*International Journal of Latest Research in Scienceand Technology***ISSN (Online):2278-5299**
Volume 6,Issue 4: Page No.14-21 ,July-August 2017
https://www.mnkpublication.com/journal/ijlrst/index.php

TREND ANALYSIS OF THE INSTITUTO POLITECNICO NACIONAL HIGHER EDUCATION LEVEL INDICATORS

[1]NashiellyYarzábal Coronel,[2]Tonáhtiu Arturo Ramírez Romero, [3]Maricela Cuellar Orozco
[1]SEPI,ESIME, IPN, [2]Instituto Politécnico Nacional, [3]Instituto Politécnico Nacional
nasyarza@hotmail.com,tonahtiu@yahoo.com, mcuellaro@ipn.mx
México

Abstract-This article presents an analysis of the academic trend of approved, dropout and desertion of students, in the high school level in the InstitutoPolitecnicoNacional, has collected information from 19 campus distributed in five states of Mexico, The history is processed from 2005 to 2016. A function of adjustment by least squares is calculated using a straight line, and with this, we know the trend from the slope, as well as the calculation of the adjustment functions to interpolate other values in a near future.

Keywords : Trend analysis, educational indicators, least squares

I. INTRODUCTION

Between the Knowledge era, Mexico has the opportunity to grow and to be economically strong through the Education. This strategy is the most important because the education will be possible to push out the country the poverty rate, for that reason need to develop technology. It could be possible if the student have the strongest education and knowledge, and also we can include technology during the teaching learning process.

In order to contribute to the improvement of high school education, the indicators are analyzed, the tendency is taken to make decisions and to generate a favorable change for students.

II. EDUCATIONAL PERFORMANCE

In the midst of a highly communicated and digitized world that brings unimaginable amounts of information, it would be desirable for less developed countries to move faster into the first world or towards better living standards.

Mexico, as a developing country, has in education a valuable alternative to getting ahead of poverty, especially an economy dependent on hydrocarbons and low technological production. Education is the lever of development that drives the country, because the objective of this, is to train individuals and therefore aspire to a better country.

According to the InstitutoPolitecnicoNacional's 2015 Self-Assessment Report [1], it mentions the following data for the 2014-2015 cycle: the percentage of students in the Higher Education Level approved all the learning units studied is 56.28%, as shown in the Figure 1.

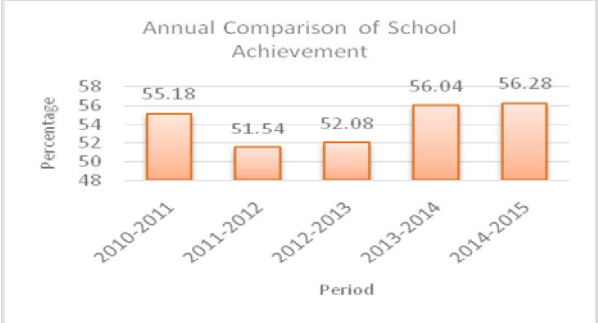

Fig. 1 Annual Comparison of the Achievement in the last five years
Source: Annual Evaluation IPN 2015

The Figure 1, shows a simple representation of the last five years the result for the learning of the students. These numbers represent that approximately half of the students approve the subjects in each period.

Below is shown the percentage of disapproval during the last five years.

Fig. 2 Annual Failure Comparisonin the last five years

Publication History
Manuscript Received : 29 June 2017
Manuscript Accepted : 20 July 2017
Revision Received : 30 July 2017
Manuscript Published : 31 August 2017

Source: Annual Evaluation IPN 2015

The Figure 2, shows a simple representation of the last five years the result for the failed students.

This number represents that they did not learn enough to prove the subject. This situation also has the consequence that students cannot continue on a regular basis with their preparation or even leave school.

The percentage of students leaving the school is shown below.

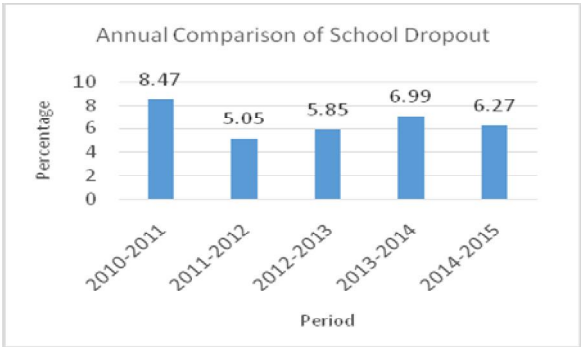

Fig. 3 Annual comparison of school dropout in the last five years
Source: Annual Evaluation IPN 2015

The figure3, shows a simple representation of the last five years the result for the School dropout of the students.

The serious situation of the indicators of approval (figure 1), reprobation (figure 2) and Dropout (figure 3), must be attended by analyzing in an integral way the high school level of the IPN; This as other educational systems, is conformed by essential factors such as: students, teachers, authorities, support staff, educational model, normativity and the environment that affects the above.

According to the United Nations,chapter Educational, Scientific and Cultural Organization [2] one of the basic requirements of 21st century education is to prepare the population to participate in an economy based on knowledge, including social and cultural perspectives. As a result, education and learning are two key aspects of UNESCO's mandate and most of the expected results in terms of Information technology diffusion.

The situation of reprobation, terminal efficiency and dropout of students represent challenges for the directors of these centers; One of the causes is the high rate of reprobation of the subjects of Sciences (Chemistry, Physics and Mathematics), since it contributes to the deficient results already mentioned. In this baccalaureate modality, the situation is accentuated, because the curriculum map includes Chemistry I, II, III, IV, Physics I, II, III, IV and Mathematics I, II, III and IV, as well as technological subjects.

For the Centers of Scientific and Technological Studies of the mathematical - Physical area, the high index of reprobation of the science subjects in both shifts is extremely worrisome since this causes that the objective of discharge is not met, besides the consequent desertion of the students by existing regulations. This problem of the reprobation of materials causes the student to miss his studies, because when he fial one of these serial units of learning, he loses the opportunity to study the subsequent ones; So it will require more time to finish their studies, among many other difficulties.

The Organization for Economic Cooperation and Development (OECD) [3] defines quality education as that which "assures all young people the acquisition of the knowledge, skills, skills and attitudes necessary to match them for adult life".

Another definition according to Braslavsky C. the quality of education refers to "one that allows everyone to learn what they need to learn, at the right time in their lives and their societies and in happiness"[4].

Ph.D. Arturo de la Orden, Hoz [5], of Spanish origin, who is an expert in educational evaluation by the Universidad Complutense de Madrid, is the author and developer of a model I call systemic, not because others are not, but because In it we clearly see that the concept of quality of education is associated with the coherence relations between the different components of its model. The accuracy of concepts, both evaluation, educational evaluation and quality of education. As expressed in the definition of Evaluation is essentially a judgment of value on a reality, it is based on a comparison. Comparison and judgment are thus the essential components of the evaluation[6].

Indicators as tools for the evaluation of the quality of education systems, establish that a good educational system is one that meets the following qualities, which define abstract dimensions of the notion of quality: Establishes a curriculum Adapted to the individual needs of students (relevance) and those of society (relevance). It ensures that the highest possible proportion of recipients reaches the school, stays there, and achieves learning objectives (internal and external effectiveness). It allows learning to be assimilated long-term and result in fruitful social behaviors for society and individuals (impact). It has sufficient resources (sufficiency) and uses them well (efficiency). It takes into account the inequality of situations and supports those who require it, so that the objectives are reached by the greatest possible number (equity).

Consequently, "... any process that is assumed as an institutional evaluation has as a requisite and indispensable condition the participation of the educational community ... hence the evaluation has as a fundamental characteristic self-evaluation" [7].

The demand for hard actions has led the experts to combine their knowledge to obtain better results, this is how third generation indicators have been developed, which according to Horbath&Gracia. [8] A third generation indicator is a synthesis of different dimensions of a phenomenon or object of study. In this sense, it is synergic or

transversal type because it incorporates different attributes under the assumption that they are comparable and complementary to each other. These indicators should respond to assessments of interdependence between levels of basic education and the articulation between the spaces of schools, both the internal spaces and the school environment. In addition they must be comparable between different levels of territorial aggregation (municipal, state, national and international) and have internal and external consistency.

From another point of view, the quality of an institution may depend on constant improvement; When an organization, be it a private company or an institution, undertakes an improvement project to be more competitive, there are diverse opinions on how to achieve this, which are grouped into two essential categories:

1. Qualitative Analysis
2. Mathematical modeling ("hard" or formal) of some or all processes.

With which performance forecasts are produced, predictive models are used to project educational attainment, in order to make decisions that impact on educational systems, as mentioned [9].

Alsoproactive approach should use the data-rich environment that is being generated in order to achieve more effective management for education that must be based on student success, performance indicators that are measured in order to support accurately the mission of education. [10].

Some schools show their performance through their indicators of which the following stand out by their academic nature: the Profitability Index, Desertion Index and the Terminal Efficiency Index.

In the IPN this is also considered as a reflex of state that keeps the average upper level. Below is the average of these indicators of the average upper level of the IPN in the last five years as can see in the table 1.

Table 1 Average of the Indicators of academic nature

Indicators	Average in the last eleven years
Approved	55.73%
Dropout	36.73%
Desertions	7.52%

Indicators in educational institutions are a reflection of reality and are used for decision making; Reason why it is considered important to be able to know their behavior in the future.

In other areas of knowledge, different techniques and methods are used to predict scenarios through knowledge of forecasts or trends, which further enriches the analysis and contributes significantly to decision making.

Forecast Models are ranking alternatives based on objective data analysis. Also, include different type of data (time series, linguistic values, interval data, etc.) in decision support systems are assuming criteria as independent. Therefore, these models give a correct information for take good decision. [12]

In this technological time filled with so much information, organizations have the opportunity to analyze their data to improve their activities. Contemporary data centers rely heavily on forecasts to accurately predict future workload. The accuracy of a forecast greatly depends upon the merit of performance data fed to the underlying algorithms. One of the fundamental problems faced by analysts in preparing data for use in forecasting is the timely identification of data discontinuities. [13]

Also the grey forecasting model has achieved good prediction accuracy with limited data andhas been widely used in various research fields. However, the grey forecasting model still have some potentialproblems that need to be improved, such as applicate range and prediction accuracy. "new information priorusing" principle is followed, and a liner function is adopted in the construe of background. Numerical examples verified that the simulation and prediction accuracy of the short-term forecasts is significantly increased. As a result, the newly improved model yields a high prediction capability. [14]

Other Methodology can produce now casting and forecasting of GDP, which estimate the missing variables using multivariate k-nearest neighbors' method and parametric vector autoregressive (VAR) modeling. In this methodology is necessary linking these monthly macroeconomic variables through the use of bridge equations. This method, is better thanthat obtained with a competitive linear VAR modeling, also provide the asymptotic normality of this k-nearest neighbors regression estimator for dependent time series, as a confidence interval for point forecast in time series. [15]

The calculation of forecasts is a necessity for different sectors, for that reason different methods or techniques are used. In addition to the method it is necessary the data that are involved in the calculation of the forecast.

The influencing factors, forecast methods, and forecast results has ascertained that the key premises of forecasts mainly rely on historical production and reserves, which excludes the effects of other factors such as the market, resource, technology, environment, transport, safety, new energy and policy. In addition the data standards and ports of the historical data are not uniform.

The scenario analysis forecasting method is less than the trend extrapolation forecasting method.All of findings demonstrate great deviations betweenthe forecasting outcomes and the actual situations. The use of realistic factors of situation should be a precondition to improving the distortion of the current forecasting.These factors should include the macroeconomic slowdown, reductions, supply-side reforms, and new technology, which will be the key constraints in remodeling the forecasts. [16]

For that reason and to obtain better results and decrease the difference between the forecast and reality, one must consider the context of the situation and the environment in which it develops in an integral systemic way.

The calculation of forecasts is applied in several areas of knowledge for exam the Research on Stock Price a chaotic genetic algorithm optimized least square support vector machine model for economic forecasting is proposed.

A multi-scale search strategy combined with genetic algorithm is employed for the selection of optimum parameters of the model. The use of GDP time series data as the input data to the model can also overcome the shortcoming of difficult to sum up all the affecting factors of the wanted indicator in other nonlinear methods. Simulation shows that this proposed model has better performance than BP network: faster convergence, greater generalization ability and more accurate prediction. It reduces the average error rate from about 25% by BP network to less than 2%.[17]

Some other methods employ other economic indicators such as investment in fixed assets, value-added of industry, retail price index as the explanatory variables to forecast the GDP. And meanwhile nonlinear methods such as artificial neural network (ANN) are also used. This method presents a deficient result since some variables have high errors which makes it unreliable to the method. [18]

In organizational settings, forecasting is also used the mix of games theory with the real options has been a dynamic range of exploration in the most recent decade. The engaging quality of the specialists for displaying aggressive speculation choices by blending ideas from both hypotheses is on account of a venture choice in a focused business sector can be seen, in its substance, as a "game" between firms.

A model to consider finite horizon real option games under incomplete information with various parameters; In incomplete information games, firms' actions express significant information about profitability to contestants. The methodology is an extended version of the Least Squares Monte Carlo algorithm to confront these results.

So that the model can aid in understanding the relation between strategic optionality and information besides how this influences the best decision policy and its value results. We find the informational feature is of great significance for firms' best decision policy and optimization of project values. [19]

One of the most used methods is the Longstaff-Schwartz least squares Monte Carlo method is one of the most applied numerical methods for the price of American-style derivatives.

We examined the step of regression of the algorithms, demonstrating that the OLS regression is not the best unbiased linear estimator due to heteroscedasticity.

We try the existence of heteroscedasticity for individual and multi-asset payments numerically and theoretically, and propose the MC method of weighted least squares to correct it. An extensive numerical study it shows that the proposed method produces a price bias significantly lower than that of Longstaff-Schwartz under several well-known price dynamics. An empirical exercise of pricing using the advantages of the improved method. [20]

III.DEVELOPMENT

For the prediction of the tendencies in this work we use the method of interpolation of least squares. Adjustment by least squares there are numerous physical laws in which it is known in advance that two magnitudes x and y are related through a linear equation :

$$y = mx + b \qquad (1)$$

The equation 1 represent the equation of the line.

Where the constants*b* (ordered at the origin) and *m* (slope) depend on the type of system being studied and, often, are the parameters to be found.

In this case variable *m* represent the period of the indicator, the variable *b* represents the date of the indicator

An effective method of determining parameters *m*,*b* are known as the least squares.

The method of interpolation by least squares, can be adjusted to different equations, most common is a straight line, but also can be used an exponential or a polynomial, this method takes a history of ordered pairs of (x, y), each point represents A real or experimental historical value, usually on x-axis represents time, but may represent other aspects, the method consists in determining an adjustment equation, which minimizes the distances of the real value on the y-axis to y and determined by An example of this can be seen in Figure 4.

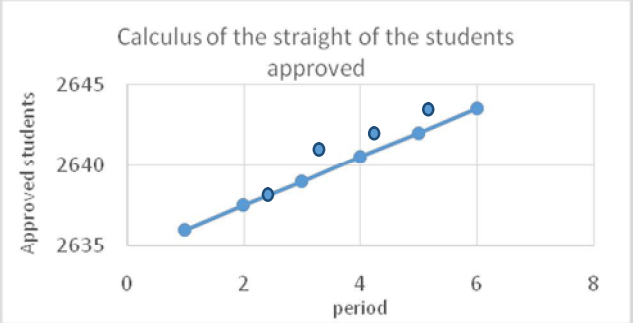

Fig. 4. Calculus of the straight

This graph shows the calculation of the straight as a trend based on the results of approval of the students, in some cases the results do not touch the line so we must calculate the error that represents the distance of each point with respect to the line.

Therefore, a point interpolation can be performed through this method, by calculating the equation of the line of those involved variables, concluding in the following equations:

$$m = \frac{n\sum_{i=1}^{n} f(x_i)x_i - \left(\sum_{i=1}^{n} f(x_i)\right)\left(\sum_{i=1}^{n} x_i\right)}{n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2} \quad (2)$$

$$b = \frac{\left(\sum_{i=1}^{n} f(x_i)\right)\left(\sum_{i=1}^{n} x_i^2\right) - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} f(x_i)x_i\right)}{n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2} \quad (3)$$

Where n is the number of samples

The values in the equations are replaced to obtain m (slope) and b (ordered to the origin)

In table 2, show the indicator variables used in this study. The Scholar period represent axis x, we Calculate the equations of the line for the variables: Approved, School dropout, Desertions.

Table 2 Indicators of academic nature

i	Scholar Period	Approved	Students Failed	Dropout	Number of students
1	2005-2006	28441	13278	3069	44788
2	2006-2007	28250	16900	2401	47551
3	2007-2008	30047	14895	5109	50051
4	2008-2009	25332	19273	4230	48835
5	2009-2010	29654	19810	4815	54279
6	2010-2011	30532	20115	4684	55331
7	2011-2012	29703	25017	2908	57628
8	2012-2013	32271	23641	5601	61513
9	2013-2014	36034	22976	4881	63891
10	2014-2015	36551	23970	4074	64595
11	2015-2016	33823	24674	4247	62744

Calculation of fit function for approved variable.

In table 3 the summaries are now calculated.

Table 3Data of approved students, for least square calculus

I	x_i	$f(x_i)$	x_i^2	$x_i * f(x_i)$
1	1	28441	1	28441
2	2	28250	4	56500
3	3	30047	9	90141
4	4	25332	16	101328
5	5	29654	25	148270
6	6	30532	36	183192
7	7	29703	49	207921
8	8	32271	64	258168
9	9	36034	81	324306
10	10	36551	100	365510
11	11	33823	121	372053
	$\sum_{i=1}^{11} x_i =$	$\sum_{i=1}^{11} f(x_i) =$	$\sum_{i=1}^{11} fx_i^2 =$	$\sum_{i=1}^{11} x_i f(x_i) =$
	66	340638	506	2135830

The sums obtained in Table 3 are replaced in equation 2

$$m = \frac{11(2135830) - (340638)(66)}{11(506) - (66)^2}$$

$$m = \frac{23494130 - 22482108}{5566 - 4356}$$

$$m = \frac{1012022}{1210}$$

m=836.381

Now we replace variables in equation 3

$$b = \frac{(340638)(506) - (66)(2135830)}{11(506) - (66)^2}$$

$$b = \frac{172362828 - 140964780}{5566 \quad 4356}$$

$$b = \frac{31398048}{1210}$$

b = 25948.8

Now the function of approximation with the line is constructed.

f(x) = 836.381(x) + 25948.8 (4)

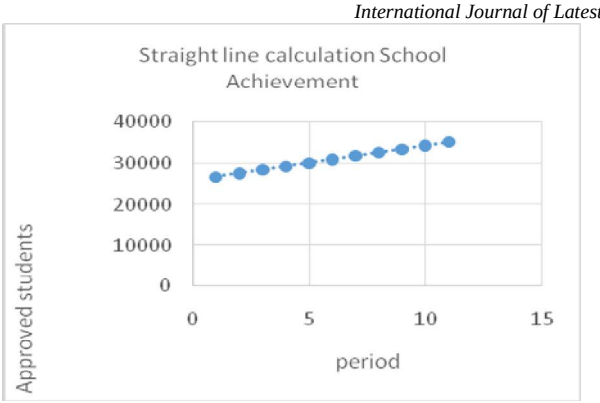

Fig. 5 Calculation of fit function for approved variable

We show the calculation of $f(x_1)$ given $x_1 = 1$
$f(x_1) = 836.518(1)+25948.254$
$f(x_1) = 26784.772$
$f(x_1) \approx 26785$

We show the calculation of $f(x_2)$ given $x_2 = 2$
$f(x_2) = 836.518(2)+25948.254$
$f(x_2) = 27621.29$
$f(x_2) \approx 27621$

Now we show in table 4, the actual values for f (x) and the interpolated ones to determine the percentage error.

Table 4. Calculus of error of the fit function approved

x_i	$f(x_i)$	$f(x_i)$ interpolated	Difference
1	28441	26785	1656
2	28250	27621	629
3	30047	28458	1589
4	25332	29294	-3962
5	29654	30131	-477
6	30532	30967	-435
7	29703	31804	-2101
8	32271	32640	-369
9	36034	33477	2557
10	36551	34313	2238
11	33823	35150	-1327
	$\sum_{i=1}^{11} f(x_i) =$		$\sum_{i=1}^{11} abs(dif(y)) =$
	340638		17340

Where
abs() - Function to calculate the absolute value
$dif() - f(x_i) - f(x_i)_{interpolated}$

The error for 11 samples with the fit function, obtained in equation 4 is:

If 340641 = 100%
Then 17337 = $error_1$

$error_1$=5.08%

Calculation of fit function for Failed Student variable.

For the calculation of this function of adjustment by minima squares it follows the same procedure that was seen in the approved variable, therefore only the function, the representative graph and the calculation of error are show

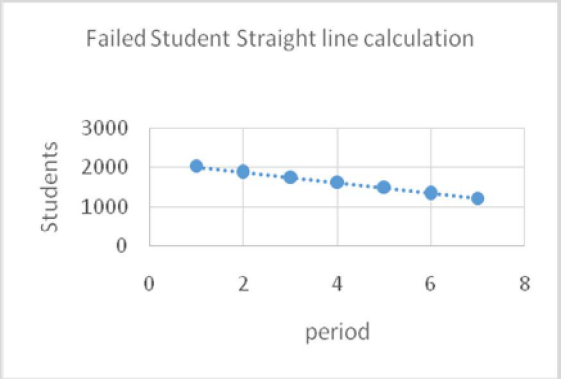

Fig. 6 Calculation of fit function for Student Failedvariable

$f(x) = 1122.2x+13680$ (5)

Table 5. Calculus of error of the fit function school dropout

x_i	$f(x_i)$	$f(x_i)$ interpolated	Difference
1	13278	14802	-1524
2	16900	15925	975
3	14895	17047	-2152
4	19273	18169	1104
5	19810	19291	519
6	20115	20414	-299
7	25017	21536	3481
8	23641	22658	983
9	22976	23780	-804
10	23970	24902	-932
11	24674	26025	-1351
	$\sum_{i=1}^{11} f(x_i) =$		$\sum_{i=1}^{11} abs(f(x_i) - \text{int}(f(x_i))) =$
	224549		14124

Then if 224549 = 100%
14125 = $error_1$

$error_2$=6.29%

Calculation of fit function Drop out (Desertions) variable

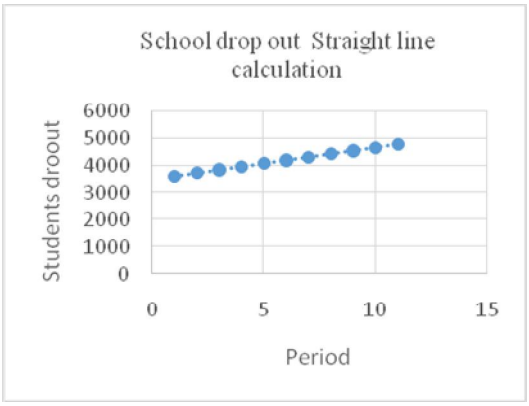

Fig. 7 Calculation of fit function for desertion variable

f(x) = 115.75x+3489 (6)

Table 5. Calculus of error of the fit function desertions

x_i	$f(x_i)$	$f(x_i)$ interpolated	Difference
1	3069	3605	-536
2	2401	3721	-1320
3	5109	3836	1273
4	4230	3952	278
5	4815	4068	747
6	4684	4184	500
7	2908	4299	-1391
8	5601	4415	1186
9	4881	4531	350
10	4074	4647	-573
11	4247	4762	-515
	$\sum_{i=1}^{11} f(x_i) =$ 46019		$\sum_{i=1}^{11} abs(f(x_i) - \text{int}(f(x_i))) =$ 8669

If 46019 = 100%
Then 8669 = $error_3$

$error_3$ = 18.83%

IV. CONCLUSIONS

The analysis of the academic indicators of the IPN, it is feasible to analyzer it by the method of least squares, because this method is reliable when the errors less than 10% since this allows to have a vision of the certain future for the decision making.

The behavior is linear and given the positive slope m, the three variables are rising.

For future research is intended a correlation analysis of the different variables with Big Data, in order to know the conditions in which it can intervene to improve the situation of the indicators.

ACKNOWLEDGMENT

We like to express sincere appreciation and deep gratitude to all participants in this work.

Authors kindly acknowledge financial and computational infrastructure support from InstitutoPolitécnicoNacional to facilitate the development of this work.

REFERENCES

[1] IPN (2015) Autoevaluación 2015 del Instituto Politécnico Nacional IPN. (DIC de 2015). *Gestion Estartegica - Evaluación.*Obtenido de Autoevaluación 2015. [Online]. Available: http://www.gestionestrategica.ipn.mx/Evaluacion/Paginas/InfoAutoeval.aspx

[2] Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. (UNESCO, 2017) Las TICs en la Educacion Aprendizaje Electronico.[Online]. Available: http://www.unesco.org/new/es/unesco/themes/icts/e-learning/

[3] Organización para la Cooperación y el Desarrollo EconómicoOCDE (2010) Organización para la Cooperación y el Desarrollo Económicos (2010) *Acuerdo de cooperación México-OCDE para mejorar la calidad de la educación de las escuelas mexicanas*. [Online]. Available: http://pnd.gob.mx: http://www.oecd.org/edu/school/46216786.pdf [27 de Mayo de 2015]

[4] Braslavsky, C. (2006). Diez factores para una Educación de Calidad para Todos en el siglo XXI. Revista Electrónica Iberoamericana sobre Calidad, Eficacia y cambio en Educación (REICE) Vol. 4, Nº2e. p. 87 [Online]. en: http://www.rinace.net/arts/vol4num2e/art5.pdf

[5] De la Orden Hoz,La Función Optimizante De La Evaluación De Programas Evaluativos, Revista de Investigación Educativa, 2000, Vol. 18, nº 2, págs. 381-389

[6] Martínez, F. (2010) "Los indicadores como herramientas para la evaluación de la calidad de los sistemas educativos" en*Sinéctica*, 35, pp. 50-62. [Online]. Available: http://sinectica.iteso.mx/assets/files/articulos/... [10 de Junio de 2015]

[7] Gozanlez, L., & Ayarza, H. (1997). Calidad, evaluación institucional y acreditación en la eduacion superioir en la región Latinoamericana y del Caribe. *La educación superiori en el sigloXXI Visión America Latina y el Caribe La Habana Cuba*.Caracas : UNESCO.

[8] Horbath J & Gracia M. la evaluación educativa en México: una propuesta de indicadores de tercera generación para valorar procesos y resultados, *Temas de Coyuntura*/64-65 (Diciembre 2011-Junio 2012): pp. 69-96

[9] Wen & Tang(2016) On the fit and forecasting performance of grey prediction models for projecting educational attainment,*Kybernetes*,Vol. 45 No. 9, 2016, pp. 1387-1405

[10] Chad L, Springer, J, Corey S& Li, N (2017) "Impacting big data analytics in higher education through Six Sigma

techniques",International Journal of Productivity and Performance Management, Vol. 66 Issue: 5, doi: 10.1108/IJPPM-09-2016-0194

[11] Ramírez Fabián, Zwerg-Villegas Anne Marie, Metodología de la investigación: más que una receta p. 92 Revista AD-minister,Universidad EAFIT, Número 20 Medellín, enero-junio 2012.

[12] Hamido Fujita, Risks-Forcast@People-in-Clouds: Big Databased Clouds Healthcare and Risk Forecasting based on Subjective Intelligence CINTI 2015 • 16th IEEE International Symposium on Computational Intelligence and Informatics Budapest, Hungary, 2015.

[13] Haroon Malik, Elhadi M. y Shakshuki. Performance Evaluation of Techniques to Detect Discontinuity in Large-scale-systems, Procedia Computer ScienceVolume 94, pp. 324-331 USA Canada, 2016.

[14] Xiangyun Liu, HongqinPeng*, Yun Bai, Yujun Zhu, Lueling Liao Tourism Flows Prediction Based on an Improved Grey GM(1,1) Model, The 9th International Conference on Traffic & Transportation Studies (ICTTS'2014) MOE Key Laboratory for Urban Transportation Complex Systems Theory Technology,Beijing Jiaotong University, Beijing 100044, China

[15] Guégan Dominique,RakotomarolahyPatrick, Chapter 8 Alternative Methods for Forecasting GDP, in FredjJawadi, William A. Barnett (ed.) Nonlinear Modeling of Economic and Financial Time-Series (International Symposia in Economic Theory and Econometrics, Volume 20, Emerald Group Publishing Limited, pp.161 – 185, 2010.

[16] Shuai Han, Hong Chen∗, Ruyin Long, Xiaotong Cui, Peak coal in China: A literature review, School of Management, China University of Mining and Technology, Xuzhou, Jiangsu 221116, PR China Resources, Conservation and Recycling Journal.[Online]. Available: www.elsevier.com/locate/resconre Elservier2016.

[17] Wei Yu, Zhiming Chen, FEiLuo, An improved chaotic genetic algorithm optimized LS-SVM method for economic forecasting, Proceedings of the 8th World Congress on Intelligent Control and Automation July 6-9 2010, Jinan, China

[18] Zhiheng Zhang;Shijie Ye, Long Term Load Forecasting and Recommendations for China Based on Support Vector Regression, International Conference on Information Management, Innovation Management and Industrial Engineering, IEEE Computer Society 2011

[19] AbdollahArasteh, Considering the investment decisions with real options games approach Industrial Engineering Department, BabolNoshirvani University of Technology, Babol, Iran, Renewable and Sustainable Energy Reviews 72 (2017).pp. 1282–1294.[Online]. Available: www.elsevier.com/locate/rser

[20] Fabozzi F., Paletta T., Tunarub R. An improved least squares Monte Carlo valuation method based on heteroscedasticity, European Journal of Operational Research 000 (2017) 1–9