Professor Mihaela I. MUNTEAN, PhD
West University of Timisoara
E-mail: mihaela.muntean@feaa.uvt.ro
Associate Professor Cornelia MUNTEAN, PhD
West University of Timisoara
E-mail: cornelia.muntean@feaa.uvt.ro

EVALUATING A BUSINESS INTELLIGENCE SOLUTION. FEASIBILITY ANALYSIS BASED ON MONTE CARLO METHOD

Abstract: *Business Intelligence (BI) initiatives are challenging tasks, implying significant costs in their implementation. Therefore, organizations have adopted prudent policies requiring a financial justification. A business-driven methodology is recommended in any BI project initiative, project scoping and planning being vital for the project success. A business-driven approach of a BI project implementation starts with a feasibility study. The decision-making process for large projects is very complicated, and will not be subject of this paper. Having in mind a middle-sized BI project, a feasibility study based on the Monte Carlo simulation method will be conducted. A SaaS BI initiative versus a traditional one will be taken into consideration.*

Keywords*: Business Intelligence (BI), Software as a Service (SaaS), Monte Carlo method, BI project feasibility, Total Cost of Ownership (TCO), Return on Investment (ROI), Internal Rate of Return (IRR)*

JEL classification: **C02, C88, G17, L21, L86, M15**

1 Business Intelligence

1.1 Adding Value to Businesses

Business Intelligence (BI) is unanimous considered the art of gaining business advantage from data (Ghilic-Micu, 2008); therefore, BI systems and infrastructures must integrate disparate data sources into a single coherent framework for real-time reporting and detailed analysis within the extended enterprise. Gaining into the business/organisation by understanding the company's information assets, like customer's information, supply chain information, personnel data, manufacturing data, sales and marketing activity data as well as any other source of critical information, BI tools have the power to make informed decisions more effectively (Negash, 2003). Including aggregation, analysis, and reporting capabilities, BI solutions transform data into a high-value insight that allows managers to make more timely and informed decisions. Without any doubts, business decisions are only as good as the information on which they are based (Manjunath, 2011).

Looking inside the business and at the environment in which they operate, managers are able to fundament the most productive and profitable decisions. Only optimizing performance, an enterprise can survive and remain an important

competitor in the changing market, constantly taking advantage of the raising opportunities, risking and being flexible at new multiple demands (Kaplan, 1996). Having as a main goal productivity and profitability, BI initiatives help decidents in solving business problems for maximizing the business value (Negash, 2003). Subordonated to performance management at operational and strategic level, the actual Business Intelligence approaches consolidate the corporate management strategies.

Also the solution to a business problem is a process that includes Business Intelligence. BI, by itself, is rarely the complete solution to the problem (Jamaludin, 2011). Therefore, BI tools must understand the process and how to be part of it.

Based on the company's information assets, the Business Intelligence value chain represents a „From DATA To PROFIT" approach and is recommended to ground any performance management program (Muntean, 2011). BI applications take data that is generated by the operations of an enterprise and translate that data into relevant and useful information for consumption by people throughout the enterprise. Further, the obtained valuable knowledge supports any decision-making processes in order to achieve profit. According to (Porter, 1980), a value chain is a systematic approach to examine the development of competitive advantage, consisting of a series of activities that create and build value. Business Intelligence can be described as a value proposition that helps organisations in their decision-making processes.

Succesful implementation of performance management relies on technology platforms that sustain the whole BI value chain. Some literature references ((Brohman, 2000), (McKnigts, 2004), (Mukles, 2009)) analyse the value delivered by BI solutions. Aberdeen Group defines the BIPM AXIS (Business Intelligence – Performance Management AXIS) and provides an objective vendor assesment looking at the provider's history of Value Delivered (Y-axis) and their Market Readliness (X-axis) (Hatch, 2009). In all situation „Value delivered" implies the knowledge created with respect to the introduced BI value chain.

1.2 Analyzing a BI project feasibility

Many organizations are in front of most competitive economic environments, where, in order to survive, they must reduce costs all the time and adopt the most intelligent business strategies, for increasing revenues and improving asset utilization.

The investment into a corporate IT project, like the implementation of a Business Intelligence approach or any other Enterprise Information Systems' view, can be profitable for the investor, if certain aspects are taken into consideration. „Building the ROI is a key component of ensuring that the project is focused on the right areas and the company's investment is justified". (Oco, Inc., 2007). A robust framework for ROI analysis is recommended, a framework that is capable to help companies, justify and measure the benefits of the IT project.

With respect to the introduced BI value chain, the value created and delivered for the organization's shareholders will be quantified, by identifying the

opportunities to increase revenue, lower costs and improve asset utilization. BI system implementation success measures rely on process performance (budget, time schedule) and infrastructure performance (system quality, information quality, system use).

Delphi experts consider that BI system implementation is a „continual information improvement program to leverage decision support“ (Yeoh, 2008). A business-driven methodology is recommended in any BI project management approaches, project scoping and planning being vital for the project success. According to a Delphi expert „the success of 90percent of the BI projects is determined prior to the first day“. A well-communicated scope, realistic expectations and time-lines and an appropriate budget will be conclusive (Yeoh, 2008).

A business-driven approach of a BI project implementation starts with a feasibility study. The decision-making process for large projects is very complicated, and will not be subject of this paper. Having in mind a middle-sized BI project, a feasibility study based on the Monte Carlo simulation method will be conducted. According to (Gonzalez, 2009), project management best practices recommend the most suitable probabilistic, statistical and simulation tools for the project analysis.

2 Monte Carlo Method

2.1. Theory fundaments

Today, the concept “Monte Carlo Method” has become something very unspecific, because you can find Monte Carlo methods in almost every domain, from medicine to economy and from chemistry to regulating the flow of traffic. It’s obvious that the way these methods are applied varies substantially from field to field and there are dozens of subsets of Monte Carlo in each of these fields. Finally, to call something a “Monte Carlo” experiment all you need to do is use random numbers to examine some problem (Woller, 1996). Upon the whole, Monte Carlo methods allows us to examine more complex systems than we otherwise can (Mode, 2011).

The Monte Carlo method relies on using random occurrences for approximation calculi. The beginnings of Monte Carlo methods can be related to the year 1873, when Hall published a paper about the determination of number Pi by means of Buffon’s needle. PERCENTBuffon's needle problem asks to find the probability that a needle of length *a* will land on a line, given a floor with equally spaced parallellines a distance *d* apart (Weisstein, 2002). Actually, the innermost crux of the method consists in revealing the association which could be established between some thorough deterministic phenomena and some random experiments.

The Monte Carlo method developed systematically starting with the second world war, when it was used at the blanketing of the atom bomb, in conjunction with direct modelling of probabilistic problems regarding the random diffusion of

neutrons from a fissile material. The possibility of applying Monte Carlo methods to deterministic problems was first announced by E. Fermi, J. Von Neumann, S. Ulam and put forth by them hard upon the second world war.

At bottom, the Monte Carlo method is a method of computational disposal of mathematical problems, based on the modelling of random variables.

We presume *z* to be a random variable. We perform *n* independent experiments so that each should end with a value of *z* (we can imagine that in every experiment, simply and solely, the value of *z* is measured). This process of constructing for *z* a number of *n* values $x_1, x_2, \ldots, x_n$ represents the *modelling of the random variables*, and the values x_i are called *the achievments of z*.

If it is about studying real phenomena, then the modelling of random variables connected with them is called *simulation*.

The main procedure of elaborating a Monte Carlo method for solving a problem consists in reducing this problem to the determination of mean values. Rather, for calculating the approximate value of a scalar *a* (which could be the area of a surface, the root of an equation, the value of a definite integral etc.) we must find a random variable *z*, so that we can have $z_{\text{med}} = a$. Then, by modelling z, that is building *n* achievments for it $x_1, x_2, \ldots, x_n$, we will consider:

$$a \approx \frac{1}{n}\sum_{i=1}^{n} x_i .$$

We want to make obvious the method by considering that we would like to estimate the area S_A of a plane bounded surface *A* (Postaru, A., 2004). To figure this out we will fix on a rectangle *D* with the area S_D which should enclose *A* (Figure 1).

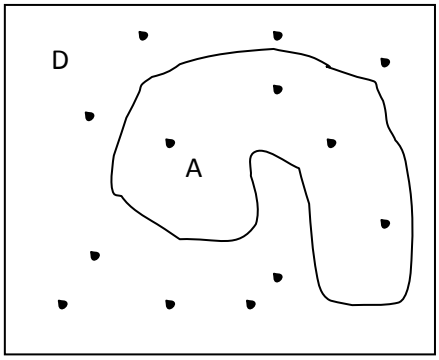

Figure 1. Area S_A estimation (*A* -a plane bounded surface included in *D*)

In *D* we choose randomly *n* points. We name with *n(A)* the number of points that got in *A*. Certainly if *n* is great-sized, then:

$$\frac{n(A)}{n} \approx \frac{S_A}{S_D},$$

Hence, we can determine the estimation:

$$S_A \approx \frac{n(A)}{n} S_D$$

In other words we can calculate the deterministic value S_A by using a known value S_D which we multiply through the incidence $\frac{n(A)}{n}$, a random variable which represents the number of favorable events $n(A)$ related to the total number of events n , produced by the experiment of generating random points in the area *D*. In this example the random variable *z* is by default present and has two possible values: S_D if the point gets in *A* and 0 if the point gets in *D\A*. We can easily verify that:

$$z_{med} = S_A,$$

and thus:

$$\frac{1}{n}\sum_{i=1}^{n} x_i = \frac{n(A)}{n} S_D$$

Based on this reasoning the Monte Carlo method has four parts:

1. The definition of a domain of possible entries;
2. The construction of the probabilistic model of the real analysed process (system);
3. The generation of random entries with a given distribution law and the execution of deterministic computations with the random generated entries;
4. The use of the statistical estimation theory for aggregating the results.

Especially due to the third item in the above list, the Monte Carlo methods lend oneself best to be approached with computer programs and tend to be used especially when it is impossible to calculate an exact result with a deterministic algorithm (Wang, 2010). In economy, the Monte Carlo methods are especially useful for modelling phenomena with uncertain entries, such as risk evaluation in business, feasibility studies, financial forecasting, portfolio analysis and much more (Evans, 2009).

2.1 Evaluating BI projects. Establishing a general theoretical approach

Nowadays, organizations have adopted more prudent policies requiring a financial justification for nearly every IT initiative, including Business Intelligence system implementation. Therefore, a feasibility analysis is determinant in the decision of going further with a BI initiative. The precision and reliability of the feasibility analysis relies on the information used in the analysis. Based on the input data, the financial condition and performance of the investment will be evaluated and forecastings will be made. Expected return and expected risks will ground the final financial decision (Björnsdóttir, 2010).

Best practises (Matson, 2000; Helfert, 2001; Park, 2002; Lee, 2009) show how financial feasibility analysis should be conducted. A project can be considered

financially viable if an economic return to the investors „at least equal to that available from other similarly risky investments“ is predictable, and additionally an „attractive interest rate of return“ has (Bennett, 2003). Therefore, for justifying a Business Intelligence initiative the following indicators have been taken into consideration:

- the Return on Investment (ROI) is a profitability ratio that evaluates the benefits of a project; it indicates how much will be obtained at the end of the project for each invested monetary unit; and
- the Internal Rate of Return (IRR) calculates the inherent discount rate or investment yield rate produced by the project.

With respect to the introduced Monte Carlo simulation method, a general approach for evaluating BI projects will be established (Figure 2). Inputs, that will ground the indicators calculation, are vital. These are in fact uncertain values up to a point and will be modelled using random variables. According to the estimates provided by experts, probability distributions will be associated with the uncertain inputs grounding the predictions for the considered time period.

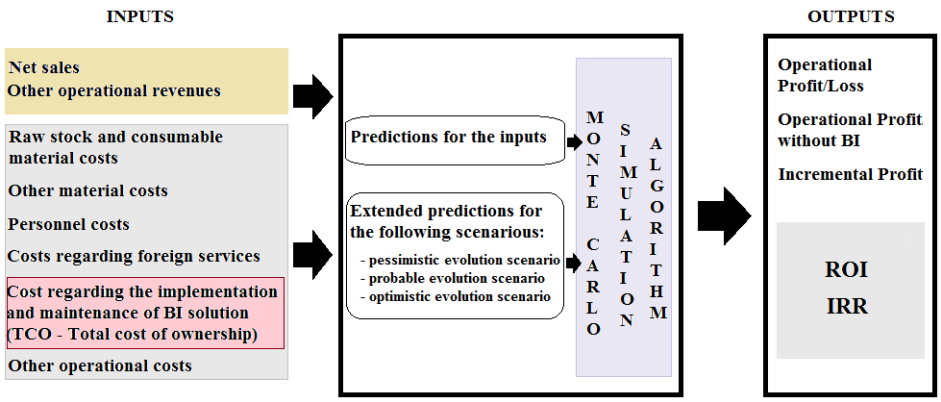

Figure 2. Establishing ROI & IRR for Business Intelligence initiatives

Financial feasibility calculations need to be done with care and the complexity of the calculations depends on the number of different aspects that need to be considered. The type of the BI initiative (Software as a Service - SaaS approach or a traditional BI implementation) is determinant for the project, having a direct influence on the Total Cost of Ownership (TCO). Obviously, a BI SaaS alternative implies a lower TCO than a traditional BI implementation (Oco, Inc., 2007). According to the previous indicated reference, the TCO is build by BI/PM Application License, Data Integration License, System Integration Costs, Database License, Infrastructure/Hardware Costs, Internal IT Personnel Costs, Training cost and Support/Subscription Fees. „For small- and mid-sized companies, a SaaS BI implementation can yield a lower TCO and a more compelling ROI“ is the conclusion of the experts from Oco (Oco, Inc., 2007); nowadays, various Cloud BI

initiatives, in fact SaaS approaches, are gaining advantage over the traditional ones, lower costs being the main reason for this phenomena (Reyes, 2010).

2.3 Business Intelligence as a shared service

SaaS is a model of software delivery that allows companies to deliver solutions to its customers in a hosted environment over the Internet (Joha, 2012). „SaaS is generally associated with business software and is typically thought of as a low-cost way for businesses to obtain the same benefits of commercially licensed, internally operated software without the associated complexity and high initial cost“ (Hurbean, C., 2010). Aspects like: 1 – low cost of entry; 2 – the responsability is on the vendor; 3 – less risky investment; 4 – vendors must provide a secure data environment; 4 – the worls is flat; 5 – Saas is safer; 6 – SaaS products are automatically backed up; 7 – SaaS vendors innovate faster; 7 - SaaS is more stable, especially for SMEs; 8 – packaging and pricing, have been recognized by the IT specialists' community ((Jakovljevic, 2006), (Peterson, 2012)) as general characteristics of the SaaS family. All major analysts, including IDC, Garnter, and Forrester, predict for the SaaS BI market a major growth through 2013 (Neubarth, 2011).

Comming back to the TCO for a BI initiative, „all the upfront and ongoing fees associated with the BI project implementation should be taken into consideration“ (Oco, Inc., 2007). Based on the proposed general approach (Figure 2), TCO will be calculated as part of a concret feasibility analysis regarding a BI project proposal for a midsized Limited Liability Company (LLC), that will ground the practical study case in paragraph 3. Figure 3a shows a TCO calculation for a SaaS BI initiative vs. a traditional BI implementation in Figure 3b.

	Implementation year (lei)	Year 1 (lei)	Year 2 (lei)	Year 3 (lei)	Year 4 (lei)
BI/PM Application License	875.000,00				
Data Integration License(ETL)					
System Integration Costs					
Database License					
Infrastructure/Hardware					
Internal IT Personnel	87.500,00	87.500,00	87.500,00	87.500,00	87.500,00
Training	87.500,00	87.500,00	87.500,00	87.500,00	87.500,00
Support/Subscription Fees	210.000,00	210.000,00	210.000,00	210.000,00	210.000,00
implementation and maintenance of the BI solution (TCO - Total cost of ownership)	1.260.000,00	385.000,00	385.000,00	385.000,00	385.000,00

Figure 3a. TCO calculation for a SaaS BI initiative

	Implementation year	Year 1	Year 2		Year 8
	(lei)	(lei)	(lei)		(lei)
BI/PM Application License	875.000,00	157.500,00	157.500,00		157.500,00
Data Integration License(ETL)	700.000,00	126.000,00	126.000,00		126.000,00
System Integration Costs	2.625.000,00	175.000,00	175.000,00		175.000,00
Database License	350.000,00	63.000,00	63.000,00		63.000,00
Infrastructure/Hardware	350.000,00				
Internal IT Personnel	1.050.000,00	350.000,00	350.000,00		350.000,00
Training	350.000,00	87.500,00	87.500,00		87.500,00
Support/Subscription Fees	38.500,00		-		-
Costs regarding the implementation and maintenance of the BI solution (TCO - Total cost of ownership)	6.338.500,00	959.000,00	959.000,00	....	959.000,00

Figure 3b. TCO calculation for a traditional implementation

As expected, the implementation year has a huge cost and the next eight years have also much greater costs then the SaaS variant. This because ETL (Data Integration License), System Integration Costs, Database License and Infrastructure/ Hardware Costs are not zero and because the internal IT Personnel costs are much higher for a traditional BI solution implementation comparing with the SaaS alternative.

3 Practical Case Study

The most powerful argument when implementing a BI solution is the substantial growth of visibility over business performance (Mircea, 2012). The greatest restriction that limits the adoption of a BI solution is the existence of a limited organizational culture (Nicolau, 2009).

In Romania, the local business culture related to BI is not so developed, only few managers have invested in BI initiatives. Recording to the last year statistics, less than 10 percent from the eligible firms acquired a BI solution (Edelhauser, 2011). In the nowadays Romanian business environment, small and medium sized enterprises proved to be a major source of innovation, flexibility and growth (Raşca, 2007), (Voicu, 2009), (Păunescu, 2012). It is also encouraging that entrepreneurs begin to identify the advantages brought by the BI systems in supporting decision-making processes (Mircea, 2008). Based on a request formulated by a Romanian midsized LLC, a complete feasibility analysis of a desired BI initiative has been conducted. The demarche was deployed according to the defined theoretical approach (Figure 2) and a convenient, popular Monte Carlo simulation based tool, like @RISK6, was used.

3.1 Establishing predictions for the inputs

Without any BI initiative, based on the real figures of the company for the last couple of years, the scenarios are those presented in Figure 4.

	Sales Growth rate	102,2%	102,0%	101,0%	100,8%
	Min	96,00%	95,00%	94,00%	94,00%
	Base	102,00%	102,00%	101,00%	101,00%
	Max	109,00%	109,00%	108,00%	107,00%
	Implementation year	Year 1	Year 2	Year 3	Year 4
Net sales	13.462.650,00	13.754.340,75	14.029.427,57	14.169.721,84	14.287.802,86
Other operational revenues	238.871,00	238.871,00	238.871,00	238.871,00	238.871,00
TOTAL OPERATIONAL REVENUES	13.701.521,00	13.993.211,75	14.268.298,57	14.408.592,84	14.526.673,86
Raw stock and consumable material costs	529.160,00	540.625,13	551.437,64	556.952,01	561.593,28
Other material costs	4.084.396,00	4.172.891,25	4.256.349,07	4.298.912,56	4.334.736,83
Personnel costs	4.365.971,00	4.365.971,00	4.365.971,00	4.365.971,00	4.365.971,00
Costs regarding foreign services	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,00
Other operational costs	1.165.538,00	1.165.538,00	1.165.538,00	1.165.538,00	1.165.538,00
TOTAL OPERATIONAL COSTS	11.736.792,00	11.836.752,38	11.931.022,71	11.979.100,57	12.019.566,11
OPERATIONAL PROFIT	**1.964.729,00**	**2.156.459,37**	**2.337.275,86**	**2.429.492,27**	**2.507.107,74**

Figure 4. No BI initiative. Prediction of the operational profit

Based on historical data and/or expert judgment, a distribution function for the annual sales growth rate is introduced.

Predictions for Year 1, for example, have in mind a Pert distribution (Figure 5) with a certain base percentage and a provisioned Min…Max range for possible extreme situations. Based on these assumptions, the probable evolution scenario together with the pessimistic and the optimistic one will be deployed. In a similar way, adequate distribution functions for the next years have been chosen.

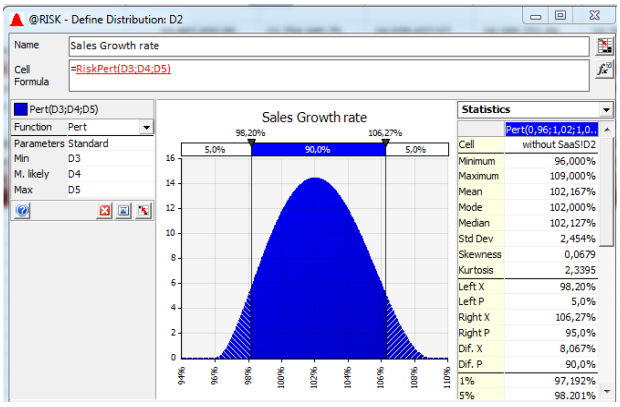

Figure 5. Pert distribution function for Sales growth rate in Year 1

Having in mind this state of art (Figure 4), the desired Business Intelligence initiative will be introduced under the form of a SaaS alternative (Figure 6).

The predicted sales growth rate has suffered some adjustments regarding the considered Base, Min and Max assumption; the Pert distribution remains in actuality. The adoption of a SaaS BI initiative is supposed to increase the sales considerable and to diminish the personnel costs due to the increased operational efficiency. Personnel costs savings are presumed to be enclosed in a range from a minimum of 5% to a maximum of 14 percent and a base value of 10 percent (Figure 6), a triangular distribution function being associated (Figure 7).

			Min	Base	Max
	Personnel costs savings	9,67%	5,00%	10,00%	14,00%
		Year 1	Year 2	Year 3	Year 4
	Sales growth rate	*109,33%*	*108,50%*	*107,50%*	*107,33%*
	Min	100%	99%	98%	98%
	Base	109%	108%	107%	107%
	Max	120%	120%	119%	118%
	Implementation year	**Year 1**	**Year 2**	**Year 3**	**Year 4**
	(lei)	(lei)	(lei)	(lei)	(lei)
Net sales	13.462.650,00	14.719.164,00	15.970.292,94	17.168.064,91	18.427.056,34
Other operational revenues	238.871,00	238.871,00	238.871,00	238.871,00	238.871,00
TOTAL OPERATIONAL REVENUES	13.701.521,00	14.958.035,00	16.209.163,94	17.406.935,91	18.665.927,34
Raw stock and consumable material cost	529.160,00	578.548,27	627.724,87	674.804,23	724.289,88
Other material costs	4.084.396,00	4.465.606,29	4.845.182,83	5.208.571,54	5.590.533,45
Personnel costs	4.365.971,00	3.943.927,14	3.943.927,14	3.943.927,14	3.943.927,14
Costs regarding foreign services	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,00
Costs regarding the implementation and maintenance of the BI solution (TCO - Total cost of ownership)	1.260.000,00	385.000,00	385.000,00	385.000,00	385.000,00
Other operational costs	1.165.538,00	1.052.869,33	1.052.869,33	1.052.869,33	1.052.869,33
TOTAL OPERATIONAL COSTS	12.996.792,00	12.017.678,02	12.446.431,16	12.856.899,24	13.288.346,80
distributed profit/loss		-	-	-	-
OPERATIONAL PROFIT/LOSS	**704.729,00**	**2.940.356,98**	**3.762.732,78**	**4.550.036,67**	**5.377.580,54**
OPERATIONAL PROFIT WITHOUT SAAS	1.964.729,00	2.156.459,37	2.337.275,86	2.429.492,27	2.507.107,74
INCREMENTAL PROFIT	- **1.260.000,00**	**783.897,61**	**1.425.456,92**	**2.120.544,41**	**2.870.472,80**
ROI (Return on Investment)	5,71				
IRR (Internal rate of Return)	95%				

Figure 6. SaaS BI initiative. Prediction of the operational profit/ ROI / IRR

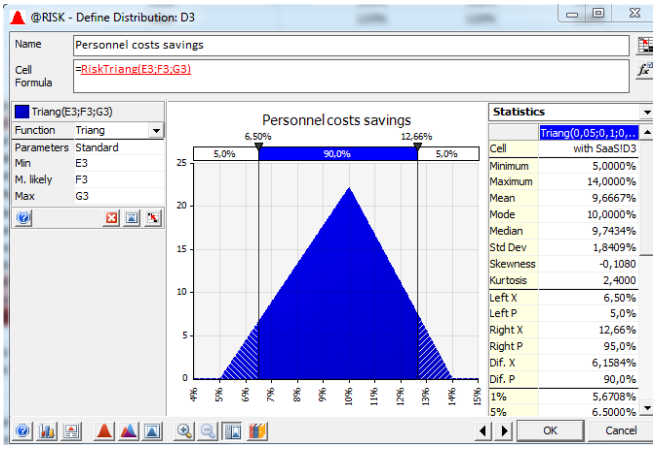

Figure 7. Triangular distribution function for the personnel costs savings

All previously established outputs (Figure 2) are calculated. A mean ROI value of 5,71 and a mean IRR of 95 percent has been obtained after 10.000 iterations executed during the Monte Carlo simulation process.

The simulation was also performed for a traditional BI initiative (Figure 8). As expected, the results are not encouraging.

2				Min		
3		Personnel costs savings	9,67%	5,00%		
4						
5			Year 1	Year 2	Year 7	Year 8
6		Sales growth rate	109,33%	108,50%	107,33%	107,33%
7		Min	100%	9	98%	
8		Base	109%	10	107%	
9		Max	120%	12	118%	
10						
11		Implementation year	Year 1	Year 2	Year 7	Year 8
12		(lei)	(lei)	(lei)	(lei)	(lei)
13	Net sales	13.462.650,00	14.719.164,00	15.970.292,94	22.785.565,66	24.456.507,1
14	Other operational revenues	238.871,00	238.871,00	238.871,00	238.871,00	238.871,0
15	TOTAL OPERATIONAL REVENUES	13.701.521,00	14.958.035,00	16.209.163,94	23.024.436,66	24.695.378,1
16	Raw stock and consumable material cost	529.160,00	578.548,27	627.724,87	895.604,50	961.282,1
17	Other material costs	4.084.396,00	4.465.606,29	4.845.182,83	6.912.849,49	7.419.791,7
18	Personnel costs	4.365.971,00	3.943.927,14	3.943.927,14	3.943.927,14	3.943.927,1
19	Costs regarding foreign services	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,00	1.591.727,0
20	Costs regarding the implementation and maintenance of the BI solution (TCO - Total cost of ownership)	6.338.500,00	959.000,00	959.000,00	959.000,00	959.000,0
21	Other operational costs	1.165.538,00	1.052.869,33	1.052.869,33	1.052.869,33	1.052.869,3
22	TOTAL OPERATIONAL COSTS	18.075.292,00	12.591.678,02	13.020.431,16	15.355.977,46	15.928.597,4
23	distributed profit/loss		4.373.771,00	2.007.414,02	-	-
24	OPERATIONAL PROFIT/LOSS	- 4.373.771,00	- 2.007.414,02	1.181.318,76	7.668.459,20	8.766.780,7
25						
26	OPERATIONAL PROFIT WITHOUT SAAS	1.964.729,00	2.156.459,37	2.337.275,86	2.743.856,55	2.824.091,7
27	INCREMENTAL PROFIT	- 6.338.500,00	- 4.163.873,39	- 1.155.957,10	4.924.602,65	5.942.688,9
28						
29						
30	ROI (Return on Investment)	2,60				
31	IRR (Internal rate of Return)	12%				

Figure 8. Traditional BI initiative. Prediction of the operational profit/ ROI / IRR after eight years of implementation

3.2 Analysing and interpreting the results

The two main outputs ROI (Figure 9) and IRR (Figure 10) will be analyzed based on a histogram, respectively a graph with cumulative descending distribution. Interactions are possible moving the sliders over the diagrams in order to identify the probability to obtain a certain output value (ROI or IRR).

In our case, according to Figure 9, the probability to obtain a ROI smaller than 1.5 is 1.6 percent, fairly sufficient for the company to go ahead with the project investment.

The graph in Figure 10 indicates a mean value for the IRR of 93.84 percent and a 2.3 percent probability to obtain an IRR smaller than 20 percent; 20 percent for IRR is generally accepted to be fairly sufficient for a new project investment in a Romanian company (Popescu, 2009). The probability to get losses is lower than 1 percent, but not zero. This result is a direct consequence of the fact that the minimum sales rate was presumed to be below 100 percent for the second, third

and fourth year.

Nevertheless, if the minimum sales growth rate can be increased to 100 percent, the risk of the project vanishes for good at all.

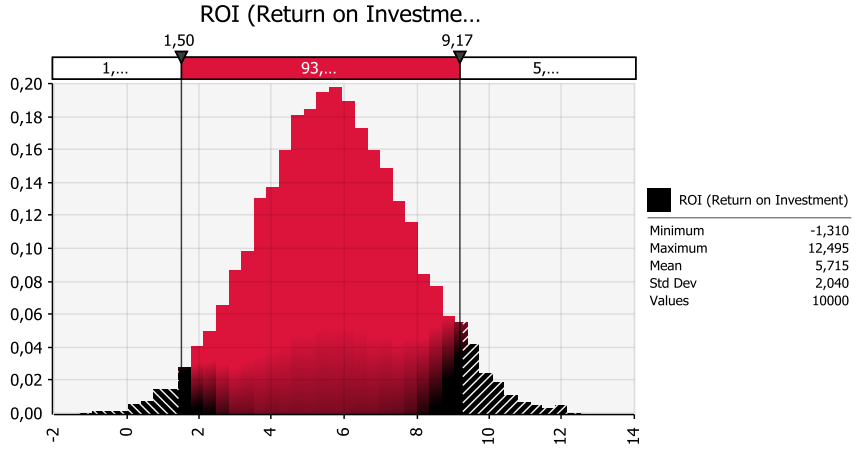

Figure 9. SaaS BI initiative. Results histogram for ROI

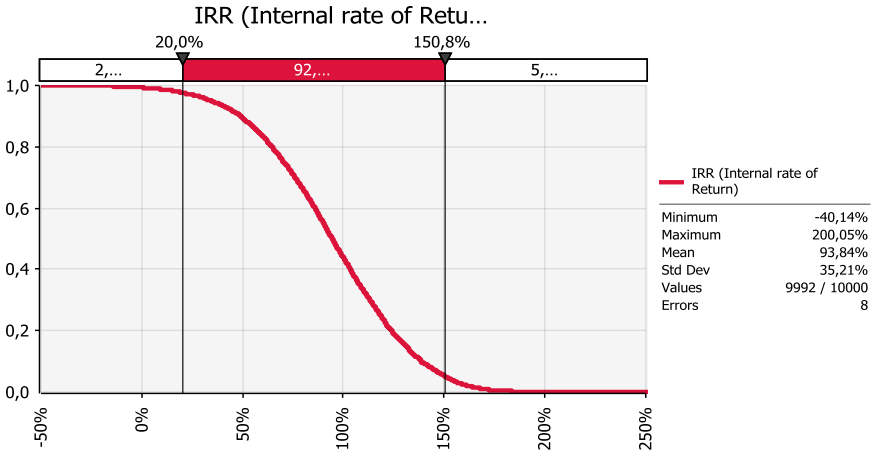

Figure 10. Saas BI initiative. Result graph for IRR

The mean values for ROI and IRR being profitable, the recommendation of a SaaS BI initiative as an advisable solution will be reinforced.

When considering the second variant, that is adopting a traditional BI solution, it is necessary to calculate the IRR and ROI similar to the SaaS variant, but for a few more years instead of just four. Even considering eight years instead of four, the investment is far too big for a midsized company and the probability to obtain losses is impermissible high. The result histogram for the obtained ROI is shown in

Figure 11, and the graph with cumulative descending distribution for the IRR is shown in Figure 12.

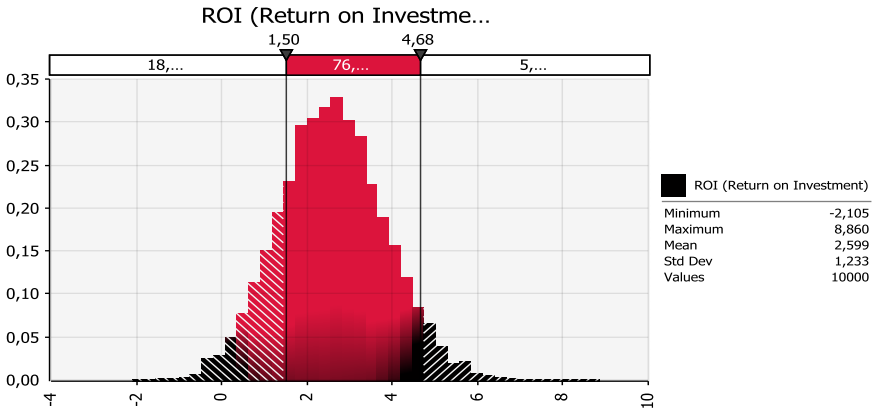

Figure 11. Traditional BI initiative. Results histogram for ROI

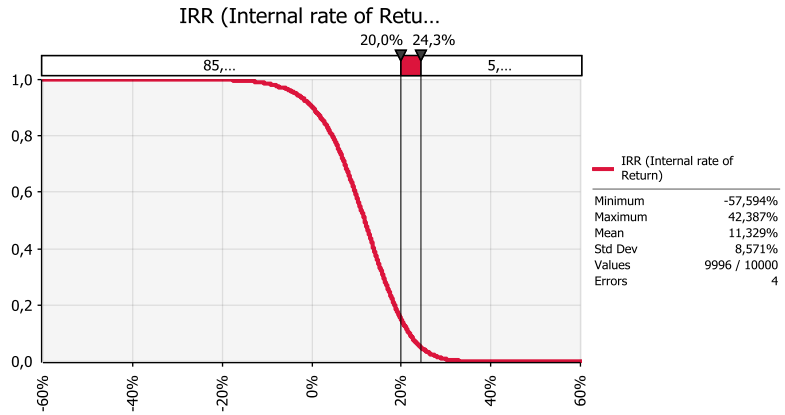

Figure 12. Traditional BI initiative. Result graph for IRR

Here, the probability to get a ROI below 1.5 is 18.7 percent, a pretty big value (in contrast to 1.6 percent, as it was for the SaaS implementation), and even worse is the probability of 85.1 percent (compared with 2.3 percent when adopting the SaaS variant) to get an IRR smaller than 20 percent. Although the mean value obtained for the ROI (2.6) is not definitely bad and the mean value of nearly 12 percent obtained for the IRR is also acceptable, the probability of getting losses is much too high in this case. A traditional BI initiative is not an option for the considered company.

4. Conclusions and future work

Business Intelligence is the process for increasing the competitive advantage of a company by intelligent use of available data in decision-making. Only a revolutionary solution, like a Business Intelligence initiative, can solve the complex issues faced when evaluating decision support applications and ensure the availability of any business-critical information.

Small and medium sized firms have demands for BI solutions, needing systems that take into account users involved in operational actions, not only top managers, using scorecards, key performance indicators, analytical grid, dashboard analysis. But a rigorously feasibility analysis should be performed before starting any BI initiative. To avoid losses, a carefully monetary analysis is necessary. Therefore, a general theoretical approach will be proposed; outputs like ROI and IRR will be determined based on the specified input values and their predictions over the considered time period. Using Monte Carlo simulation techniques, pessimistic, probable and optimistic scenarios are deployed.

The theoretical considerations have been applied to a concrete study case on a Romanian LLC. Predictions of the inputs have been established, simulations have been fulfilled and results have been analysed. As expected, the SaaS BI initiative can be implemented with almost no risks at all.

Future researches have in mind an extended theoretical unitary approach of further financial indicators in order to improve the proposal's capabilities. Thereby, the necessary support for evaluating BI initiatives will be guaranteed. This is an essential first step in helping firms, in particularly Romanian small and medium sized organizations, to become competitive by accumulating the right business intelligence.

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