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Environmental Performance Evaluation of some Industrial Firms Duto to ISO 14031 Standard

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Abstract

ISO 14031 is the member of the ISO 14000 series of standards that addresses environmental performance and used for assessment this performance. An Environmental Performance Indicators(EPIs) for ten industrial activities in the middle Euphrates region at: Babylon, Al-Najaf and Karbala governorates were constructed and applied. The data of EPIs were collected by form of questionnaire ; the forms used to collect data of EPIs, and these forms were applied it a Reliability test and get Reliability value 89.5%. Then, the appreciation rate(RA) results of indicators were compared with the management standards (standard 80%) to determine performance extent and suggest suitable solutions. The results of this study indicate that there is no management or quality system applied on these factories selected in study area also no environmental policy. The Maximum unaccepted percentage of RA was 27.5% for a performance and infrastructure indicator at rubber products factory in al-Najaf governorate, this is due to different reasons such as little production and limited of quality of production, instruments and technique in the manufacturing process were old, also communication process limited, also the maximum unaccepted percentage was 17.5% for the quality and environmental policy indicator where a babylon governorate because there is no environmental policy in babel grain factory by clear aims and it also doesn't have limits of the important aspects which have important impact on environmental or its activities, and the maximum unaccepted percentage of industrial and occupational safety indicator was 47%. Either a maximum percentage of RA was 100% for puraching operation indicator at many factories in case study

Key words: EPIs, Environmental Performance, ISO 14031, Plan-Do-Check-Act

1. Introduction

ISO 14031 is the member of the ISO 14000 series of standards that addresses environmental performance, the ISO 14031 is an international standard that describes a process for measuring environmental performance, too it is not a standard for certification, as ISO 14001. The EPE tool is designed as a management tool to quantify, understand and track the relevant environmental aspects of a system, and to provide management with reliable and verifiable information on an ongoing basis to determine whether or not its organization's environmental performance is meeting criteria it has set for itself. ISO 14031 is also being used by organizations of all sizes, types, locations, and complexity, and it provides benefits to organizations with and without environmental management systems in place [1].

ISO 14031 focus central aspects related to the construction and it used of environmental performance indicators (EPIs) for environmental performance evaluation in industrial companies [2], Despite the diversity of methods and tools for measuring environmental performance, indicators always play a central role. To assure that environmental performance indicators (EPIs) serve the purpose for which they are intended and to control the way they are specifically selected and developed, it is important to organize them into a framework [3]. where Indicator data provide the means to understand whether environmental impacts are greater or lesser under management systems or prescriptive approaches [4] and; The number of environmental performance indicators(EPIs)could range from 5 to 80, showing the great diversity of objectives and approaches [5].

EPIs may be used on a macro level by external stakeholders for regulatory, control, influence and risk minimization purposes. They may also be used on a micro level inside the company for goal setting, control and surveillance of product performance and performance of manufacturing and administrative processes [2].

Development of the environmental performance indicators system is based on various fundamentals: The type and dimension of the sector; Baseline environmental sensitivity; major significant environmental aspects; the identification of impacts which have poor accuracy or lack of basic data; Other related environmental monitoring programs; and The importance of indicators satisfying the information desires of the stakeholders (internal and external) [5].

Many studies tried to applied the EPE as follow

David; 2002 implemented of EPE at Mother Diary, while **(Xinfeng Zhao ;2003)**[19] tried to facilitate the Environmental Performance Evaluation (EPE) in healthcare sector by selecting a set of Environmental Performance Indicators (EPIs) applicable at norfolk & norwich university hospital, and **(Alanya and Ozturk ;2005)**[22] undertook to develop and apply the specific EPIs to be able from determine the current environmental performance level of the textile sector in Turkey.

The aim of this study is implemented of EPE Due to to ISO 14031 Standard for some industrial activities in middle Euphrates region of Iraq.

2. Framework of Environmental Performance Evaluation (EPE)

For conducting effective EPE, a framework, which assists the understanding of environmental issues, is helpful. The Organization for Economic Cooperation and Development (OECD) developed the “Pressure-State-Response (PSR)” framework in 1991.

The PSR framework states that human activities exert pressures on the environment, which can induce changes in the state of the environment. Society then responds to changes in pressures or state with environmental and economic actions intended to prevent, reduce or mitigate pressures and/or environmental damage [6].

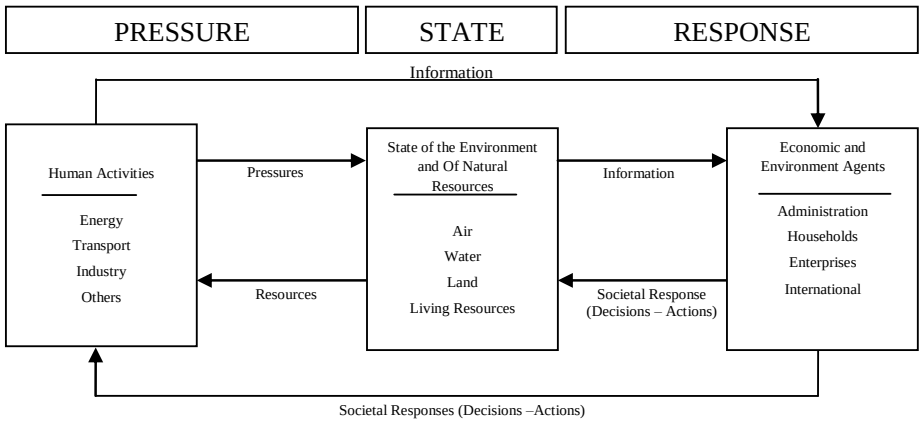

Figure 1: Pressure - State - Response Framework [6]

3. Continual Improvement Process of ISO 14031

The process described in this standard is based on the process improvement model (**Plan-Do-Check-Act) (PCDA**).

A. Plan (Preparation): focus of planning efforts on the indicators select, which should be based on significant environmental aspects, environmental performance criteria and the views of interested parties.

B. Do (Assessing Performance): Assessing performance involves [7]:

(1)-selection (e.g. developing or choosing) of indicators for EPE measurement (e.g. collecting data) [8].

(2)-analysis and conversion of data into information describing the organization's environmental performance, expressed as indicators for EPE [8].

(3)-assessment and reporting: after data have been analyzed and converted into performance information, expressed in terms of EPIs they should by compared with the organization's environmental performance and quality criteria This comparison may indicate improvement, or weaknesses in environmental performance. The information describing the organization's environmental performance and the results of comparison should be reported to management, in order to support appropriate management actions to improve environmental performance. [9]

c. Check and Act (Reviewing and Improving Performance): EPE results should be reviewed periodically to identify opportunities for improving environmental performance and EPE system [5].

4. Area of Study:

The performance indicators in the middle Euphrates region of Iraq (Babylon, Al-Najaf and Kerbela) was studied. The numbers and types of industrial activities selected for applying the performance indicators, there were: (1) textile factories, (1) chemical industries factory, (1) grain mill factories, (4) cement factories, (1) lime factory, (1) rubber products factory, and (1) dairy products factories, respectively.

5. Data collection:

the fill lists of indicators by data in this study base on many way, then some indicators depended on the testing and measuring, and others depended on the interviews, observations, regulatory reports, inventory and production records, environmental review, assessment reports, environmental training records, and scientific/research studies and reports.

6. Methodology of Study:

6.1 Construction indicators and assessment it.

Construction indicators assessment it depends on **(PCDA**) model, these Lists depended on six references([10], [11], [12], [9], [13],and [5]), and it consist from eight main indicator that it was arrange in tables as follow:(1-Performance and Infrastructure Indicator, 2-Quality(Goodness) and Environmental Policy Indicator, 3-Training Indicator, 4-Industrial and Occupational Safety Indicator, 5-Measurement and Continuous Improvement Indicator, *6*-Arrangements Production and Services Indicator, *7*-Puraching Operation Indicator; 8-Environmental Control Indicator) with different numbers of sub-indicator or (criteria) for each one of indicator. These indicators classify under Environmental performance indicators (EPIs) and Environmental condition indicators (ECIs).The cause of selective above indicators in this study that is applicable in industrial sector of study area. This form of list was arranged to include the necessary information about indicators of organization.

Reliability of questionnaire Tool was calculated, the internal reliability (or consistency) of test (or Questionnaire) is measured by Cronbach's α, A "high" value of alpha is often used as evidence that the items measure an underlying (or latent) construct. Cronbach's α is defined as:

$$\alpha = \frac{N.\bar{C}}{\bar{v}+(N-1).\bar{c}} \qquad \text{…….Eq.(1)}$$

Where:- N: number of items (in this study n= no. of criteria for each indicator) , $\bar{C}$ the average inter-item covariance among the items, and $\bar{V}$: equals the average variance [14].

The factor α used to determine the reliability of the form of indicators; the form was studied by ten of the committee staff of college of engineering Babylon University. SPSS programs used to compute reliability value of these indicators as shown below:

Table1 : Indicators reliability

Indicator	one	Two	Three	Four	Five	Six	Seven	Eight	Total
N of Items	14	11	6	3	6	5	3	4	52
Reliability	87.8	84.7	88.4	84.2	90.0	87.7	86.2	92.9	89.5

A Complete Analysis for data of indicators that taken from the forms after completing a questionnaire for all industrial facilities in case study, where used some statistical computations to analysis it. Analysis process and the calculation of appreciation Rate and mean of questionnaire forms data must contain on the following statistical steps [15]:

1- seven range is limited for each indicators and given importance scale (Likert Scale) for each range

First range 90 ≤ Excellent ≤ 100 importance (7)

Second range	80	≤	Very good	<	90	importance	(6)
Third range	70	≤	Good	<	80	importance	(5)
Fourth range	60	≤	Medium	<	70	importance	(4)
Fifth range	50	≤	Accept	<	60	importance	(3)
Sixth range			Rare	<	50	importance	(2)
Seven range			Un-inquiry	=	0	importance	(1)

2- Calculation the relative frequency for the indicators and each criteria In indicators.

$$Relative\ frequency = \frac{\sum f}{n} \qquad \text{…….Eq.(2)}$$

Where:- f: frequency of category, n: total number of data reads, Max.end: maximum end

3- Calculation the mean frequency for the indicators and criteria with in indicators

$$Frequency\ mean = relative\ frequency * significance\ factor \qquad \text{…….Eq.(3)}$$

4- Calculation frequency mean from the following equation:

$$Mean\ of\ Appreciation\ (MA) = \sum frequency \qquad \text{…….Eq.(4)}$$

5-Calculation the appreciation rate to all indicators by *Rate of Appreciation*

$$Rate\ of\ Appreciation\ (RA) = \frac{\sum Appreciation\ mean}{total\ number\ of\ significance} \qquad \text{…….Eq(5)}$$

6- Calculation the average appreciation rate for all criteria in one indicator and this percentage should be equal to

$$Appreciation_{Rate\ from\ Max\ end} = \frac{max.end}{\sum Appreciation\ mean\ for\ all\ criteria} \qquad \text{…….Eq(6)}$$

$$Max.end = number\ of\ criteria * total\ number\ of\ significance \qquad \text{…….Eq(7)}$$

7- a comparison of indicators values were done with the 80% as limit accept. So each value of appreciation rate of indicators equal or greater than 80% acceptable Otherwise it is unacceptable

6.2 Variance Analysis

Is the tactic of splitting differences in the total set of observations to the different components of the differences derived from different sources, some known and others are completely unknown. Fisher has enabled to develop statistical method for measuring the degree of freedom and the differences in the experiences that contain more than two factors, called analysis of variance [16].

The magnitude of the variance limits by F value and which was calculated by division mean square for treatments on the error mean square [17]. The computations for this test procedure are usually summarized in tabular form as shown in Table (2). This is called an analysis of variance (or ANOVA) table.

Table2 : The Analysis of Variance for a Single-Factor Experiment, Fixed-Effects Model [17]

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_0
Treatments	$SS_{\text{Treatments}}$	$a \_ 1$	$MS_{\text{Treatments}}$	$\frac{MS_{\text{Treatments}}}{MS_E}$.
Error	SS_E	$a(n \_ 1)$	MS_E	
Total	SS_T	$an \_ 1$		

All this step of analysis in single direction is adopted for data analysis of indicator after multiplying by significance, and this way of analysis is developed by SSPS programs (version. 17) for computing F and significance.

7. Result and discussion

based on the process improvement model (Plan-Do-Check-Act) (PCDA) of ISO 14031 that use for constructed indicators and assessment selected fctories of study area the result of application this model explain as follow:

1- General indicators :-the general or final appreciation rate to all factories selected in the middle Euphrates region is77.1 from table 3, while at Karbala, al-Najaf, and Babel governorates is 77.1, 79, and 75.9 respectively, all it lower than limited standard. These numbers indicate that, it do not find environmental performance system applied in accurate form at activities, this come back to delay by catching on in the industry sector recently. This cause also lacks in modern technology, old the instruments and buildings, and lack of control devices to minimize pollution although saves scientific experiences of workers delay of applying the system of environmental and goodness in industrial activities.

2- Performance and Infrastructure Indicator: all factories have unaccepted appreciation rate to this indicator except cement factories of al-Najaf al-ashraf and Karbala, the minimum percentage of RA for criteria of mentioned indicator was 12%in General company for Textile. This little rate duo to don't found governmental industrial support for production and don't saves appropriate environmental conditions to performance, subsequently the quantity of production is reducing which it was the main cause in decreasing values of this indicator

3- Quality(goodness) and Environmental Policy Indicator:- Any factory of the study area doesn't get certification of quality system, also don't get the certification of management system but some factories try to get certification of quality system, specially Al-kufa cement factory therefore most percentage of this indicator match to criteria.

4- Training Indicator:-Training is an important factor and must be available in any organization to develop skills of workers. Training process depends upon need range to acquire skills for workers. The most RA percentage acceptable, this proves that training indicator is available in a study area.

5- Industrial and Occupational Safety Indicator:-The main cause which make all rate in this indicator unaccepted as in tables below don't saves healthy services for workers to treatment them when occur sudden

6- Measurement and Continuous Improvement Indicator:-The magnitudes of RA for this indicator indicate that always found measurement and improvement process in activities from its members to improve production process therefore, the result always accepted.

7- Arrangements Production and Services Indicator:-all appreciation rate are accepted for all factories in a study area for this indicator.

8- Puraching Operation Indicator:-Also here, all appreciation rate are accepted for all factories in a study area

The following tables illustrate the results of analysis, values of appreciation $_{rate}$ for each indicators

Table 3: the mean and Rate of appreciation for all factories

I	Ni=1		Ni=2		Ni=3		Ni=4		Ni=5		Ni=6		Ni=7		Ni=8	
	Max.end=98		Max.end=77		Max.end=42		Max.end=21		Max.end=42		Max.end=35		Max.end=21		Max.end=28	
1	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA
1	4.5	64.3	4.8	68.6	6.4	91.4	4.8	68.7	6.1	87.1	7	100	7	100	3.1	44.3
2	6.2	88.6	4.2	60	5.3	75.7	6.1	87.1	6.2	88.6	6.7	95.7	6.4	91.4	5.2	74.3
3	6	85.7	5.8	84.3	4.9	70	1.9	27.1	6.8	97.1	6.4	91.4	7	100	1.9	27.1
4	4.3	61.4	5.5	78.6	5.6	80			6.8	97.1	6.3	90			2.4	34.3
5	4.9	70	5.6	80	4.4	62.86			4.6	65.7	6.1	87.1				
6	5.5	78.6	5.8	82.8	5.8	82.86			7	100						
7	4.4	62.86	5.5	78.6												
8	5.9	84.28	6.1	87.1												
9	6.7	95.7	4.8	68.6												
10	5.9	84.3	5.5	78.6												
11	6.7	95.7	5.3	75.7												
12	5.8	82.86														
13	3.1	44.3														
14	4.8	68.6														
Tot	**74.7**	**Av=76.22**	**58.9**	**Av=76.6**	**32.5**	**Av=77.1**	**12.8**	**Av=61**	**37.5**	**Av=89.3**	**32.5**	**Av=92.84**	**20.4**	**Av=97.1**	**12.6**	**Av=45**
$AV_{from\ Max.end}$=77.1									**AV_{FINAL}=77.1**							

Table4: the mean and Rate of appreciation for all factories Karbala governorate

I	Ni=1		Ni=2		Ni=3		Ni=4		Ni=5		Ni=6		Ni=7		Ni=8	
	Max.end=98		Max.end=77		Max.end=42		Max.end=21		Max.end=42		Max.end=35		Max.end=21		Max.end=28	
	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA
1	4.67	67	4.66	66.6	6.67	95.3	2.99	42.7	6.33	90.4	7	100	7	100	2.77	42.6
2	6.34	90.5	4.95	70.7	5.33	76.1	5.67	81	5.94	85	6.34	90.6	6.34	90.6	5.02	71.7
3	6.34	90.5	5.94	85	4.34	62	2	28.6	7	100	7	100	7	100	1.33	19
4	4.66	66.5	5.33	76.1	7	100			7	100	7	100			3.3	47.1
5	4.34	62	5.67	81	4.29	61.3			5.94	85	6.34	90.6				
6	5.28	75.4	6	85.7	5.66	81			7	100						
7	4.29	61.3	5.67	81												
8	4.95	70.7	5.94	85												
9	6.67	95.3	4.33	62												
10	4.29	61.3	5.33	76.1												
11	6.67	95.3	5	71.4												
12	6.67	95.3														
13	3.65	52														
14	5.67	81														
tot	**74.49**	**AV=76**	**58.8**	**AV=76.4**	**33.29**	**AV=79.2**	**10.7**	**AV=51**	**39.21**	**AV=93.4**	**33.7**	**AV=96.2**	**20.3**	**AV=97**	**12.4**	**AV=45.1**

$AV_{fromMax.end}$=77.1	**AV=77.1**

Table5: the mean and Rate of appreciation for all factories in al-Najaf governorate

I	Ni=1		Ni=2		Ni=3		Ni=4		Ni=5		Ni=6		Ni=7		Ni=8	
	Max.end=98		Max.end=77		Max.end=42		Max.end=21		Max.end=42		Max.end=35		Max.end=21		Max.end=28	
1	MA	RA	MA	RA	ME	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA
1	4.62	66	4.95	70.7	7	100	6.32	90.5	6.33	90.4	7	100	7	100	2.98	42.6
2	6.01	85.8	4.29	61.3	5.33	76.1	6.67	95.3	5.66	80.8	6.33	90.4	5.94	85	5.02	71.7
3	6.01	85.8	6.67	95.3	4.62	66	1.67	24	7	100	5.94	85	7	100	1.33	19
4	3.96	56.6	6	85.7	6.67	95.3			7	100	7	100			1.67	24
5	5.28	75.4	5.94	85	4.29	61.3			3.66	52.3	7	100				
6	5.35	76.4	6.67	95.3	6.33	90.4			7	100						
7	5.35	76.4	6.34	90.6												
8	6.34	90.6	5.94	85												
9	6.33	90.4	5.61	80.1												
10	6.01	85.8	5.94	85												
11	6.33	90.4	5.67	81												
12	5.33	76.1														
13	3.32	47.4														
14	4.34	62														
tot	**74.6**	**Av= 76.1**	**64.02**	**Av= 83.2**	**34.24**	**Av=81.5**	**14.7**	**Av= 70**	**36.7**	**Av= 87.3**	**33.3**	**Av= 95.1**	**20**	**Av= 95**	**11**	**Av=39.3**
$AV_{From\ Max.end}$=79									**AV=79**							

Table5 : Summery to mean and Rate of appreciation for all factories in Babylon governorate

I	Ni=1		Ni=2		Ni=3		Ni=4		Ni=5		Ni=6		Ni=7		Ni=8	
	Max.end=98		Max.end=77		Max.end=42		Max.end=21		Max.end=42		Max.end=35		Max.end=21		Max.end=28	
1	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA	MA	RA
1	4.25	60.7	4.75	67.8	5.75	82.1	5	71.4	5.75	82.1	7	100	7	100	3.25	46.4
2	6.25	89.3	3.5	50	5.25	75	6	85.7	6.75	96.4	6.75	96.4	6.75	96.4	5.5	78.6
3	5.75	82.1	5.25	75	5.25	78.6	2	28.6	6.5	92.8	6	85.7	7	100	2.5	35.7
4	4.25	60.7	5.25	75	3.75	53.6			6.5	92.8	6	85.7			3	42.8
5	5	71.4	5.25	75	4.5	64.6			4.25	60.7	5.25	75				
6	5.75	82.1	5	71.4	5.5	78.6			7	100						
7	3.75	53.6	4.75	67.8												
8	6.25	89.3	6.25	89.3												
9	7	100	4.5	64.3												
10	7	100	5.25	75												
11	7	100	5.25	75												
12	5.5	78.6														
13	2.5	35.7														
14	4.5	64.3														
Tot	**74.75**	**Av= 76.2**	**55**	**Av= 71.4**	**30**	**Av= 72**	**13**	**Av= 61.9**	**36.75**	**Av= 87.5**	**31**	**Av=88.6**	**20.7**	**Av= 98.8**	**14.2**	**Av= 51**
$AV_{From\ Max.end}$=75.7									**AV=75.7**							

Table 6: the mean and Rate of appreciation to every factory

Ni	al-sada Cement factory		al-najaf al-ashraf Cement factory		Al-kufa cement factory		Karbala cement factory		Lime-Karbala factory		General company Textile industries		Furat company for chemical industries		Rubber products factory		Al-wessam company for dairy products		Babel grain mill factory	
	Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56		Max.end=56	
	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE	ME	RE
1	5.504	78.6	5.71	81.6	6.22	88.8	5.77	82.5	4.776	68.2	4.92	70.3	5.49	78.4	4.06	58	5.42	77.4	5.43	77.6
2	5.37	76.7	6.81	97.3	6.1	87.1	5.76	82.3	5.01	71.6	5.09	72.7	4.88	69.7	5.01	71.6	5.37	76.7	4.63	66.1
3	5.32	76	6.81	97.3	5.67	81	5.34	76.3	6.33	90.4	4.62	66	4.82	68.8	5.17	73.8	5.17	73.8	5.32	76
4	4.29	61.3	5.35	76.4	5.02	71.7	3.32	47.4	2.99	42.7	3.96	56.6	4.01	57.3	4.29	61.3	4.29	61.3	4.95	70.7
5	6.5	92.8	6.5	92.8	6.34	90.6	6.5	92.8	6.5	92.8	5.83	83.3	6.66	95.1	5.82	83.1	6.6	95.1	5.53	79
6	5.8	83	5.8	82.8	6.2	88.6	7	100	6.2	88.6	6.6	94.3	6.4	91.4	6.6	94.3	7	100	6	85.7
7	7	100	6.34	90.6	7	100	7	100	7	100	7	100	7	100	6.67	95.3	6.34	90.6	6.67	95.3
8	2.75	39.3	2.75	39.3	2.75	39.3	2.75	39.3	4	57.1	2.75	39.3	5.25	75	2.75	39.3	2.75	39.3	3	42.8
Tot / AV	42.5	76	46.07	82.3	45.3	80.9	43.4	77.5	42.8	76.4	40.8	73	44.51	79.5	40.	72.1	42.94	76.7	41.53	74.2

The next step of this work is a verification results of appreciation rate from maximum end and average appreciation rate for criteria in the one indicator, as a following figure: -

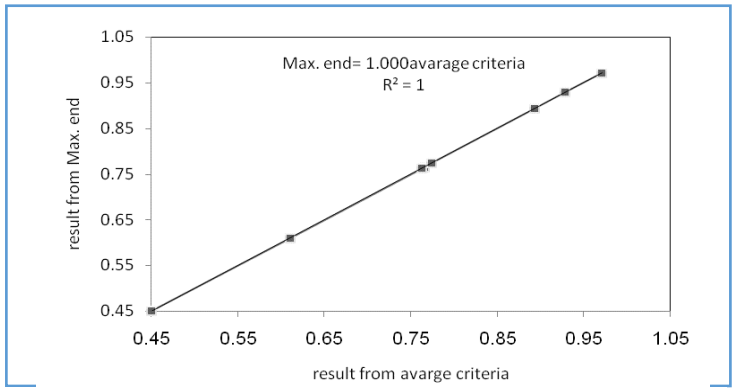

Figure2 : checking appreciation rate of indicators for all factory

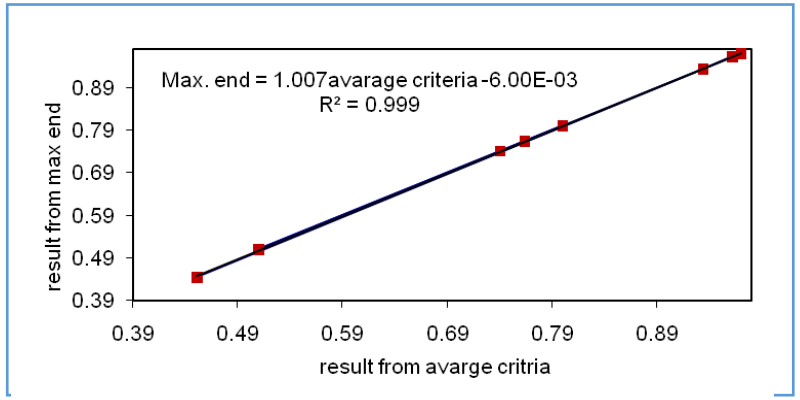

Figure 3: checking appreciation rate of indicators for Karbala governorate

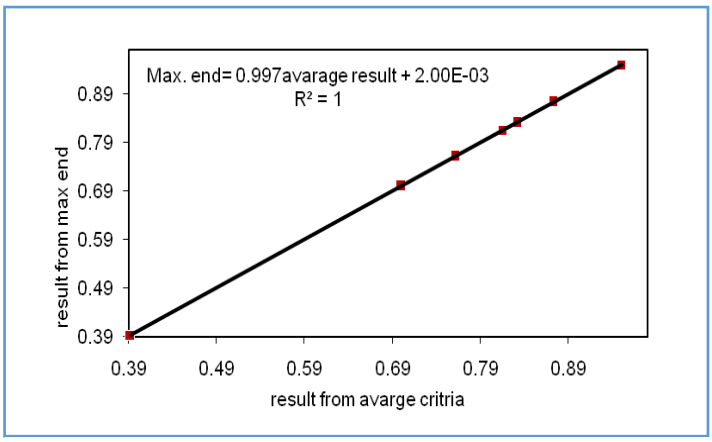

Figure 4 checking appreciation rate of indicators for al-najaf governorate

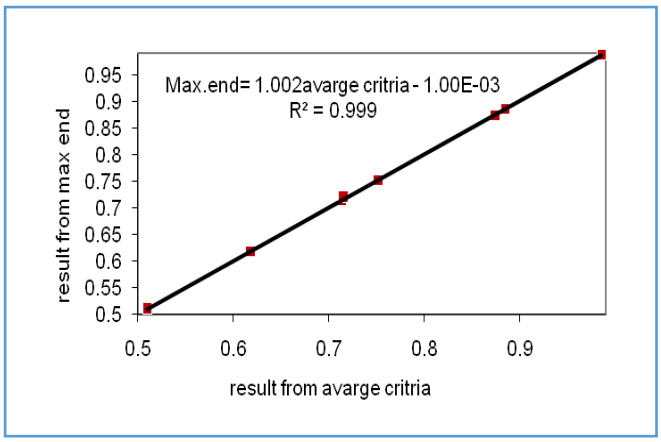

Figure 5 checking appreciation rate of indicators for Babel governorate

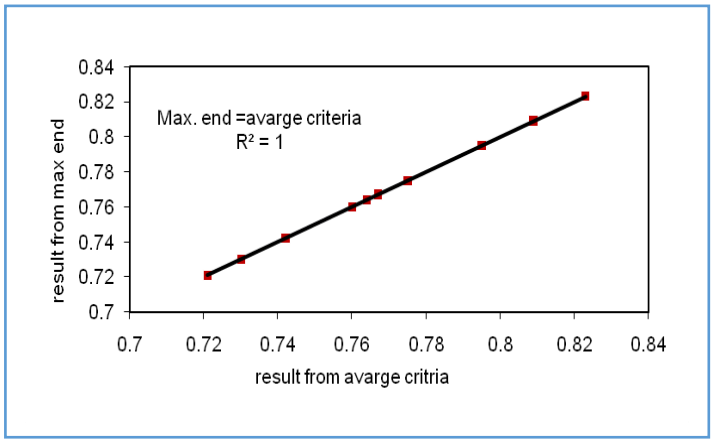

Figure 6 checking appreciation rate of indicators for every factory

Table (8 and 9) shows the result the variance analysis to the Data of indicators from applying an SPSS programs. F computed and significance comparison with F(1-α),v1,v2 and (α=0.05) respectively to explain the if it's found impact for data of indicators on analysis process(i.e. suitability data).

The accepted value of F when a result of **F** computed from spss program < $F_{(1-\alpha),v1,v2}$ and significant > (α=0.05), all results of **F** of this case study accepted, this indicate all data are suitable and don't any impact from data ofindicators on evaluation process.

Table7 analysis of variance for the data of indicators for each factory

Factory	Variance source	Sum of Squares	DF	Mean Square	F computed	Sig.	F from table
al-Sada Cement factory	Treatments	1.735	7	.248	.125	.996	2.304
	Error	95.270	48	1.985			
	Total	97.005	55				
al-Najaf al-ashraf Cement factory	Treatments	3.073	7	.439	.243	.972	2.304
	Error	84.836	47	1.805			
	Total	87.910	54				
Al-kufa cement factory	Treatments	1.714	7	.245	.091	.999	2.304
	Error	129.606	48	2.700			

	Total	131.320	55				
Karbala cement factory	Treatments	2.561	7	.366	.135	.995	2.304
	Error	129.958	48	2.707			
	Total	132.519	55				
Lime-Karbala factory	Treatments	1.938	7	.277	.124	.996	2.304
	Error	107.427	48	2.238			
	Total	109.365	55				
General company for Textile industries	Treatments	2.252	7	.322	.159	.992	2.304
	Error	97.165	48	2.024			
	Total	99.417	55				
Furat company for chemical industries	Treatments	1.072	7	.153	.059	1.000	2.304
	Error	124.758	48	2.599			
	Total	125.830	55				
Rubber products factory	Treatments	1.784	7	.255	.174	.989	2.304
	Error	70.266	48	1.464			
	Total	72.050	55				
Al-wessam company for dairy products	Treatments	1.905	7	.272	.120	.997	2.304
	Error	108.798	48	2.267			
	Total	110.703	55				
Babel grain mill factory	Treatments	1.406	7	.201	.109	.997	2.304
	Error	88.257	48	1.839			
	Total	89.663	55				

In the same manner, repeat a calculation process for computation the F for all factories, karbala, babel, and al-najaf data of indicators

Table 8 analysis of variance for the data of indicator

Number of indicator	for all factories		for Karbala factories		for al-najaf factories		for Babylon factories		F from table
	F computed	Sig.	F computed	Sig.	F computed	Sig.	F computed	Sig.	
One	.112	1.000	.080	1.000	.060	1.000	.106	1.000	2.304
Two	.037	1.000	.021	1.000	.033	1.000	.037	1.000	2.304
Three	.057	.998	.073	.996	.067	.997	.089	.994	2.304
Four	.783	.472	.442	.649	.502	.613	.625	.547	2.304
Five	.030	1.000	0.009	1.000	.056	.998	.042	.999	2.304
Six	.004	1.000	.003	1.000	.007	1.000	.018	.999	2.304
Seven	.003	.997	.004	.996	.011	.989	.000	1.000	2.304
Eight	.287	.835	.280	.839	.379	.769	.197	.898	2.304
Total	1.136	.357	1.003	.441	1.086	.387	1.005	.440	2.304

The accepted value of F when a result of **F** computed from spss program < $F_{(1-\alpha),v1,v2}$ and significant > (α=0.05), all results of **F** of this case study accepted, this indicate all data are suitable and don't any impact from data of indicators on evaluation process

8. Conclusions and Recommendations

Based on results study, the following points can be concluded:

1. Environmental Performance Evaluation (EPE) procedure is most useful for any factories, because the strengths of (EPIs) for quantifying risks, trends and benchmarking it with previous years. If monitored regularly they thus serve as an early warning system.

2. The EPE of the middle Euphrates region have demonstrated that the region will have a significant environmental challenges in future for economic and human development. Environmental policies in middle Euphrates cities need further coordinated efforts and joint action for effective implementation of it.

3. The factories of the study area don't practice ISO 9000 for the quality of products and ISO 14000 for quality of environment.
4. The middle Euphrates region applied Environmental Performance Evaluation system (EPE) which depended on a set of indicators: the application percentage is77percentage.
5. All factories, which located in the study area, have accept measurement and continuous improvement, arrangements of production and services, and puraching operation indicators.
6. The maximum unaccepted percent for indicators of middle Euphrates region is environmental control indicator (43.75%).
7. The unaccepted maximum percentage Performance and Infrastructure Indicator (27.5%) from al-Najaf governorate, Quality(Goodness) and Environmental Policy Indicator(17.375%) and Training Indicator(17.5%) at Babel governorate, Industrial and Occupational Safety Indicator(47.625%) at Karbala governorate.
Recommendations for future studies:
1. Using Environmental Impact Assessment (EIA) in conjunction with environmental performance evaluation in order to assess the environmental impact pollution.
2. The indicators should be focused more on environmental condition indicators
3. Applying of Life Cycle Cost method for evaluating of economic criterion also using (cost-benefit analysis).
4. Using of Decision support system (DSS) for dynamic monitoring and decision.

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