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Lean Six Sigma Methodologies Applied to the Internal Control of Insurance Companies

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Abstract

The evolution of internal control systems brought also out the fact that risks have evolved, especially in the insurance and reinsurance sector, as outlined below. More often than not, the management of the insurance and reinsurance entities asks the questions: how would it be better? to set up more controls or to target control better? The opinions are divided. Some authors argue that, at present, control being structured in accordance with the information systems, the priority should be given to the legitimacy of these risk-related controls. The issue we want to talk about does not refer to what controls do, what it controls, but rather if it is tailored to the specifics of insurance entities and if it is effective. Even though internal control provides only reasonable assurance, quality-based reflections have proven in terms of effectiveness that they leave room for a fake reassuring logic, namely risk control. In this article, we want to briefly outline some aspects of the Lean Six-Sigma approach as an opportunity to reconcile operational and risk control objectives into a common performance target.

Key words Insurance, Risk, Warranty, Accounting, Hypothesis, Control

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1. Introduction

In all areas of activity, the future of an entity, regardless of the performance it performs, depends on its ability to keep its customers and gain new customers because its consumers are the only sources of income. Therefore, any entity must take into account the requirements of its customers in terms of the quality, the commercial term and the price the customer is willing to pay.

In English, "lean" euphemistically means "easy", meaning an activity "skimmed" of tasks that do not add value to the client. Lean is a management philosophy that aims to optimize the processes and resources needed to properly meet customer’s requests.

By synthesizing the views expressed in the literature, both foreign and indigenous, we can give the following definition to the lean system: "a method of optimizing the performance of any entity that allows, on the basis of a detailed analysis of the different stages of the process of the performed activity, optimization of each stage and each function of the enterprise ".

According to this definition, we can say that the Lean system is based on the principle of reducing waste throughout the activity and thus helps to reduce the costs associated with each step.

Likewise the main purpose of the Six-Sigma method is to bring customer satisfaction. In the Six-Sigma method, this goal is achieved by simultaneously reducing costs and improving quality.

Six Sigma philosophy was originally developed to improve the overall quality of business processes in the manufacturing sector. With the development of new tools and techniques, Six Sigma is nowadays suited to the service sector, especially in financial and insurance companies, contributing to a disciplined approach, to preventing errors and minimizing risks as well as gaining the customers' loyalty.

The slogan of Six-Sigma philosophy is that "it is not enough to be good, to stay on the market you must be excellent."

The essential concern of insurance companies is now no longer to carry out as many controls as possible in order to prevent and limit risks but to adapt them to be as effective as possible.

The Lean Six-Sigma approach is an opportunity to reconcile operational objectives with internal control objectives in a common performance objective. If the quality approach is well-targeted towards the client, the internal control system is not always perceived in this respect, although internal control should be done to meet an internal or external customer's requirements, especially in terms of efficiency and cost-effectiveness. It is often perceived as a cost center that has to make judgments about the possible non-cost benefits.

The risk-based approach, which develops in a significant way, places a particular emphasis on the control system, which is an integral part of risk management and cost reduction.

It is demonstrated that there are few methods that can assess the effectiveness of control devices, and Lean Six-Sigma method comes to their help.

2. Literature review

In order to understand the Lean Six Sigma methodology and its articulation in the internal control system, where it started from and how to be applied in order to obtain the expected results, a brief presentation of each of the two components of Lean and Six Sigma pun upon words is necessary.

The Lean system is a state of mind that aims to increase the added value of a process by suppressing or limiting the waste, methods, techniques, tools and indicators they have in applying Lean philosophy.

The philosophy of thinking Lean is a standardized way of thinking developed at Toyota, the founder of TPS[1]. The interest shown for Lean has led to the emergence of other, more or less closely related principles, according to the authors. Taking into account the phases of the Lean approach outlined by R.Shah and P.T.Ward (2007) and adding some points of view to Barbara Lyonnet, we can emphasize the following:

- Ohno, considered the founding father of TPS, has identified eight principles to describe the production system based on two pillars, JIT and Automation, pillars that Toyota still relies on;
- Womack and Jones are based on five principles (value, value chain, flow, flow - translation into - and perfection), a definition that has become one of the most cited in the past ten years, as M.Holweg (2007))
- James Moore and Gibbon, University of Manchester researchers, and the London Business School researcher Âhlström, used five different principles to define the Lean system. Thus, James Moore and Gibbon were based on the principles of flexibility, elimination of waste, process control, optimization and use of the human resource, while Âhlström relies on waste disposal, best quality, vertical information systems, multi-functional teams and team leader concept;
- Drew *et al.* (2004), consultants of McKinsey & Company, define Lean's expression on the basis of eight principles as a result of adding to previous principles, detecting and solving emerging issues and standardization activities;
- Bruun and Mefford (2004) identify six principles by adding to the five cuts by James Moore and Gibbon;
- Shah and Ward (2007), in order to assess the Lean impact on performance, defines Lean system based on four principles, namely human resource management, maintenance management, JIT and TQM;

Although a number of authors and renowned companies have identified a varying number of principles, a consensus can be drawn on defining the Lean system by grouping all the principles into six

[1] Toyota Production System

common concepts, namely eliminating waste, JIT, quality, continuous improvement, visual management and human resource management.

What can the new Lean bring into the accounting universe? Assuming that the same causes produce the same effects, a standardized process whose execution is perfectly standardized, should always produce the same result. This is not confirmed in all cases, and then there is talked about the variability of processes, this being often a source of dissatisfaction for the client.

As Baldellon and Chometon (2009) assert, inflexibility means that in a moving environment, society must be able to adapt quickly to unexpected events. One of the keys of an organization success is its ability to adapt its fluctuations to the environment or the easy and frequent reconfiguration of its various processes.

To achieve a superior level of quality and lower costs, it would be preferable for each process to be value-adding. Thus the Six-Sigma concept emerged.

A series of authors (Antony *et al*., 2003; Gowen and Tallon, 2005; Linderman *et al*., 2003) argue that Six Sigma is a method that reduces the variability of the most important processes from a customer's point of view and their stabilization is achieved through a statistical approach (George, 2002; Schroder *et al*., 2008; Leseure *et al.,* 2010).

Over time, the effectiveness of the low quality cost optimization method has recorded various values. According to Conti, Kondo and Watson (2003), if Sigma One was recognized for an efficiency of maximum 31%, and low quality cost reduction was a non-quantifiable variable, Six (Sigma) Sigma has a recognized efficacy of 99,9997%, and the low quality cost is less than 10% of the earnings, the accepted level being 3.4 faults or errors per million opportunities.

The Six-Sigma method is associated with the DMAIC[2] and DMADV[3], the acronyms that characterize a standard method of process improvement due to problem elimination.

If DMAIC has focused on optimizing the cost of existing quality in a process (in order to obtain products or services), DMADV is used to optimize the quality of design or design costs.

The Lean Six-Sigma pun unquestionably suggests that we are talking about a new concept based on integrating the good parts that have been taken from Lean with the benefits of Six-Sigma, but without identifying them with any of these. This statement can be supported by highlighting the major differences that exist between the Lean methodology using Kaizen events, the highlighting of the value flow, the tracking of post-work load balancing, the waste analysis (errors) and the Six Sigma methodology based on DMAIC in order to reduce process variability and better targeting towards the customer.

3. Methodology of research

Currently, the economic environment requires many changes in the way entities are managed and structured. This is due to the fact that organizations act in an unstable environment, characterized by rapid, large, dispersed, unpredictable developments in time and space that make the information uncertain. For managers, it is a real challenge to identify the most important avalanche of indicators to stay afloat.

In the context, it can be stated that the assessment of the degree to which the routes followed correspond to the predetermined objectives is achieved through a surveillance that uses various mechanisms combined, generically under the name of control.

Looking ahead, internal control remains channeled into risk management, which forces members of management teams to clearly define objectives by enabling them to make informed decisions about issues to solve and to help target resources get the best results.

The risk management model is a true learning process that is divided into four logically sequenced components that combine to form a whole, namely risk identification, risk assessment, risk tolerance and risk response / risk control.

The main objective of this study is the possibility of identifying the extent to which the internal control is adapted to the specific nature of the insurance entities and its effectiveness.

[2] DMAIC = Define, Measure, Analyze, Improvement and Control
[3] DMADV = Define , Measure, Analyze, Design and Verify.

The starting point in the research was the study of the specialized literature in the field in relation to which we have formulated three hypotheses:

• *Ip.1 - there is a possibility of using Lean Six Sigma in the control of insurance companies;*

• *Ip.2 - it is necessary to integrate the DMAIC model in the market risk control system;*

• *Ip.3 - there is a possibility to apply the VaR model for estimating market risks in an insurance company.*

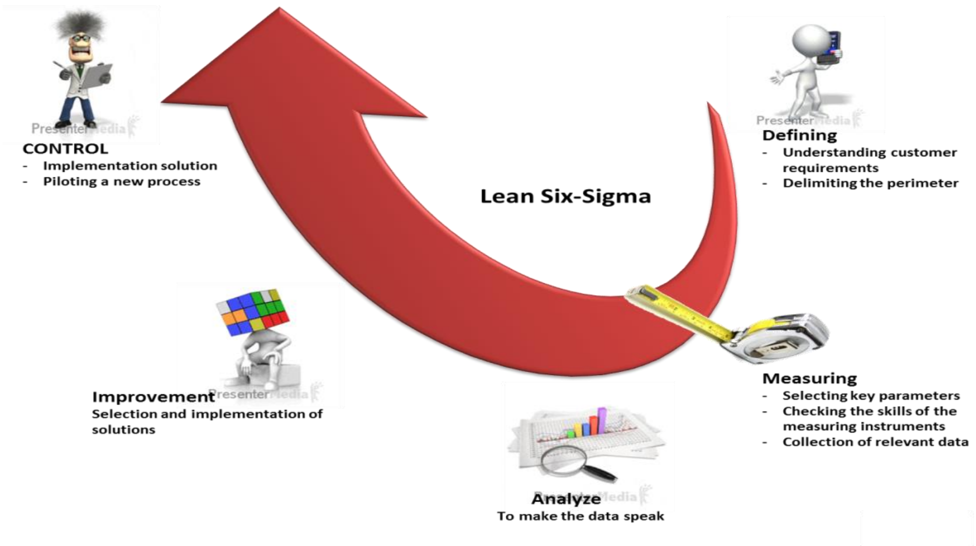
To demonstrate these hypotheses we used qualitative and quantitative data analysis as well as data series analysis based on a deductive reasoning, from general to specific, through a top-down approach, and as a tool we used statistical research using Eview programme.

4. Results and discussions

4.1. Appraisal of the possibility of using the Lean Six Sigma method in the control of insurance companies

Designed by M.L. George (2002), the Lean Six Sigma method has quickly become an interesting method for business, all the more as it integrates and synthesizes a long history of manufacturing.

We have questioned whether the Lean Six Sigma methodology can be applied to the internal control of insurance companies? The answer is definitely YES due to the fact that there are some common points that link this process with the risk control device in the internal control system (Figure 1).



Source: Belongs to the author

Figure 1. Lean Six Sigma Model

The Lean Six-Sigma approach can bring internal control to new perspectives by reducing complexity, through a process that evokes change, adaptability and flexibility, aspects that are sometimes lacking in control, as well as by reducing waste that can take on the following forms of control:

• errors and control incidents;

• overproduction of control results that can be interpreted by unnecessary, time redundant, risk-shifted controls;

• a superfluity resulting from too many control reports;

• poor use of professional knowledge materialized in the realization of controls without the possibility of reacting to certain abnormalities;

• non-ergonomic and less intuitive controls.

Since the internal control system is based on two key variables, controlling any achievement and flexibility, the Lean Six-Sigma method, which aims to optimize an activity by going through the five steps (defining, measuring, analyzing, improving and controlling) allows the manager to answer the basic questions that any service is expecting, namely "what is my business waiting for, what do my collaborators expect?"

4.2. The need to integrate DMAIC into the control system market risks

Referring to the risks associated with the investments, we note that they have different reasons why they take the form of market risk (priced in price risk, currency risk and interest rate risk), liquidity risk and credit risk, our risk analysis market. The application of the internal control standard "Risk Management" depends very much on the activity, environment, culture, organization and objectives of each individual company, the risk management task applied to market risk including the 4 known stages: identification, evaluation, monitoring and control, steps that can be aligned to the design of the DMAIC in order to balance risks with benefits. The conceptual qualitative understanding of this topic of discussion is essential as long as the aim remains to strengthen stability while preserving a reasonable competitive environment.

The tendency of insurance companies, to undermine / overestimate the market risks to which they are exposed, forces risk management as a component of internal control to define and measure market risk, identify the type and source of risk to which it is exposed, as well as the exposure limit that it can endure, which could not be achieved without applying the DMAIC concept based on a series of information on:

• financial instruments, assets and liabilities (and their incompatibility) to which a company is exposed, and the limits of such exposure;

• investment strategy;

• description of any activities that are intended to protect existing investment policy (including non-correction of investment terms of assets and liabilities);

• presentation of the methods and criteria used for measuring the exposure to market derivative instruments (sensitivity tests, limit scenarios, VaR etc.).

The need to integrate the DMAIC model into the market risk control system is a consequence of some deficiencies found in the current stages imposed by the Methodology for Implementing the Internal Control Standard "Risk Management".

Although very well understood, market risk is still undetectable in many positions and the attempt to evaluate it is based on a large number of scenarios. We refer to less liquid assets and liabilities that cannot be objectively and reasonably assessed. Fortunately, adoption of IAS/IFRS favors the recording of fair values of assets and liabilities without affecting the company's profit reporting and thereby encourages greater market risk.

4.3. Apply the Value at Risk (VaR) model for risk assessment market to an insurance company

The Value at Risk (VaR) model is among the latest models that have emerged and rarely used to assess asymmetric risks, such as those associated with investments. The VaR model, above all, serves to quantify market risk in monetary units to which a probability and time horizon are connected.

In our view, the VaR goal is not to describe the worst possible scenario but to estimate a range of possible gains or losses.

Sydor (2007) defines VaR as the maximum loss of portfolio value under normal market conditions for a confidence level and a given holding period. The VaR is based on statistical distributions, standard deviation and confidence intervals, the choice of each parameter being made according to various criteria, including the intended purpose and the level of risk that can be accepted. The precondition is that the portfolio does not change over the analyzed period, which is why shorter periods are chosen (10-30 days for example).

The analysis we want to present is demonstrative in view of the intended purpose.

a) The evolution of the assets related to the fund units during the period 2011-2015, respectively of the investments related to the contracts for which the exposure to the investment risk is transferred to the contractors, is presented according to the data in table no. 1.

b) Working hypotheses:

• the level of investments in euro is maintained in 2016;

• The average euro/lei during N-1, calculated on the basis of the daily fluctuation, was 4.49 lei;

- The number of fluctuation days (t) in 2016 was 254 days;
- Estimated volatility for year N is 9%;
- Daily volatility: VZ = VA * √t, where VA = annualized volatility, where: VZ = 9 / √254 = 0,5647% or 0,005647.

Table 1. Evolution of assets of fund units

Year / Money	2011	2012	2013	2014	2015
Ron	1.186.419.111	1.309.969.737	1.441.894.406	1.577.582.651	1.641.173.089
Euro	13.719.050	34.792.922	43.566.959	62.151.297	97.337.854
USD	19.559.680	20.670.742	20.043.642	24.959.542	24.640.520
Total	1.219.697.841	1.365.433.401	1.505.505.007	1.664.693.490	1.763.151.463

Source: Data collected by the author of the Annual Financial Statements prepared by the insurance company

c) Working methodology:

1. calculation of possible deviations[4]:

- for a standard deviation:

H = 4.4900 * (1 + 1.00 * 0.005647) = 4.5154
L = 4.4900 * (1-1.00 * 0.005647) = 4.4646

- for two standard deviations:

H = 4.4900 * (1 + 2 * 0.005647) = 4.5407
L = 4.4900 * (1-2 * 0.005647) = 4.4393

2. The VaR calculation for 95% and 99% confidence intervals, the placement of 97,337,854 euros equivalent to 437,046,964 lei

- For the first standard deviation

VaR = 0.005647 * 437.046.964 = 2.468.004

- for two standard deviations

VaR = 0.005647 * 2 * 437.046.964 = 4.936.008

3. Fluctuation band euro/leu

For the first standard deviation

- in the range of 4.4646 - 4.5154 a gain or loss of no more than 2.468.004 lei may be recorded (gain if the euro rises above 4.4900, loss if it falls below 4.49 lei/euro)

for the second standard deviation

- in the range of 4.4393 - 4.5407 there may be a gain or loss of 4,936,008 lei (gain if the euro rises above 4,4900, loss if it falls below 4,49 lei/euro)

4. Analysis on confidence intervals according to standard values

- for 95%

1.6449 * 2.468.004 = 4.059.620

- for 99%

2.5758 * 2.468.004 = 6.357.085

5. Validation

In 95% of the time, the loss/earnings will not exceed 4,059,620 lei and in 99% of the time, the loss will not exceed the threshold of 6,357,085 lei. There is a 5% chance that the euro will be less than 4.4646 lei/euro. To validate the conclusions we reached, we used the GARCH model on the volatility of the euro/lei exchange rate in the EViews statistical program. Based on the euro data series in 2016, we compiled the

[4] The standard deviation is a dispersion indicator that shows the scattering of the individual values around the sample average

series of natural logarithms and the first difference according to the following relationships obtained through the EViews program:

- the natural logarithm of the euro exchange rate:

course_euro_ln = @log (course_euro) (1)

- the first difference of the natural logarithm series:

dln_curs_euro = d (course_euro_in) (2)

which leads us to the result in Figure 2:

Dependent Variable: DLN_CURS_EURO
Method: ML ARCH - Generalized error distribution (GED) (BFGS / Marquardt steps)
Date: 03/02/17 Time: 11:17
Sample (adjusted): 2 254
Included observations: 253 after adjustments
Convergence achieved after 33 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(1) + C(2)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(3)*RESID(-1)/@SQRT(GARCH(-1)) + C(4)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Variance Equation				
C(1)	-6.874066	4.614814	-1.489565	0.1363
C(2)	0.417658	0.182107	2.293475	0.0218
C(3)	0.013530	0.114112	0.118571	0.9056
C(4)	0.494204	0.350150	1.411408	0.1581
GED PARAMETER	1.211167	0.160789	7.532633	0.0000

R-squared	-0.000178	Mean dependent var	2.11E-05
Adjusted R-squared	0.003775	S.D. dependent var	0.001586
S.E. of regression	0.001583	Akaike info criterion	-10.16936
Sum squared resid	0.000634	Schwarz criterion	-10.09953
Log likelihood	1291.424	Hannan-Quinn criter.	-10.14127
Durbin-Watson stat	2.254117		

Figure 2. The GARCH test applied to the euro exchange rate

The coefficient of volatility in the average equation, being positive, shows that when the volatility increases, the RON depreciates (the EUR/RON rate increases).

The asymmetry coefficient in the c (3) volatility equation is statistically significant and shows that if the rate has risen in the previous period, volatility is reduced.

The fluctuation of the euro/leu exchange rate, presented in Figure 3, confirms that the volatility is not linear. There are periods in which volatility is very high and followed by periods of very low volatility, but the evolution of past information significantly influences the yields present, which confirms the VaR calculation previously presented.

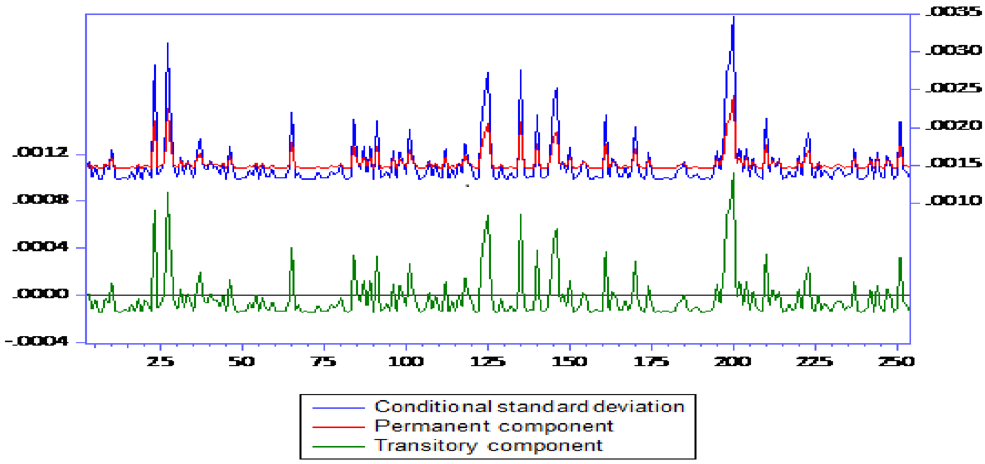


Figure 3. Volatility of the euro/leu exchange rate

For the exercise of prudential rules (hedging), it is necessary to determine the amount of capital required to meet the euro investment obligations according to the following relationship:

Required Capital = 3 * VaR + Mandatory Minimum Capital (3)

Taking into account the current regulation regarding the obligation of a life insurance company to constitute a minimum share capital of 12,000,000 lei, we obtain the following result:

- for the first deviation

Capital required = 3 * 2.468.004 + 12.000.000 = 19.404.012 lei

- for the second deviation

Required capital = 3 * 4,936,008 + 12,000,000 = 26,808,024 lei

Considering the share capital at 31 December 2015 of RON 244,615,617, constantly at this level during the analyzed period, we consider that foreign exchange risk is covered, both for plasmas in euros and for dollar placements.

5. Conclusions

The Lean Six-Sigma methodology had to be researched by integrating it into the particular sector of the insurance sector and focusing on the DMAIC (definition, measurement, analysis, improvement, control). The result of the research undertaken as a conclusion of the scientific approach was to customize the DMAIC model on the example of an insurance company for estimating market risks in which we integrated the Value at Risk (VaR) model - one of the latest models and widely used for the assessment of asymmetric risks, such as those associated with financial investments.

The conclusion we reached is that it is time to find the notion of efficiency in new control systems and Lean Six-Sigma is an opportunity in this direction. Lean Six Sigma application requires rethinking the control system as a separate process with clear objectives to be achieved.

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