frac{181,53}{24} = 7,56 \qquad \ln b = \frac{6,18}{1.300} = 0,0048$$

Thus, the coefficient of variation in the case of the exponential function will be:

$$v_{\exp} = \left[\frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{\exp} \right|}{n} : \frac{\sum_{i=-m}^{m} x_i}{n} \right] \cdot 100 \Rightarrow v_{\exp} = \frac{\sum_{i=-m}^{m} \left| x_i - x_{t_i}^{\exp} \right|}{\sum_{i=-m}^{m} x_i} \cdot 100 \tag{13}$$

$$v_{\exp} = \frac{6679,68}{47.037,92} \cdot 100 \Rightarrow v_{\exp} = 14,20\%$$

We remark the following relationships between the coefficients of variation related to the linear, quadratic and exponential functions, in the case of start-ups:

$$v_{\exp} = 14,20\% < v_I = 14,38\% < v_{II} = 14,41\%$$

We can conclude that the path described by the monthly CI budgets, allocated from the turnover of the start-ups is represented by an exponential trend; in other words, the second alternative hypothesis H_2 is confirmed.

4.2 Analysis of the trend pattern related to utility-developers

In the conditions of null hypothesis H_0, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the utility-developers) as a linear function $x_{t_i} = a + b \cdot t_i$, the values of the parameters "*a*" and "*b*" are determined by taking into account the data stored in Table 6, in Appendix.

$$a = \frac{100.039,13}{24} = 4.168,2 \qquad \text{and} \qquad b = \frac{80.453,83}{1.300} = 61,88$$

Thus, the coefficient of variation in the case of the linear function will be:

$$v_I = \frac{7.296,12}{100.039,13} \cdot 100 \Rightarrow v_I = 7,29\%$$

In the conditions of the alternative hypothesis H_1, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of utility-developers) as a quadratic function $x_{t_i} = a + b \cdot t_i + ct_i^2$, the parameters "*a*", "*b*" and "*c*" are determined by taking into account the data stored in Table 7, in Appendix:

$$a = \frac{121.420 \cdot 100.039,13 - 1.300 \cdot 5.500.796,55}{24 \cdot 121.420 - (1.300)^2} = 4.081,20$$

$$b = \frac{80.453,83}{1.300} = 61,88$$

$$c = \frac{24 \cdot 5.500.796,55 - 1.300 \cdot 100.039,13}{24 \cdot 121.420 - (1.300)^2} = 1,60$$

Thus, the coefficient of variation in the case of the quadratic function will be:

$$v_{II} = \frac{7.249,84}{100.039,13} \cdot 100 \Rightarrow v_{II} = 7,24\%$$

In the conditions of the alternative hypotheses H_2, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the utility-developers) as a exponential function $x_{t_i} = ab^{t_i}$, the parameters "ln *a*" and "ln *b*" are determined by taking into account the data stored in Table 8, in Appendix:

$$\ln a = \frac{199,81}{24} = 8,33 \quad \text{and} \quad \ln b = \frac{19,06}{1.300} = 0,0147$$

Thus, the coefficient of variation in the case of the exponential function will be:

$$v_{\exp} = \frac{7.230,12}{100.039,13} \cdot 100 \Rightarrow v_{\exp} = 7,23\%$$

We remark the following relationships between the coefficients of variation related to the linear, quadratic and exponential functions, in the case of utility-developers:

$$v_{\exp} = 14,20\% < v_I = 14,38\% < v_{II} = 14,41\%$$

In conclusion, the path described by the monthly CI budgets, allocated from the turnover of utility-developers is represented by an exponential trend; in other words, the second alternative hypothesis H_2 is confirmed for the companies belonging to this cluster.

4.3 Analysis of the trend pattern related to expert-coders

The third analysis will be focused on expert-coders included in our convenience sample. The expert coders are more focused on technology and high-skilled employees than the utility developers, whose strategic intentions are more concentrated on market analysis; this fact can be an argument for lower CI budgets in the case of expert coders, in comparison with the utility developers.

In the conditions of null hypothesis H_0, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the expert-coders) as a linear function $x_{t_i} = a + b \cdot t_i$, the values of the parameters "*a*" and "*b*" are determined by taking into account the data stored in Table 9, in Appendix:

$$a = \frac{60.534,24}{24} = 2.522,26 \quad \text{and} \quad b = \frac{39.085,54}{1.300} = 30,06$$

Thus, the coefficient of variation in the case of the linear function will be:

$$v_I = \frac{6.238,04}{60.534,24} \cdot 100 \Rightarrow v_I = 10,30\%$$

In the conditions of the alternative hypotheses H_1, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of expert-coders) as a quadratic function $x_{t_i} = a + b \cdot t_i + ct_i^2$, the parameters "*a*", "*b*" and "*c*" are determined by taking into account the data stored in Table 10, in Appendix:

$$a = \frac{121.420 \cdot 60.534,24 - 1.300 \cdot 3.386.240,96}{24 \cdot 121.420 - (1.300)^2} = 2.408,30$$

$$b = \frac{39.085,54}{1.300} = 30,06$$

$$c = \frac{24 \cdot 3.386.240,96 - 1.300 \cdot 60.534,24}{24 \cdot 121.420 - (1.300)^2} = 2,10$$

Thus, the coefficient of variation in the case of the quadratic function will be:

$$v_{II} = \frac{6.109,88}{60.534,24} \cdot 100 \Rightarrow v_{II} = 10,09\%$$

In the conditions of the alternative hypotheses H_2, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the expert-coders) as a exponential function $x_{t_i} = ab^{t_i}$, the parameters "ln *a*" and "ln *b*" are determined by taking into account the data stored in Table 11, in Appendix:

$$\ln a = \frac{187,69}{24} = 7,82 \quad \text{and} \quad \ln b = \frac{14,95}{1.300} = 0,0115$$

Thus, the coefficient of variation in the case of the exponential function will be:

$$v_{\exp} = \frac{10.352,01}{60.534,24} \cdot 100 \Rightarrow v_{\exp} = 17,10\%$$

We remark the following relationships between the coefficients of variation related to the linear, quadratic and exponential functions, in the case of expert-coders:

$$v_{II} = 10,09\% < v_I = 10,30\% < v_{\exp} = 17,10\%$$

In conclusion, the path described by the monthly CI budgets, allocated from the turnover of expert-coders is represented by a quadratic function; in other words, first alternative hypothesis H_1 is confirmed.

4.4 Analysis of the trend pattern related to stars

The last analysis will be focused on the stars included in our convenience sample. Market leadership, the most common strategy of star companies, is based on the competition on a non-price basis in order to become the most popular market choice. A star software company that implements a market leadership strategy offers additional reasons, beyond price, to motivate its clients.

In the conditions of null hypothesis H_0, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of the stars) as a linear function $x_{t_i} = a + b \cdot t_i$, the values of the parameters “*a*” and “*b*” are determined by taking into account the data stored in Table 12, in Appendix:

$$a = \frac{196.520,11}{24} = 8.188,33 \quad \text{and} \qquad b = \frac{279.099,77}{1.300} = 214,69$$

Thus, the coefficient of variation in the case of the linear function will be:

$$v_I = \frac{14.227,99}{196.520,11} \cdot 100 \Rightarrow v_I = 7,24\%$$

In the conditions of the alternative hypothesis H_1, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of stars) as a quadratic function $x_{t_i} = a + b \cdot t_i + ct_i^2$, the parameters “*a*”, “*b*” and “*c*” are determined by taking into account the data stored in Table 13, in Appendix.

$$a = \frac{121.420 \cdot 196.520,11 - 1.300 \cdot 10.868.351,60}{24 \cdot 121.420 - (1.300)^2} = 7.950,96$$

$$b = \frac{279.099,77}{1.300} = 214,69$$

$$c = \frac{24 \cdot 10.868.351,60 - 1.300 \cdot 196.520,11}{24 \cdot 121.420 - (1.300)^2} = 4,38$$

Thus, the coefficient of variation in the case of the quadratic function will be:

$$v_{II} = \frac{14.434,21}{196.520,11} \cdot 100 \Rightarrow v_{II} = 7,34\%$$

In the conditions of the alternative hypothesis H_2, which supposes the existence of a trend pattern for the X factor (the monthly CI budgets, allocated from the turnover of stars) as a exponential function $x_{t_i} = ab^{t_i}$, the parameters "ln *a*" and "ln *b*" are determined by taking into account the data stored in Table 14, in Appendix:

$$\ln a = \frac{215,70}{24} = 8,99 \qquad \ln b = \frac{34,16}{1.300} = 0,0263$$

Thus, the coefficient of variation in the case of the exponential function will be:

$$v_{\exp} = \frac{14.249,60}{196.520,11} \cdot 100 \Rightarrow v_{\exp} = 7,25\%$$

We remark the following relationships between the coefficients of variation related to the linear, quadratic and exponential functions, in the case of stars:

$$v_I = 7,24\% < v_{\exp} = 7,25\% < v_{II} = 7,34\%$$

In conclusion, the path described by the monthly CI budgets, allocated from the turnover of stars is represented by a linear trend; in other words, null hypothesis H_0 is confirmed in this case. The linear trend is mainly due to the continuous increase of the stars CI budgets in the period 2010-2011.

The lower the value related to the coefficient of variation, the higher the data homogeneity in the convenience sample is. We remark the lowest value of the coefficient of variation in the case of utility developers (7,23%) and the highest one in the case of start-ups (14,20%), although both of the curves reflect exponential trends. These results can be explained by significant differences in the budget allocation to CI activities within start-ups, which reveal their entrepreneurs' vision regarding the techniques employed to monitor the market. The utility developers and especially the stars, which are focusing their strategies on gathering and analyzing relevant knowledge about customers and competitors, reported a high homogeneity degree of the data associated to CI budgets dynamics in the period 2010-2011.

5 Conclusions

The knowledge-based society involves the ability to collect competitive information efficiently and ethically in view to predict the business environment in the future. In this context, competitive intelligence processes add value to both the development process and the software products and services.

Our survey emphasizes significant differences between the average CI budgets employed within Romanian software industry. The companies involved in software development would benefit from the clearly defined patterns related to CI budgets dynamics by focusing their attention on the trends which are specific to each cluster.

This research provided an initial insight of the CI budgets dynamics in the case of the Romanian software industry; however, this is only an initial step into understanding how the increase of CI budgets can improve the software companies' abilities to face the competition. At the time of concluding the writing of this paper, we are waiting for the software industry's feedback on the relevance of the pattern.

The findings of this study should assist the managers of Romanian software companies in having a more informed knowledge of CI budgets allocated in this industry. Additionally, these findings provide a decision making support to software companies' managers regarding the opportunities to increase CI budgets, as a response to competitors' initiatives within this highly competitive market.

The most significant limitation of this study is the use of a convenience sample. The results may therefore not be representative for the all managers' perceptions of the Romanian software companies. Future studies in this field could solve this problem by using representative and larger samples.

An interesting approach in the future research agenda would be to conduct a cross-cultural survey in order to identify the CI techniques employed by the software companies from different countries and to analyze the gaps between the CI budgets dynamics, by taking into account a large sample of companies.

Acknowledgements. This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/1.5/S/59184„ Performance and excellence in postdoctoral research in Romanian economics science domain".

Appendix

Table 3: Design of the linear function pattern for the analysis of CI budget dynamics of start-ups

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*START-UPS*) (*EURO*) (x_i)	LINEAR TREND				
			t_i	t_i^2	$t_i x_i$	$x_{t_i} = a + bt_i$	$\left\|x_i - x_{t_i}\right\|$
2010	January	1.810,67	-12	144	-21.728,06	1.837,75	27,08
	February	1.892,41	-11	121	-20.816,47	1.847,93	44,48
	March	1.605,80	-10	100	-16.058,02	1.858,11	252,31
	April	2.054,75	-9	81	-18.492,78	1.868,29	186,46
	May	1.654,41	-8	64	-13.235,28	1.878,47	224,06
	June	2.167,42	-7	49	-15.171,94	1.888,65	278,77
	July	1.995,31	-6	36	-11.971,89	1.898,83	96,48
	August	1.311,55	-5	25	-6.557,747	1.909,01	597,46
	September	1.634,30	-4	16	-6.537,21	1.919,19	284,89
	October	2.251,79	-3	9	-6.755,384	1.929,37	322,42
	November	2.461,42	-2	4	-4.922,843	1.939,55	521,87
	December	2.642,52	-1	1	-2.642,52	1.949,73	692,79
2011	January	1.618,25	1	1	1.618,25	1.970,09	351,84
	February	1.896,07	2	4	3.792,145	1.980,27	84,20
	March	1.935,72	3	9	5.807,163	1.990,45	54,73
	April	1.951,29	4	16	7.805,147	2.000,63	49,34
	May	2.445,31	5	25	12.226,57	2.010,81	434,50
	June	1.882,78	6	36	11.296,66	2.020,99	138,21
	July	1.850,29	7	49	12.952,06	2.031,17	180,88
	August	1.286,75	8	64	10.293,98	2.041,35	754,60
	September	1.669,33	9	81	15.023,94	2.051,53	382,20
	October	2.185,76	10	100	21.857,65	2.061,71	124,05
	November	2.547,05	11	121	28.017,54	2.071,89	475,16
	December	2.286,95	12	144	27.443,45	2.082,07	204,88
TOTAL		**47.037,92**	**-**	**1.300**	**13244,42**	**-**	**6763,68**

Table 4: Design of the quadratic function pattern for the analysis of CI budget dynamics of start-ups

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*START-UPS*) (*EURO*) (x_i)	QUADRATIC TREND				
			t_i^2	t_i^4	$t_i^2 \cdot x_i$	$X_t = a + bt_i + ct_i^2$	$\lvert x_i - x_{t_i} \rvert$
2010	January	1.810,67	144	20.736	260.736,48	1.830,97	20,3
	February	1.892,41	121	14.641	228.981,61	1.842,99	49,42
	March	1.605,80	100	10.000	160.580	1.854,85	249,05
	April	2.054,75	81	6.561	166.434,75	1.866,55	188,2
	May	1.654,41	64	4.096	105.882,24	1.878,09	223,68
	June	2.167,42	49	2.401	106.203,58	1.889,47	277,95
	July	1.995,31	36	1.296	71.831,16	1.900,69	94,62
	August	1.311,55	25	625	32.788,75	1.911,75	600,2
	September	1.634,30	16	256	26.148,8	1.922,65	288,35
	October	2.251,79	9	81	20.266,11	1.933,39	318,4
	November	2.461,42	4	16	9.845,68	1.943,97	517,45
	December	2.642,52	1	1	2.642,52	1.954,39	688,13
2011	January	1.618,25	1	1	1.618,25	1.974,75	356,5
	February	1.896,07	4	16	7.584,28	1.984,69	88,62
	March	1.935,72	9	81	17.421,48	1.994,47	58,75
	April	1.951,29	16	256	31.220,64	2.004,09	52,8
	May	2.445,31	25	625	61.132,75	2.013,55	431,76
	June	1.882,78	36	1.296	67.780,08	2.022,85	140,07
	July	1.850,29	49	2.401	90.664,21	2.031,99	181,7
	August	1.286,75	64	4.096	82.352	2.040,97	754,22
	September	1.669,33	81	6.561	135.215,73	2.049,79	380,46
	October	2.185,76	100	10.000	218.576	2.058,45	127,31
	November	2.547,05	121	14.641	308.193,05	2.066,95	480,1
	December	2.286,95	144	20.736	329.320,8	2.075,29	211,66
TOTAL		**47.037,92**	**1.300**	**121.420**	**2.543.420,95**		**6.779,7**

Table 5: Design of the exponential function pattern for the analysis of CI budget dynamics of start-ups

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*START-UPS*) (*EURO*) (x_i)	EXPONENTIAL TREND				
			$\ln x_i$	$t_i \ln x_i$	$\ln x_t = \ln a + t_i \cdot \ln$	$x_{t_i} = ab^{t_i}$	$\lvert x_i - x_{t_i} \rvert$
2010	January	1.810,67	7,50	-90,02	7,50	1.812,39	1,72
	February	1.892,41	7,55	-83,00	7,51	1.821,11	71,30
	March	1.605,80	7,38	-73,81	7,51	1.829,87	224,07
	April	2.054,75	7,63	-68,65	7,52	1.838,67	216,08
	May	1.654,41	7,41	-59,29	7,52	1.847,52	193,11
	June	2.167,42	7,68	-53,77	7,53	1.856,41	311,01
	July	1.995,31	7,60	-45,59	7,53	1.865,34	129,97
	August	1.311,55	7,18	-35,89	7,54	1.874,32	562,77
	September	1.634,30	7,40	-29,60	7,54	1.883,34	249,04
	October	2.251,79	7,72	-23,16	7,55	1.892,40	359,39
	November	2.461,42	7,81	-15,62	7,55	1.901,50	559,92
	December	2.642,52	7,88	-7,88	7,56	1.910,65	731,87
2011	January	1.618,25	7,39	7,39	7,56	1.929,08	310,83
	February	1.896,07	7,55	15,10	7,57	1.938,36	42,29
	March	1.935,72	7,57	22,70	7,57	1.947,69	11,97
	April	1.951,29	7,58	30,30	7,58	1.957,06	5,77
	May	2.445,31	7,80	39,01	7,58	1.966,48	478,83
	June	1.882,78	7,54	45,24	7,59	1.975,94	93,16
	July	1.850,29	7,52	52,66	7,59	1.985,45	135,16
	August	1.286,75	7,16	57,28	7,60	1.995,00	708,25
	September	1.669,33	7,42	66,78	7,60	2.004,60	335,27
	October	2.185,76	7,69	76,90	7,61	2.014,25	171,51
	November	2.547,05	7,84	86,27	7,61	2.023,94	523,11
	December	2.286,95	7,73	92,82	7,62	2.033,68	253,27
TOTAL		**47.037,92**	**181,53**	**6,18**			**6.679,68**

Table 6: Design of the linear function pattern for the analysis of CI budget dynamics of utility-developers

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*UTILITY-DEVELOPERS*) (*EURO*) (*x_i*)	LINEAR TREND				
			t_i	t_i^2	$t_i x_i$	$x_{t_i} = a + bt_i$	$\lvert x_i - x_{t_i} \rvert$
2010	January	3.513,23	-12	144	-42.158,71	3.425,73	87,50
	February	3.375,77	-11	121	-37.133,48	3.487,61	111,84
	March	3.337,31	-10	100	-33.373,08	3.549,49	212,18
	April	3.946,59	-9	81	-35.519,31	3.611,37	335,22
	May	4.043,41	-8	64	-32.347,29	3.673,25	370,16
	June	4.021,56	-7	49	-28.150,92	3.735,13	286,43
	July	3.616,94	-6	36	-21.701,64	3.797,01	180,07
	August	3.231,94	-5	25	-16.159,71	3.858,89	626,95
	September	3.824,22	-4	16	-15.296,89	3.920,77	96,55
	October	4.187,73	-3	9	-12.563,18	3.982,65	205,08
	November	4.523,52	-2	4	-9.047,042	4.044,53	478,99
	December	4.311,04	-1	1	-4.311,042	4.106,41	204,63
2011	January	3.494,08	1	1	3.494,084	4.230,17	736,09
	February	3.929,47	2	4	7.858,943	4.292,05	362,58
	March	4.618,85	3	9	13.856,55	4.353,93	264,92
	April	4.413,95	4	16	17.655,79	4.415,81	1,86
	May	4.461,62	5	25	22.308,11	4.477,69	16,07
	June	4.304,68	6	36	25.828,07	4.539,57	234,89
	July	4.988,25	7	49	34.917,72	4.601,45	386,80
	August	3.746,19	8	64	29.969,5	4.663,33	917,14
	September	4.939,74	9	81	44.457,66	4.725,21	214,53
	October	4.635,34	10	100	46.353,38	4.787,09	151,75
	November	5.368,18	11	121	59.049,98	4.848,97	519,21
	December	5.205,53	12	144	62.466,33	4.910,85	294,68
TOTAL		**100.039,13**	**-**	**1.300**	**80.453,83**		**7.296,12**

Table 7: Design of the quadratic function pattern for the analysis of CI budget dynamics of utility-developers

YEAR	MONTH	AVERAGE MONTHLY “CI” BUDGET (*UTILITY-DEVELOPERS*) (*EURO*) (x_i)	QUADRATIC TREND				
			t_i^2	t_i^4	$t_i^2 \cdot x_i$	$X_t = a + bt_i + ct_i^2$	$\lvert x_i - x_{t_i} \rvert$
2010	January	3.513,23	144	20.736	505.905,12	3.569,04	55,81
	February	3.375,77	121	14.641	408.468,17	3.594,12	218,35
	March	3.337,31	100	10.000	333.731	3.622,4	285,09
	April	3.946,59	81	6.561	319.673,79	3.653,88	292,71
	May	4.043,41	64	4.096	258.778,24	3.688,56	354,85
	June	4.021,56	49	2.401	197.056,44	3.726,44	295,12
	July	3.616,94	36	1.296	130.209,84	3.767,52	150,58
	August	3.231,94	25	625	80.798,5	3.811,8	579,86
	September	3.824,22	16	256	61.187,52	3.859,28	35,06
	October	4.187,73	9	81	37.689,57	3.909,96	277,77
	November	4.523,52	4	16	18.094,08	3.963,84	559,68
	December	4.311,04	1	1	4.311,04	4.020,92	290,12
2011	January	3.494,08	1	1	3.494,08	4.144,68	650,6
	February	3.929,47	4	16	15.717,88	4.211,36	281,89
	March	4.618,85	9	81	41.569,65	4.281,24	337,61
	April	4.413,95	16	256	70.623,2	4.354,32	59,63
	May	4.461,62	25	625	111.540,5	4.430,6	31,02
	June	4.304,68	36	1.296	154.968,48	4.510,08	205,4
	July	4.988,25	49	2.401	244.424,25	4.592,76	395,49
	August	3.746,19	64	4.096	239.756,16	4.678,64	932,45
	September	4.939,74	81	6.561	400.118,94	4.767,72	172,02
	October	4.635,34	100	10.000	463.534	4.860	224,66
	November	5.368,18	121	14.641	649.549,78	4.955,48	412,7
	December	5.205,53	144	20.736	749.596,32	5.054,16	151,37
TOTAL		**100.039,13**	**1.300**	**121.420**	**5.500.796,55**		**7249,84**

Table 8: Design of the exponential function pattern for the analysis of CI budget dynamics of utility-developers

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*UTILITY-DEVELOPERS*) (*EURO*) (x_i)	EXPONENTIAL TREND				
			$\ln x_i$	$t_i \ln x_i$	$\ln x_t = \ln a + t_i \cdot \ln b$	$x_{t_i} = ab^{t_i}$	$\lvert x_i - x_{t_i} \rvert$
2010	January	3.513,23	8,16	-97,97	8,15	3.475,87	37,36
	February	3.375,77	8,12	-89,37	8,17	3.527,34	151,57
	March	3.337,31	8,11	-81,13	8,18	3.579,58	242,27
	April	3.946,59	8,28	-74,53	8,20	3.632,59	314,00
	May	4.043,41	8,30	-66,44	8,21	3.686,38	357,03
	June	4.021,56	8,30	-58,10	8,23	3.740,97	280,59
	July	3.616,94	8,19	-49,16	8,24	3.796,37	179,43
	August	3.231,94	8,08	-40,40	8,26	3.852,59	620,65
	September	3.824,22	8,25	-33,00	8,27	3.909,64	85,42
	October	4.187,73	8,34	-25,02	8,29	3.967,53	220,20
	November	4.523,52	8,42	-16,83	8,30	4.026,29	497,23
	December	4.311,04	8,37	-8,37	8,32	4.085,91	225,13
2011	January	3.494,08	8,16	8,16	8,34	4.207,82	713,74
	February	3.929,47	8,28	16,55	8,36	4.270,13	340,66
	March	4.618,85	8,44	25,31	8,37	4.333,37	285,48
	April	4.413,95	8,39	33,57	8,39	4.397,54	16,41
	May	4.461,62	8,40	42,02	8,40	4.462,66	1,04
	June	4.304,68	8,37	50,20	8,42	4.528,74	224,06
	July	4.988,25	8,51	59,60	8,43	4.595,81	392,44
	August	3.746,19	8,23	65,83	8,45	4.663,87	917,68
	September	4.939,74	8,51	76,55	8,46	4.732,93	206,81
	October	4.635,34	8,44	84,41	8,48	4.803,02	167,68
	November	5.368,18	8,59	94,47	8,49	4.874,15	494,03
	December	5.205,53	8,56	102,69	8,51	4.946,32	259,21
TOTAL		**100.039,13**	**199,81**	**19,06**	**-**	**-**	**7.230,12**

Table 9: Design of the linear function pattern for the analysis of CI budget dynamics of expert-coders

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET *EXPERT-CODERS* (*EURO*) (x_i)	LINEAR TREND				
			t_i	t_i^2	$t_i x_i$	$x_{t_i} = a + bt_i$	$\left\| x_i - x_{t_i} \right\|$
2010	January	2.045,27	-12	144	-24.543,23	2.161,54	116,27
	February	1.904,60	-11	121	-20.950,61	2.191,6	287,00
	March	2.276,36	-10	100	-22.763,6	2.221,66	54,70
	April	2.318,99	-9	81	-20.870,87	2.251,72	67,27
	May	2.623,09	-8	64	-20.984,69	2.281,78	341,31
	June	2.512,66	-7	49	-17.588,62	2.311,84	200,82
	July	2.636,13	-6	36	-15.816,78	2.341,9	294,23
	August	2.389,08	-5	25	-11.945,4	2.371,96	17,12
	September	2.858,77	-4	16	-11.435,07	2.402,02	456,75
	October	2.587,55	-3	9	-7.762,641	2.432,08	155,47
	November	2.493,06	-2	4	-4.986,122	2.462,14	30,92
	December	2.635,52	-1	1	-2.635,52	2.492,2	143,32
2011	January	1.799,45	1	1	1.799,447	2.552,32	752,87
	February	1.961,73	2	4	3.923,451	2.582,38	620,65
	March	1.963,42	3	9	5.890,268	2.612,44	649,02
	April	2.436,52	4	16	9.746,085	2.642,5	205,98
	May	2.516,85	5	25	12.584,23	2.672,56	155,71
	June	2.626,43	6	36	15.758,55	2.702,62	76,19
	July	2.864,19	7	49	20.049,31	2.732,68	131,51
	August	3.063,75	8	64	24.509,97	2.762,74	301,01
	September	2.537,48	9	81	22.837,33	2.792,8	255,32
	October	3.193,92	10	100	31.939,25	2.822,86	371,06
	November	3.142,49	11	121	34.567,4	2.852,92	289,57
	December	3.146,95	12	144	37.763,4	2.882,98	263,97
TOTAL		**60.534,24**	**-**	**1.300**	**39085,54**	**-**	**6.238,4**

Table 10: Design of the quadratic function pattern for the analysis of CI budget dynamics of expert-coders

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET *EXPERT-CODERS* (*EURO*) (x_i)	QUADRATIC TREND				
			t_i^2	t_i^4	$t_i^2 \cdot x_i$	$X_t = a + bt_i + ct_i^2$	$\lvert x_i - x_{t_i} \rvert$
2010	January	2.045,27	144	20.736	294.518,88	2.349,98	304,71
	February	1.904,60	121	14.641	230.456,6	2.331,74	427,14
	March	2.276,36	100	10.000	227.636	2.317,7	41,34
	April	2.318,99	81	6.561	187.838,19	2.307,86	11,13
	May	2.623,09	64	4.096	167.877,76	2.302,22	320,87
	June	2.512,66	49	2.401	123.120,34	2.300,78	211,88
	July	2.636,13	36	1.296	94.900,68	2.303,54	332,59
	August	2.389,08	25	625	59.727	2.310,5	78,58
	September	2.858,77	16	256	45.740,32	2.321,66	537,11
	October	2.587,55	9	81	23.287,95	2.337,02	250,53
	November	2.493,06	4	16	9.972,24	2.356,58	136,48
	December	2.635,52	1	1	2.635,52	2.380,34	255,18
2011	January	1.799,45	1	1	1.799,45	2.440,46	641,01
	February	1.961,73	4	16	7.846,92	2.476,82	515,09
	March	1.963,42	9	81	17.670,78	2.517,38	553,96
	April	2.436,52	16	256	38.984,32	2.562,14	125,62
	May	2.516,85	25	625	62.921,25	2.611,1	94,25
	June	2.626,43	36	1.296	94.551,48	2.664,26	37,83
	July	2.864,19	49	2.401	140.345,31	2.721,62	142,57
	August	3.063,75	64	4.096	196.080	2.783,18	280,57
	September	2.537,48	81	6.561	205.535,88	2.848,94	311,46
	October	3.193,92	100	10.000	319.392	2.918,9	275,02
	November	3.142,49	121	14.641	380.241,29	2.993,06	149,43
	December	3.146,95	144	20.736	453.160,8	3.071,42	75,53
TOTAL		**60.534,24**	**1.300**	**121.420**	**3.386.240,96**	**-**	**6.109,88**

Table 11: Design of the exponential function pattern for the analysis of CI budget dynamics of expert-coders

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET *EXPERT-CODERS* (*EURO*) (x_i)	EXPONENTIAL TREND				
			$\ln x_i$	$t_i \ln x_i$	$\ln x_{t_i} = \ln a + t_i \cdot \ln b$	$x_{t_i} = ab^{t_i}$	$\left\lvert x_i - x_{t_i} \right\rvert$
2010	January	2.045,27	7,62	-91,48	7,68	2.168,95	123,68
	February	1.904,60	7,55	-83,07	7,69	2.194,04	289,44
	March	2.276,36	7,73	-77,30	7,71	2.219,42	56,94
	April	2.318,99	7,75	-69,74	7,72	2.245,09	73,90
	May	2.623,09	7,87	-62,98	7,73	2.271,06	352,03
	June	2.512,66	7,83	-54,80	7,74	2.297,32	215,34
	July	2.636,13	7,88	-47,26	7,75	2.323,90	312,23
	August	2.389,08	7,78	-38,89	7,76	2.350,77	38,31
	September	2.858,77	7,96	-31,83	7,77	2.377,96	480,81
	October	2.587,55	7,86	-23,58	7,79	2.405,47	182,08
	November	2.493,06	7,82	-15,64	7,80	2.433,29	59,77
	December	2.635,52	7,88	-7,88	7,81	2.461,44	174,08
2011	January	1.799,45	7,50	7,50	7,83	2.518,70	719,25
	February	1.961,73	7,58	15,16	7,84	2.547,84	586,11
	March	1.963,42	7,58	22,75	7,85	2.577,31	613,89
	April	2.436,52	7,80	31,19	7,87	2.607,12	170,60
	May	2.516,85	7,83	39,15	7,88	2.637,27	120,42
	June	2.626,43	7,87	47,24	7,89	2.667,77	41,34
	July	2.864,19	7,96	55,72	7,90	2.698,63	165,56
	August	3.063,75	8,03	64,22	7,91	2.729,84	333,91
	September	2.537,48	7,84	70,55	7,92	2.761,42	223,94
	October	3.193,92	8,07	80,69	8,47	4.769,52	1575,60
	November	3.142,49	8,05	88,58	8,48	4.817,45	1674,96
	December	3.146,95	8,05	96,65	8,50	4.914,77	1767,82
TOTAL		**60.534,24**	**187,69**	**14,95**	**-**	**-**	**10.352,01**

Table 12: Design of the linear function pattern for the analysis of CI budget dynamics of stars

YEAR	MONTH	AVERAGE MONTHLY “CI” BUDGET (*STARS*) (*EURO*) (x_i)	LINEAR TREND				
			t_i	t_i^2	$t_i x_i$	$x_{t_i} = a + bt$	$\lvert x_i - x_{t_i} \rvert$
2010	January	5.397,66	-12	144	-64.771,86	5.612,05	214,39
	February	5.104,87	-11	121	-56.153,55	5.826,74	721,87
	March	6.445,02	-10	100	-64.450,21	6.041,43	403,59
	April	6.257,97	-9	81	-56.321,72	6.256,12	1,85
	May	7.164,95	-8	64	-57.319,63	6.470,81	694,14
	June	7.089,99	-7	49	-49.629,9	6.685,5	404,49
	July	6.940,70	-6	36	-41.644,21	6.900,19	40,51
	August	7.483,97	-5	25	-37.419,84	7.114,88	369,09
	September	7.694,00	-4	16	-30.776,01	7.329,57	364,43
	October	7.643,25	-3	9	-22.929,75	7.544,26	98,99
	November	8.278,89	-2	4	-16.557,78	7.758,95	519,94
	December	8.677,31	-1	1	-8.677,309	7.973,64	703,67
2011	January	6.640,86	1	1	6.640,855	8.403,02	1.762,16
	February	8.243,97	2	4	16.487,93	8.617,71	373,74
	March	9.080,69	3	9	27.242,07	8.832,4	248,29
	April	8.700,23	4	16	34.800,93	9.047,09	346,86
	May	8.899,77	5	25	44.498,84	9.261,78	362,01
	June	8.961,42	6	36	53.768,52	9.476,47	515,05
	July	7.739,36	7	49	54.175,51	9.691,16	1.951,80
	August	9.039,84	8	64	72.318,73	9.905,85	866,01
	September	10.130,31	9	81	91.172,79	10.120,54	9,77
	October	11.013,59	10	100	110.135,9	10.335,23	678,36
	November	12.188,57	11	121	134.074,3	10.549,92	1.638,65
	December	11.702,94	12	144	140.435,2	10.764,61	938,33
TOTAL		**196.520,11**	**-**	**1.300**	**279.099,77**	**-**	**14.227,99**

Table 13: Design of the quadratic function pattern for the analysis of CI budget dynamics of stars

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*STARS*) (*EURO*) (x_i)	QUADRATIC TREND				
			t_i^2	t_i^4	$t_i^2 \cdot x_i$	$X_t = a + bt_i + ct_i^2$	$\lvert x_i - x_{t_i} \rvert$
2010	January	5.397,66	144	20.736	777.263,04	6.005,4	607,74
	February	5.104,87	121	14.641	617.689,27	6.119,35	1.014,48
	March	6.445,02	100	10.000	644.502	6.242,06	202,96
	April	6.257,97	81	6.561	506.895,57	6.373,53	115,56
	May	7.164,95	64	4.096	458.556,8	6.513,76	651,19
	June	7.089,99	49	2.401	347.409,51	6.662,75	427,24
	July	6.940,70	36	1.296	249.865,2	6.820,5	120,2
	August	7.483,97	25	625	187.099,25	6.987,01	496,96
	September	7.694,00	16	256	123.104	7.162,28	531,72
	October	7.643,25	9	81	68.789,25	7.346,31	296,94
	November	8.278,89	4	16	33.115,56	7.539,1	739,79
	December	8.677,31	1	1	8.677,31	7.740,65	936,66
2011	January	6.640,86	1	1	6.640,86	8.170,03	1.529,17
	February	8.243,97	4	16	32.975,88	8.397,86	153,89
	March	9.080,69	9	81	81.726,21	8.634,45	446,24
	April	8.700,23	16	256	139.203,68	8.879,8	179,57
	May	8.899,77	25	625	222.494,25	9.133,91	234,14
	June	8.961,42	36	1.296	322.611,12	9.396,78	435,36
	July	7.739,36	49	2.401	379.228,64	9.668,41	1.929,05
	August	9.039,84	64	4.096	578.549,76	9.948,8	908,96
	September	10.130,31	81	6.561	820.555,11	10.237,95	107,64
	October	11.013,59	100	10.000	1.101.359	10.535,86	477,73
	November	12.188,57	121	14.641	1.474.816,97	10.842,53	1.346,04
	December	11.702,94	144	20.736	1.685.223,36	11.157,96	544,98
TOTAL		**196.520,11**	**1.300**	**121.420**	**10.868.351,60**	-	**14.434,21**

Table 14: Design of the exponential function pattern for the analysis of CI budget dynamics of stars

YEAR	MONTH	AVERAGE MONTHLY "CI" BUDGET (*STARS*) (*EURO*) (x_i)	EXPONENTIAL TREND				
			$\ln x_i$	$t_i \ln x_i$	$\ln x_t = \ln a + t_i \cdot \ln b$	$x_{t_i} = ab^{t_i}$	$\lvert x_i - x_{t_i} \rvert$
2010	January	5.397,66	8,59	-103,12	8,67	5.851,19	453,53
	February	5.104,87	8,54	-93,92	8,70	6.007,12	902,25
	March	6.445,02	8,77	-87,71	8,73	6.167,20	277,82
	April	6.257,97	8,74	-78,67	8,75	6.331,55	73,58
	May	7.164,95	8,88	-71,02	8,78	6.500,28	664,67
	June	7.089,99	8,87	-62,07	8,81	6.673,50	416,49
	July	6.940,70	8,85	-53,07	8,83	6.851,34	89,36
	August	7.483,97	8,92	-44,60	8,86	7.033,92	450,05
	September	7.694,00	8,95	-35,79	8,88	7.221,37	472,63
	October	7.643,25	8,94	-26,82	8,91	7.413,81	229,44
	November	8.278,89	9,02	-18,04	8,94	7.611,38	667,51
	December	8.677,31	9,07	-9,07	8,96	7.814,22	863,09
2011	January	6.640,86	8,80	8,80	9,02	8.236,25	1595,39
	February	8.243,97	9,02	18,03	9,04	8.455,73	211,76
	March	9.080,69	9,11	27,34	9,07	8.681,07	399,62
	April	8.700,23	9,07	36,28	9,10	8.912,41	212,18
	May	8.899,77	9,09	45,47	9,12	9.149,92	250,15
	June	8.961,42	9,10	54,60	9,15	9.393,75	432,33
	July	7.739,36	8,95	62,68	9,17	9.644,08	1904,72
	August	9.039,84	9,11	72,88	9,20	9.901,09	861,25
	September	10.130,31	9,22	83,01	9,23	10.164,94	34,63
	October	11.013,59	9,31	93,07	9,25	10.404,57	609,02
	November	12.188,57	9,41	103,49	9,28	10.713,93	1474,64
	December	11.702,94	9,37	112,41	9,31	10.999,44	703,50
TOTAL		**196.520,11**	**215,70**	**34,16**	**-**	**-**	**14249,60**

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