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Environmental Performance Evaluation (EPE) of Iran Khodro Co. (IKCO)

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ABSTRACT: Iranian industries are increasingly concerned with sustainable development by controlling their impacts on environment. Iranian automotive industries have began conducting environmental management within a structured management system based on ISO 14001 international standard since 1997. Iran Khodro Co. (IKCO), the largest Iranian automotive manufacturer, implemented EMS entire the company in 2000. IKCO have found that environmental audits carried out within EMS are non sufficient to provide management of the organization with reliable and verifiable information on organization's environmental performance trend. Therefore, it decided using Environmental Performance Evaluation (EPE) for mentioned purpose. To begin EPE process, EPE scope was determined entire IKCO and EPE period was considered 2002–2004. Then, EPE process of IKCO followed the steps as selecting Environmental Performance Indicators (EPIs), collecting data relevant to the selected indicators, analyzing and converting data into information describing environmental performance and assessing information in comparison with the Environmental Performance Criteria (EPCs). Tracking IKCO's environmental performance trend over EPE period indicates that considerable progress has been made regarding decreased water, electricity, natural gas and compressed air consumption as well as waste water generation. The results of EPE have also helped to identify several effective measures for further improvement, e.g. environmental training performance and investments for environmental projects. EPE helped IKCO to verify the areas to which the environmental programs within IKCO's EMS had advanced. Furthermore, EPE gave a good idea for providing a basis for any corrective actions in areas which have not made considerable progress or shown deficiency. However, IKCO's environmental performance evaluation is still in its early stages. It is necessary reviewing the EPE process for improvement to conform the appropriateness of the selected EPIs, relevance of EPCs, reliability of data collected, comparability of data between years and companies, etc.

Key words: Environmental Performance, Evaluation, Indicators, Criteria , Iran Khodro Co.

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INTRODUCTION

Iranian industries are increasingly concerned with sustainable development by controlling the impacts of their activities, products and services. They are pursuing this aim for a variety of reasons, ranging from promoting views of interested parties to meeting upcoming regulatory initiatives. Iranian automotive industry is among the most outstanding industrial sectors regarding number of employees, financial turnover, total investment, value added, etc. Therefore, it plays an essential role on development scene due to its social and economic performance.

On the other hand, Iranian automotive industry is an intensive energy and material user and produces a product - the automobile - that is the single largest contributor to environmental degradation. Hence, it is vital for this industrial sector achieving to sound environmental management to realize sustainable development by integrating social, economic and environmental performance. To move toward sustainable development, Iranian automotive industries have began conducting environmental management within a structured management system based on ISO 14001 international standard since 1997. In

order to implement an effective environmental management system (EMS), they are seeking ways to understand, demonstrate and improve their environmental performance. Just a good financial management requires regularly tracking financial measures within an accounting system, sound environmental management also depends on measuring environmental performance to determine an organization's environmental performance trend over time.

Iran Khodro Co. (IKCO), the largest Iranian automotive manufacturer established in 1962 with approximately 20,000 employees and annual sales of nearly 500,000 vehicles, implemented EMS entire the company in 2000. IKCO has conducted periodical internal environmental audits twice a year as well as third party environmental audits annually to assess its environmental performance. However, IKCO have found that environmental audits are non sufficient to provide management of the organization with reliable and verifiable information on organization's environmental performance trend. Therefore, it decided using Environmental Performance Evaluation (EPE) as an internal management tool to provide management with information on an ongoing basis to determine whether the IKCO's environmental performance is meeting criteria set by management of the organization.

EPE is the subject of EN ISO 14031: 1999 International Standard that was prepared by Technical Committee ISO/ TC 207, Environmental Management, Subcommittee SC 4, Environmental Performance Evaluation of the International Organization for Standardization (ISO). This standard was given the status of a national standard in the following countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

However, This International Standard is applicable to all types and sizes of organizations and to accommodate diverse geographical, cultural and social conditions. There are a range of organizations, e.g. manufacturing and service companies; non-governmental organizations; governmental agencies; small, medium and large enterprises; organizations with and without certified EMS, and geographical locations which have used EPE suited their needs and application purposes (ISO 14032, 2000).

Automotive companies' stakeholders, such as institutional investors, shareholders, regulators and the non-governmental organizations, are taking an increasing interest in reporting of their Environmental Performance. That is because automotive manufacturers will be the great contributor to environmental degradation during next three decades. For example, vehicle use is expected to grow from an 580 million vehicles in 2000 to nearly 850 million vehicles in 2030 in Organization for Economic Cooperation and Development (OECD) countries alone (OECD, 2000).

Given the tremendous increase expected, reducing environmental impacts of automotive industrial sector is a priority. On the other hand, it is crucial to determine if sustainability efforts are being accurately measured and reflected in automotive industrial sector. Hence, many automotive companies issues in a public corporate environmental performance reports regularly. As an example, General Motors has used the Coalition for Environmental Responsible Economies (CERES) guidelines for Environmental Performance reporting since 1997 until now. Toyota has reported its Environmental Performance in the same format over the mentioned period.

Iranian automotive companies use reporting information describing their Environmental Performance to communicate with interested parties within and outside the company, especially through their websites, intranets, annual environmental exhibition, etc. However, Environmental Performance reporting by Iranian automotive companies does not follow a standardized procedure and format. IKCO, as a pioneer automotive manufacturer, applied EN ISO 14031: 1999 International Standard for EPE.

MATERIALS & METHODS

To begin EPE process, EPE scope was determined entire IKCO and EPE period was considered 2002 – 2004. Then, EPE process of IKCO followed the steps as below:

Selecting indicators for EPE: The motivation behind conducting EPE process in IKCO was meeting ISO 14001 international standard requirements and ensuring about effectiveness of EMS. To select Environmental Performance Indicators (EPIs), IKCO's prioritized environmental aspects as improvement areas (SBA, 2003), IKCO's management commitment stated in the organization's environmental policy (IKCO's Annual Environmental Report, 2005) and IKCO's management roles required by ISO 14001 international standard (ISO 14001, 2004) were considered. IKCO took into account its significant environmental aspects in implementing its EMS.

Whereas the results of an organization's management of its environmental aspects are known as organization's environmental performance (ISO 14031, 2000), information about IKCO's management on significant environmental aspects identified in the context of its EMS was based for selecting EPE indicators classed Operational Performance Indicators (OPIs). IKCO's management commitment and roles provided the bases for selecting EPE indicators categorized Management Performance Indicators (MPIs). Availability of relevant data in the scope and period of EPE was the final consideration to select the indicators (Veleva and Ellenbecker, 2001). On the other hand, existing data was used to finalize EPIs. Table 1 illustrates EPE indicators selected, their type and bases for choice of them.

Data collection procedure included identifying data sources and ensuring about data reliability. Data sources used were monitoring and measuring results on consumed water, electricity, natural gas, compressed air and generated waste water conducted by Energy Management Department of IKCO, financial records on investments for environmental projects available from Accounting Department of IKCO, environmental training records maintained in Training Center of IKCO, and environmental audits reports accessible from Environmental Affairs Department of IKCO. Data reliability was ensured regarding factors such as data availability, adequacy, statistical validity and verifiability. To increase the comparability of data between years, data was normalized. To normalize data, quantities such as physical production (Tyteca, 2002), number of employees (Templet, 1993) and total investment (Tyteca, 2002) were used.

The information derived from analyzed data was compared with Environmental Performance Criteria (EPCs) to indicate progress or deficiencies in IKCO's environmental performance. Since the motivation behind conducting EPE process in IKCO was meeting ISO 14001 international standard requirements, the environmental performance criteria were based on elements of IKCO's EMS such as environmental objectives, environmental policy and management roles required by ISO 14001 international standard. Table 2 illustrates environmental performance criteria used for tracking IKCO's environmental performance trend over EPE period to understand they have, or have not, been met.

Table 1. IKCO's EPE indicators selected, their type and bases for choice of them

Environmental Performance Indicator (EPI)	Type Of EPI	Basis for selecting EPI
Cubic Meters of Water Consumed per Vehicle	OPI	Information about IKCO's significant environmental aspects identified in the context of its EMS introduces reduction of water consumption as an improvement area
Kilowatt Hours Electricity Used per Vehicle	OPI	Information about IKCO's significant environmental aspects identified in the context of its EMS introduces reduction of electricity usage as an improvement area
Cubic Meters of Natural Gas Consumed per Vehicle	OPI	Information about IKCO's significant environmental aspects identified in the context of its EMS introduces reduction of natural gas consumption as an improvement area
Cubic Meters of Compressed Air Consumed per Vehicle	OPI	Information about IKCO's significant environmental aspects identified in the context of its EMS introduces reduction of compressed air consumption as an improvement area
Cubic Meters of Waste Water Generated per Vehicle	OPI	Information about IKCO's significant environmental aspects identified in the context of its EMS introduces reduction of waste water generation as an improvement area
Hours Environmental Training Performed Per Capita	MPI	IKCO's environmental policy, stated by IKCO's top management, includes a commitment to arising personnel's environmental awareness by means of training
Total Investments for Environmental Projects in Thousand Rials (9200 Rials = 1 US$)	MPI	As a requirement of ISO 14001 international standard, IKCO's management shall ensure the availability of financial resources essential to maintain and improve the IKCO's EMS

RESULTS & DISCUSSIONS

IKCO's environmental performance trend shows smoothly continual improvement in operational performance and oscillation in management performance. Tracking IKCO's environmental performance indicators over EPE period indicates progress regarding decreased consumption of water, electricity, natural gas, compressed air and generation of waste water, while environmental training performance has trended deficiency at beginning and then moved toward improvement. Total investments for

environmental projects started to considerable progress during 2002 – 2003, but they declined noticeably during 2003 -2004. Table 2 and Figs. 1-7 illustrate IKCO's environmental performance trend during 2002 - 2004.

Table 2. Tracking IKCO's environmental performance over EPE period

Environmental Performance Indicator (EPI)	Performance In Year 2002	Performance In Year 2003	Performance In Year 2004	Environmental Performance Criterion (EPC)
Cubic Meters of Water Consumed per Vehicle	6. 94	5. 89	5. 29	reduction of water consumption as an environmental objective set within IKCO's EMS
Kilowatt Hours Electricity Used per Vehicle	791. 5	735 .9	669. 8	reduction of electricity usage as an environmental objective set within IKCO's EMS
Cubic Meters of Natural Gas Consumed per Vehicle	147. 7	131. 5	109. 9	reduction of natural gas consumption as an environmental objective set within IKCO's EMS
Cubic Meters of Compressed Air Consumed per Vehicle	1163. 8	1026. 3	891. 9	reduction of compressed air consumption as an environmental objective set within IKCO's EMS
Cubic Meters of Waste Water Generated per Vehicle	0. 008	0. 007	0. 007	reduction of waste water generation as an environmental objective set within IKCO's EMS
Hours Environmental Training Performed Per Capita	0. 815	0. 778	1. 372	arising of personnel's environmental awareness by means of training as a top management commitment stated in IKCO's environmental policy
Total Investments for Environmental Projects in Thousand Rials	229, 880, 000	828, 852, 138	103, 656, 820	ensuring the availability of financial resources essential to maintain and improve the IKCO's EMS as a requirement of ISO 14001 standard

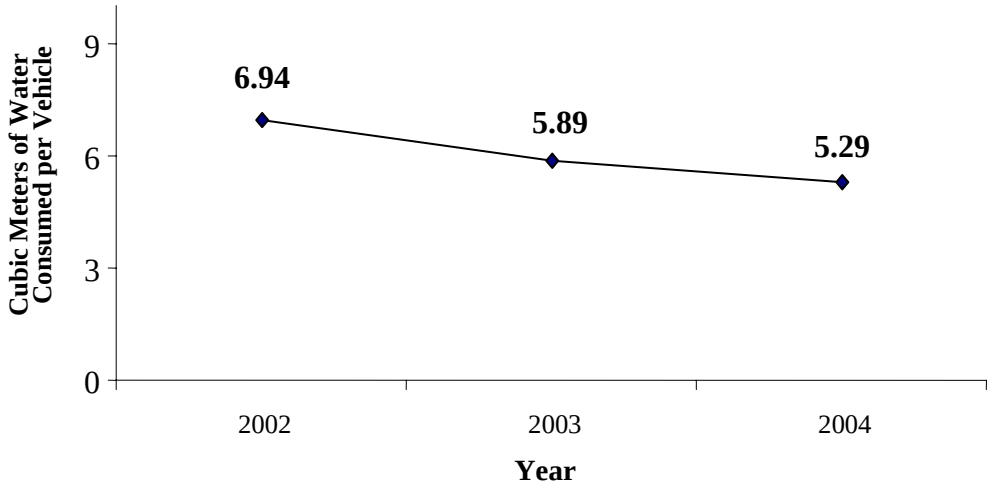

Fig. 1. Water Consumption Trend in IKCO During 2002-2004

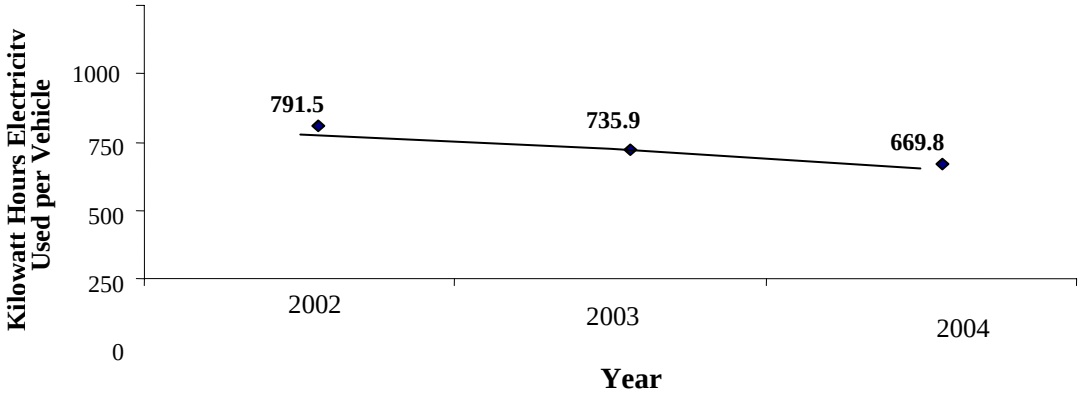

Fig. 2. Electricity Consumption Trend in IKCO during 2002-2004

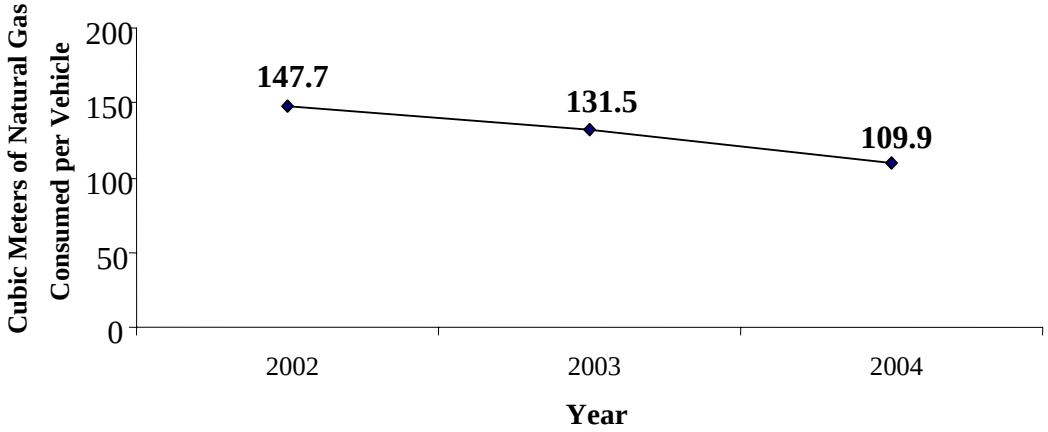

Fig. 3. Natural Gas Consumption Trend in IKCO during 2002-2004

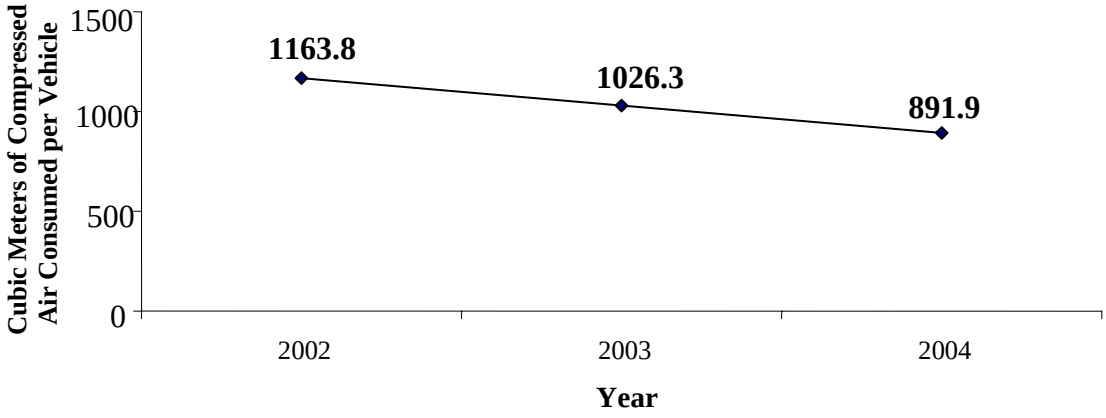

Fig. 4. Compressed Air Consumption Trend in IKCO during 2002-2004

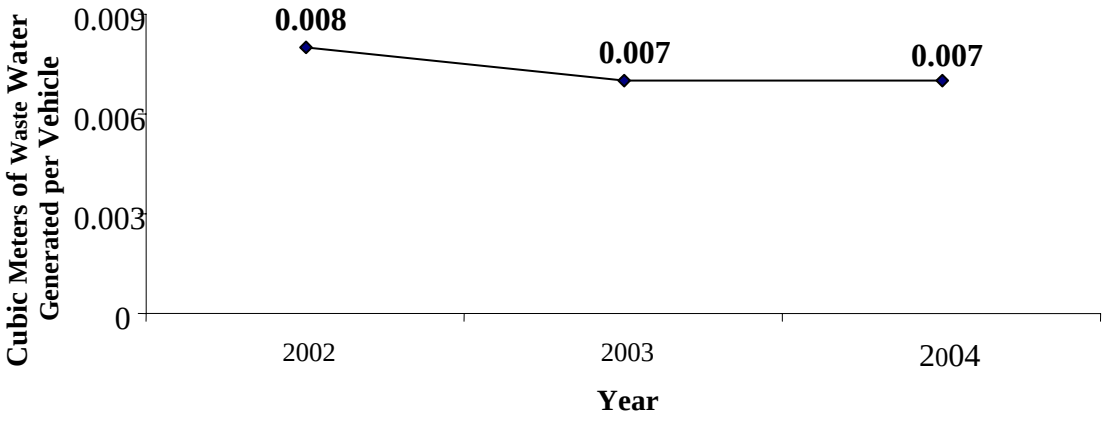

Fig. 5. Waste Water Generation Trend in IKCO during 2002-2004

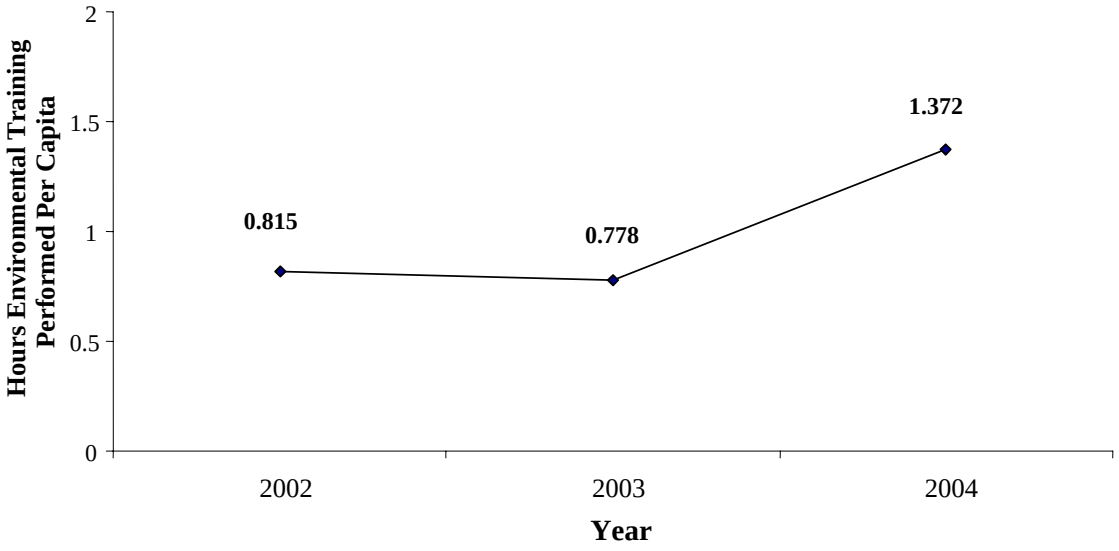

Fig. 6. Environmental Training Performance Trend in IKCO during 2002-2004

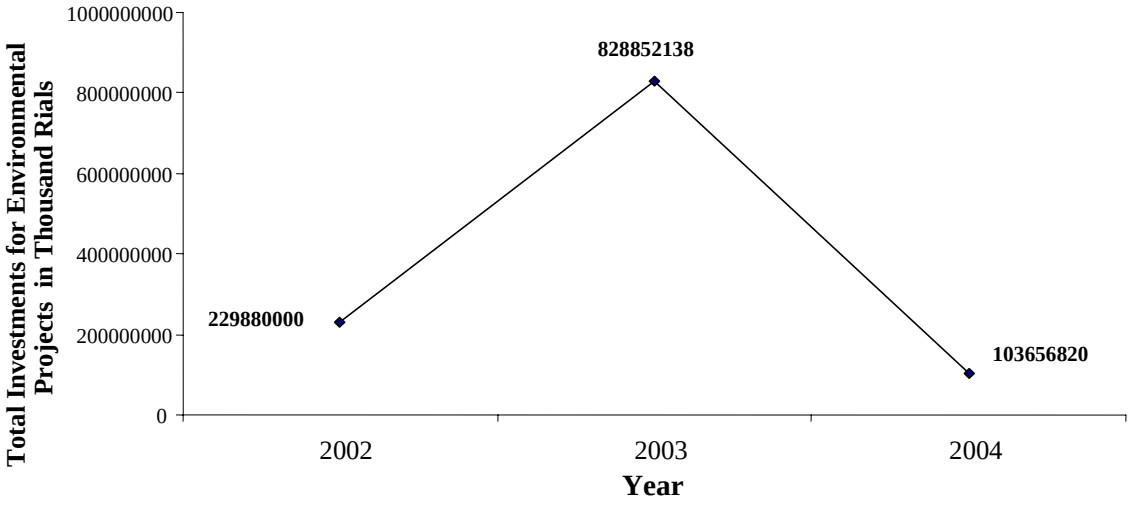

Fig. 7. Trend of Investments for Environmental Projects in IKCO during 2002-2004 (9200 Rials = 1 US $)

The measurement and monitoring of environmental performance with indicators is important for controlling a company's compliance with the requirements for continuous improvement of environmental performance (Jasch, 2000). The experience of conducting EPE integrated with the IKCO's EMS was successful because of the high level of control achieved by monitoring the company's environmental performance against set criteria derived from elements of EMS. Identifying indicators for EPE has given new insights on how to optimize the processes, especially in the areas of water, electricity, natural gas and compressed air consumption. EPE has also helped to identify several effective measures for improvement, e.g. environmental training performance and investments for environmental projects.

For Vollmann "key performance indicators are basically how an organization describes itself (its performance) to itself. It teaches itself through these tools about success and failures, and it behaves accordingly" (Vollmann, 1996). The use of indicators for EPE helped IKCO to verify the area to which the environmental programs within IKCO's EMS had advanced, e.g. water and energy careers consumption during EPE period (Figs. 1-5). Furthermore, EPE gave a good idea for providing a basis for any corrective actions in areas which have not made considerable progress or shown deficiency, e.g. environmental training performance in year 2003 and investments for environmental projects in year 2004 (Figs. 6 and 7).

For a company with an EMS certified to ISO 14001 standards, EPE can supplement the procedures already exist and especially help focus the process of internal environmental reporting and the management review. Conducting EPE inspired IKCO to find new EPIs, which are incorporated into existing EMS, especially MPIs such as "hours environmental training performed per capita" and "total investments for environmental projects in thousand rials", as well as OPIs illustrated in table 1. MPIs were known useful in relation to the management reviews required by ISO 14001 international standard to ensure IKCO's EMS continuing suitability, adequacy and effectiveness. OPIs were found particularly useful in daily operational controls which are carried out to ensure controlling the situations where their absence could lead the deviation from the IKCO's environmental policy and objectives.

An important benefit of conducting EPE for IKCO was that it had access to hard figures about the environmental performance of the company. Together with regularly updated environmental objectives, IKCO is able to control and improve effectively the company's environmental performance and to communicate it successfully to the interested parties.

However, the environmental indicators used in the automotive industry illustrate some challenges (Tam, 2002). The National Academy of Engineering (1999) notes that "a metric expressed in pounds per vehicle may be different for otherwise comparable vehicles because of differences in vertical integration and supplier chains among manufacturers". This leads to question how can different companies compared and benchmarked.

As an example for the mentioned notes above, in 1997, 1998 and 1999, General Motors of North America reported that it produced 0.048, 0.048 and 0.052 vehicles per giga joule of energy consumed, and 0.09, 0.09 and 0.1 vehicles per cubic meter of water consumed, respectively (GM, 2000). Toyota (Toyota, 2000) reported the inverse format for these same categories over the same years. It used 10.4, 10.0 and 10.0 GJ per vehicle and 4.6, 4.6 and 4.3 cubic meters of water per vehicle. To compare their performance in terms of vehicle manufacture, the values from Toyota were converted to correspond to the ratio format used by GM (i.e., vehicle per energy or water). Values from both GM and Toyota are for their North American operation only. Based on these figures, it appears that Toyota is outperforming GM in terms of environmental efficiency by nearly 2 times, implying that Toyota produces more environmentally friendly vehicles. However, these must be taken in context, since overall corporate averages for environmental performance can be misleading.

The manufacturing capacity of Toyota in North America grew to 1.2 million vehicles per year in 2000, with an expected increase to 1.45 million vehicles per year within 3 years (Toyota, 2000). In contrast, GM North America produced 1.568 million vehicles, consisting of 787000 cars and 781000 trucks, in second quarter of 2000 alone (GM, 2000). Vehicles with similar attributes from both companies may have similar water and energy requirements. Larger vehicles, such as trucks and vans would presumably require more resources. For the last several years, Toyota U.S.A has produced approximately 3 times more cars than pickups, minivans or sport utility models and this trend can be assumed to apply to the overall North American operations for Toyota. Conversely, GM has produced approximately equal number of cars and trucks. Thus, to produce certain vehicle types,

GM may as eco-efficient as Toyota, but this would not be revealed using aggregate analysis. The overall corporate scenario given by commonly reported indicators and based on average product definitions (i.e., a vehicle) is, therefore, instructive but not definitive. The use of appropriate indicators is thus crucial for facilitating intercompany comparisons from a sector wide perspective.

CONCLUSION

In conclusion, IKCO's environmental performance evaluation is still in its early stages. It is necessary reviewing the EPE process for further improvement to conform the appropriateness of the selected EPIs, relevance of EPCs, reliability of data collected, comparability of data between years and companies, etc.

The recommendations for reviewing and improving IKCO's EPE are followings:

- IKCO is already working actively with Operational Performance Indicators (OPIs) selected as a tool for controlling the consumption of water, electricity, natural gas and compressed air as well as generation of waste water. It is offered an Eco-balance approach to select additional OPIs by taking into account all incoming (input) and all outgoing (output) material and energy streams of the company. In order to this purpose, quality and quantity of raw materials input to as well as quality and quantity of emissions to air and wastes output from the company should be considered.
- It is encouraged reviewing the present OPIs for more effective and adequate operational controls. For example, the indicator "Cubic Meters of Waste Water Generated per Vehicle" can be improved to track physical, chemical and biological factors in waste water effluent, volume of waste water treated, reuse rate of waste water treated, etc.
- It is stimulated developing and applying Environmental Condition Indicators (ECIs) to monitoring IKCO's impacts on condition of surroundings from local to global environment. Examples of such indicators include "noise level at perimeter of IKCO's facility" and "concentration of a specific contaminant in groundwater/ ambient air/ surface soils" for assessing impacts on condition of local environment (ISO 14031, 2000) as well as "global warming contribution" and "ozone-depleting contribution" for evaluating impacts on condition of global environment (UNCTAD, 2003).
- It is advised conducting a project to development of an environmental indicator system. It is needed organizing a project team consisting of experts from the Environmental Affairs Department as well as line managers from different departments whose activities will have an influence on the development of indicators. It is preferable arranging the team by members of Steering Committee for EMS established in different departments of IKCO.
- As mentioned, existing data was used to finalize the first set of IKCO's EPIs. It is suggested establishing a consolidated environmental data supporting system to collect data regularly to provide input for calculating values for EPIs. Data should be collected systematically from appropriate sources at frequencies consistent with EPE period. Data collection procedure should ensure data reliability regarding factors such as data availability, adequacy, statistical validity and verifiability. Data collection should be supported by quality control and quality assurance practices that ensure the data obtained are of the type and quality needed for EPE use. A consolidated environmental data supporting system should include the appropriate identification, filing, storage, retrieval and deposition of data and information.
- To increase the comparability of information describing IKCO's environmental performance and transparency of performance for external users, it is offered aggregating data on company's environmental performance to produce simple, but meaningful indicators that reflect a IKCO's overall environmental performance (Tyteca, 1996). To convert large amounts of data into managerially useful information appropriate metrics is necessary (James & Bannett, 1996). It is preferable using potency metrics, such as ozone depletion potential and global warming potential, which are relevant in intra-impact assessment aiming to aggregate emissions of different physical/ chemical nature into physical indicator for pressure on various environmental endpoints (Tyteca, 2002).
- The potential cost reductions identified so far have shown that it is possible to link indicators for EPE to costs. It could be happened for savings derived from decreased water, electricity, natural gas and compressed air consumption as well as decreased waste water treatment. Potentially, this could be expanded into systematic environmental cost

management and tracked using relevant MPIs such as "environmental costs per vehicle".

- It is recommended reporting and communicating information describing IKCO's EPE to interested parties within and outside the company through IKCO's website, intranet, annual environmental reports, periodical internal magazine, annual environmental exhibition, etc. The benefits of reporting and communicating environmental performance can include: demonstrating the IKCO's commitment and efforts to improving its environmental performance, providing the mechanisms to respond to concerns and questions about the organization's environmental aspects, increasing awareness and dialogue about the organization's EMS and relevant achievements, helping the IKCO to achieve its environmental performance criteria, etc. The general framework of environmental reporting has been published by several institutes, the most relevant being the documents issued by the Global Environmental Management Initiative (GEMI, 1994), Global Reporting Initiative (GRI, 2005).
- Presentation of EPE results to all personnel will allow management to show satisfactory progress of environmental programs they involved and obtain their support for extension of the programs. An important benefit of this approach is the training and increased motivation of personnel for participation in setting environmental priorities and designing the process for monitoring and control. Increased environmental awareness and personnel motivation also provides more commitment to implementation of EMS programs**.**

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