



Quantifiable Pollution Management through Various Performance Indicators in the Perspective of ISO 14001: A Review

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Abstract: This paper establishes a methodology for deviations of performance indicators that provides industrial and regulatory strategies to be implemented in view of traditional achievements of industrial environmental performance, which would be resulted into reduction in pollution levels and waste loads. The performance indicators could become an important foundation of environmental information, which would promote environmental efforts in the entire society. This study will assist in allowing environmental performance to become a factor in business planning and holistic view of any organization.

Keywords: *Methodology, performance indicators, environmental performance, Holistic view.*

Introduction

Environmental performance indicators promote environmental efforts of business organizations because business organizations use them for internal evaluation and decision-making and business organizations so it is essential to use them with qualitatively. It provides a management framework within which most companies and local governments can identify cost effective actions that improve further their operational efficiency. The ISO 14001 standards claimed to be less confrontational and user friendly, may provide a potentially innovative supplement to current environmental regulations (Murray, 1999). The series of standards will help companies integrate environmental considerations into corporate decision making in a more organized and systematic fashion (Gale, 1996). The benefits of ISO 14001 lie in cost saving through energy consumption, raw material input, waste management, environmental impact reversal as well as an improved public image (Chattopadhyay, 2001). Organizational environmental performance evaluation requires not only the detection of damage potential, as expressed in explicitly defined safeguard subjects and quantified in respective damage indicators, but the evaluation of a company for actual and perceived performance, using both enabling management and actual results. Various necessary performance indicators for performance evaluation are not used at appropriate and proper levels resulted into environmental performance not up to the satisfactory mark. This paper deals with the various indicators used by many authors and if these are used it can give effective and perfect picture of pollutions levels in Indian context.

Brief History of Developments

A case study methodology is used putting forth the "Implementation of an EMS system at Pioneer Building and Construction", a registered company in the construction industry. Author says responsible and sustainable system of environmental management should start with pollution prevention then expand into control and environmental design.

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Buildings consume a significant proportion of the world's annual energy production in their construction, operation, maintenance, renovations, demolition and disposal resulted into energy consumption; the green house gas emissions associated with fossil fuel use have a significant environmental impact. (Chavan, 2005),

An EMS can assist a company in the following ways:

- Minimize environmental liabilities;
- Maximize the efficient use of resources;
- Reduce waste;
- Demonstrate a good corporate image;
- Build awareness of environmental concern among employees;
- Gain a better understanding of the environmental impacts of business activities; and
- Increase profit, improving environmental performance, through more efficient operations.

Critical Success Factors (CSFs) for successful implementation of an environmental management system (EMS). Successful implementation was defined as one being "smoother, faster, effective and sustainable" in nature (Zutshi *et al.*, 2004).

The framework presented by the author covers three major EMS implementation phases namely, development; certification; and maintenance and continuous improvements and can further enhance the capacity of an organization to achieve and maintain a successful EMS implementation. (Zutshi *et al.*, 2005)

Environmental management can be described as a methodology by which organizations acting in a structured manner assess their operations to ensure that they are functioning in a proper manner (Whitelaw, 1997). An environmental management system is a system that aims to encourage an organization to control its environmental impacts and reduce such impacts continuously.

Recent evidence from the USA (Khanna *et al.*, 2002) suggests that the factors motivating organizations to pursue environmental policies are a combination of both reactive and proactive. The authors (Presley *et al.*, 2004) described the conceptual model to aid in the environmental systems decision-making process. The model will utilize the Analytic Hierarchy Process (AHP) for EM decision-making. AHP will allow both quantitative and qualitative criteria to be entered into the model and offers an overall solution for the model. AHP instead is used as a framework for presenting and discussing the various dimensions and criteria for evaluating sustainability decisions.

Managing and reporting on environmental performance can lead to significant business benefits as well as benefits for the environment.

1. Cost savings and productivity gains
2. Improved sales
3. Preferred supplier status
4. Increased attractiveness to the investment community
5. Product and service innovation
6. Employee recruitment

Environmental Key Performance Indicators (KPIs) provided businesses with a tool for measurement. They were quantifiable metrics that reflected the environmental performance of a business in the view of achieving goals and objectives of the organizations. Basically, Indicators are helping businesses to implement strategies at various levels of an organization (business units, departments and individuals) with targets (EES).

The purpose of the Environmental Management Plan (UNSW, 2005) is to:

- Identify the priorities
- Set objective and targets
- Define performance indicators
- Document strategies and timeframe to achieve targets

- Allocate responsibilities and identify the necessary resources
- Establish mechanism to monitor

Mostly, SMEs rated the success of their EMSs by monitoring the resources used, the waste minimized both of which were closely related to cost saving and key performance included the volume of raw material, water and energy consumption, recycling rate, hazardous and non-hazardous waste generation and the number of volume releases. In survey of 580 manufacturing company with more than 50 employees, Florida and Davison (2001) found and pointed out that recycling and reduction in air emission, solid waste and electricity use, regulatory compliance and employee's involvement are major partners for involvement in EMS to fulfil the requirements of regulatory authorities (CEC, 2005).

Approaches Adopted

The TOWS (Threats-Opportunities-Weaknesses-Strengths) and SPACE (Strategic Position and Action Evaluation) Matrices were tools that could be used to effectively develop feasible alternative strategies. The SPACE Matrix consisted of a four-quadrant framework and indicated whether aggressive, conservative, defensive or competitive strategies were the most appropriate for a given organization (Chavan, 2005)

Data was collected over a period of three years as part of a large research project identifying and exploring the role of organizational stakeholders during the EMS adoption process. Triangulation method, a combination of a questionnaire survey and interviews were conducted with managers who were responsible for various management systems, primarily environmental quality and occupational health and safety, was used to collect the data framework for EMS adoption based on the relevant literature, the framework developed included the following three phases (Zutshi *et al.*, 2005):

- (1) EMS development;
- (2) EMS certification; and
- (3) EMS Maintenance and continuous improvement.

There were two main criteria used, the “enabler” elements considered business management, and the “results” criteria described what the organization had achieved. Environmental issues were dealt with in both criteria, but it had their most significant role within one of the results categories, namely society results. This provided a conceptual platform for the evaluation of a company for actual and perceived performance, using both enabling management and actual results, which assisted in the evaluation of “cause and effect” relationships (Rowland-Jones *et al.*, 2005).

The sample population for each of the original surveys was in each case drawn from the Times top 1,000 lists of the highest grossing UK companies for the year of the survey. Although response rates over the period found dropped, it was noted that 25.6 per cent of the original respondents supported the subsequent two surveys, which provided some basis for the identification of longitudinal trends. However overall, in 1994, 47.5 per cent responded. By 1996, the rate had dropped to 32 per cent and in 1999 only 17.3 per cent of surveys were returned (Faulkner *et al.*, 2005).

The model was being tested with a representative of a flooring adhesive company. The company in this case study mixes various adhesives in 600 gallons batches. Various testing is conducted every three hours to determine the pH level, the amount of solids present, and the viscosity of the product. Periodically there is some type of error and a batch of glue is unacceptable in its current form (Presley, 2004).

There were 22 Key Performance Indicators considered to be significant to UK businesses (UK). Emissions to air were such as greenhouse gases, acid rain, eutrophication and Smog precursors, dust and particles, ozone depleting substances, volatile organic compounds, metal emissions to air and emission to water, nutrients and organic pollutants, metal emissions to water. Emissions to land were pesticides and fertilizers, metal emissions to land, acids and organic pollutants, waste (landfill, incinerated and recycled), radioactive Waste. Resource use

were water use and abstraction, natural gas, oil, metals, coal, minerals, aggregates, forestry, agriculture

Every business should also consider reporting on how it influences the environmental performance of its supply chain and products. Every factor had been discussed in details by the author for reporting of concerned performance indicators.

Strong environmental management system that includes the following characteristics such as pollution prevention, community involvement and environmental performance measures (SEM). Richmond (EES) has developed various metrics based on Global Reporting Initiative such as environmental, economic, social and partial reports

Results and Discussion

Evaluation of the alternative strategies, offered by both the TOWS and SPACE Matrices, suggests that Pioneer should adopt a market penetration strategy, based on developing the quality of product and service offered. This would involve product enhancement, via the implementation of an effective EMS (Chavan, 2005).

Even though ISO 14001 was created to help organizations, there were some factors that may prevent a company from successfully implementing an EMS: Anger from staff that may oppose the increase in their responsibilities the EMS Would create; Reluctance from the management to give the time and resources necessary to implement the EMS; and belief that once the EMS is in place, it does not need to be constantly reviewed and improved (Chavan, 2005)

Before organizations decide to go ahead with any of the phases, it is imperative that there is two-way consultation and communication with all the internal and external stakeholders. Feedback from the top and bottom of the organization, internal audits and management reviews is required to ensure that any gaps or improvements identified are promptly addressed. Completion of each phase will require adequate resources and top management commitment, as well as adequate training of the appropriate stakeholders. (Zutshi *et al.*, 2005)

No methodology had been given for analyzing and converting data and assessing information and no quantitative or qualitative outcome publication format was shown for the derived data (Rowland-Jones *et al.*, 2005).

Throughout the three surveys, it was increasingly evident that smaller companies proved less inclined to continue their support by returning the questionnaires as required in the study and original researchers acknowledged, biased findings in favour of larger companies (David *et al.*, 2005).

In the hierarchy shown, the overall goal was to pick the best environmental system where that system could be defined as a new product, options for producing a product, whether to implement an Environmental Management System, or any number of environmental related choices. Under this author determined the importance or influence of each of the stakeholders in the decision and then determined for each stakeholder the importance of the each of the dimensions of the sustainability (Presley & Meade, 2004).

Environmental performance measurement provides (UNSW, 2005):

- Feedback on the effectiveness of action taken to reduce the university's ecological footprint
- A basis for reviewing environmental objectives and targets
- A structure for the annual UNSW state of the environment report
- A frame work for achieving continual improvement in terms of management performance indicators and operational performance indicators have been selected in the whole system

Functional areas such as management systems, knowledge system, energy management, materials management, water management, planning, design and development, compliance and pollution and prevention, transport, biodiversity and open space had been selected and likewise various performance indicators as against each functional areas had been dealt out.

A commonly used definition of an indicator is: "A number, absolute or relative, that facilitates management, communication and follow-up of an organization's performance." Indicators of environmental performance can be (Maier & Vanstone, 2005):

- Absolute - basic raw data e.g. total carbon dioxide emitted in 2005
- Relative - e.g. energy consumption per unit of output
- Indices - constructed to produce a number by using a baseline year, factoring equivalents on a scientific basis or through the use of factors and weighting to produce a number e.g. 100 as the baseline number with increasing efficiency producing a larger number

Various performance indicators had also been considered such as environmental performance indicators, environmental conditions indicators, environmental compliance indicators, management framework indicators, pollution prevention indicators, and cost/benefit indicators, community participation indicators and stakeholder indicators to improve in environmental performance in the organization. (UNSW, 2005)

The intention of the study was to raise level of awareness of the users to the recently developed environmental performance indicators specifically the operational indicators used by the companies. The indicators specified were as under (Castillo *et al.*, 2004):

- Environmental performance indicators
- Input indicators were materials, energy, water,
- Output indicators were waste, air emissions, wastewater
- Environmental management indicators were environmental cost, training staff and purchasing indicators

Study is based on the implementation of system in Vidarbha Region in Maharashtra, India (Years 2004-2006). Existence of the above illustrated parameters and performance indicators are not found in Indian context in the perspective of ISO 14001. To improve upon further it is necessary to implement the EMS in a befitting manner by all the Small and Medium Size Organizations.

Many parameters are not looked in details while implementing and maintaining the environmental management systems. The parameters are as under:

- Involvement of all employees: selected employees are found involved in the system
- Terms and conditions specified in the consent granted by the regulatory authorities are not followed properly
- Attitude of the staff
- Management review meetings are not conducted as per agenda and in effective manner
- Variations in the skill and knowledge of the employees
- Input data even not sufficient to justify the applications
- Objectives are not set in view of environmental globalization such as rain harvesting, setting of a big ecological parks etc.
- Solid waste management is not effective manner through various systems such as incineration, composting, sanitary land filling only throw of waste on low-lying areas is practiced
- Objectives once set are reviewed within the stipulated time of achievement.
- Non-availability of funds at appropriate stages of Environmental Management Programmes
- Management is overlooking the resources required for implementation of systems
- High demand of electricity so maintenance purpose state thermal power stations are not taken at required time as per preventive maintenance schedule
- Management review meetings and internal audits are not conducted as per frequency.

- Very few industries are going for ISO - 14001 system

1. Clauses-wise discussion

1.1. Environmental Policy

- Review of policy at suitable time is not evident
- Policy is not communicated to nearby industries and own suppliers and contractors
- Implementation of system as per policy statement is not found
- Policy is not understandable to each employee
- Purpose is not reflected in policy statement
- Policy is not reviewed as per frequency and at suitable time

1.2 Environmental Aspect

- New developments or modifications are not considered as aspect
- Awareness is not organized on aspect evaluation techniques as per frequency
- Aspect evaluation techniques is not properly followed
- Aspect created by nearby industries are not taken seriously
- Procedure on aspect evaluation is not effectively implemented and followed
- Normal, abnormal and emergency conditions are not properly addressed in the aspect evaluation
- Aspects are not covered when it is observed in the system

1.3. Legal and Other Requirements

- Legal compliance is not evaluated as per frequency
- Other requirements are not followed properly
- Procedure is not followed
- Mission, Vision and Code of practice is not followed
- No proper correspondence in case of change in legal requirements
- No effective liaisoning with legal authorities
- Each acts and rules is not found
- Awareness regarding legal and other requirements is not satisfactory
- Social commitments are not taken care of effectively and record is not maintained

1.4. Objective, Targets & Programme(s)

- Objectives are not set as per requirement of clause
- Objectives are not set on the basis of various legal requirements, environmental aspects and policy statement
- Objectives are not communicated to each employee and contractors
- Objectives are not displayed in local language
- Environmental management programmes are not specified with all the actions required to fulfil the requirement of programme
- Targets are fixed on the basis of no data and irrelevant data
- Targets are not reviewed every year
- Proper responsibilities are not fixed as per section
- Proper performance indicators are not used as per objective
- Base on which targets are fixed is not perfect
- Proper objectives are not set
- Action in EMP are not initiated as per the targets given
- Insufficient actions to achieve the environmental management programme

1.5. Resources, Roles, Responsibility and Authority

- Responsibilities & authorities are not assigned properly and it is not known to respective authorities
- Each staff is not given proper job responsibility and communicated
- Resources are not provided as and when required or effective plan is not prepared

1.6. Competence, Training and Awareness

- Training calendar is not prepared and if prepared it is not reviewed as and when required
- Training is not given to all employees
- Training calendar is not followed
- Training feedback and evaluation is not done
- Training feedback format is not filled in properly
- Training calendar is not prepared on the basis of requirement of employee
- Competence is not measured

1.7. Communication

- Internal communication is not effective
- Internal communication record is not properly maintained
- No frequency of organizing various slogan, poster competitions
- Slogan and poster competition is not organized for better communication
- Various parameters are not displayed at main entrance and also updating of same is not evident

1.8. Control of Documents

- Documentation control is not found as per procedure
- Retrievability is not up to the mark
- No safe place identified for effective control of documents in case of fire
- Log sheets, formats and other records are not updated
- Procedure on control of document is not followed
- Actual formats are not used in the system
- Type of formats used are not as per requirement of the system
- Manual and procedures are not provided at appropriate locations

1.9. Operational Control

- All operational controls are not displayed or documented
- Operational controls are not in working condition
- All the controls are not tested periodically

1.10. Emergency Preparedness and Response

- Safety inspections as per checklist are not carried out
- Safety audits are not carried out as per schedule and if carried out the suggestions are not implemented
- Mock drills are not carried out effectively and as per frequency. Only mock drills on fire is conducted
- Only 25% of the staff is witnessing the mock drills
- Many leakages are observed in fire hydrant line
- Workers are using fire hydrant line for washing and cleaning purpose which may affect required pressure in case of emergency
- Required pressure is not found all the time
- Emergency numbers are not displayed at appropriate locations of the factory
- Disaster Management Plan (DMP) or Emergency Management Plan awareness is not up to the grass root level
- DMP is not available in local languages
- Distribution of fire extinguishers are not as per location of the factory or as per activity
- Required first-aiders are not available

1.11. Monitoring and Measurement

- Calibration of instrument is not done as per frequency
- Labelling of instruments is not found
- Critical and non-critical instruments are not identified for calibration purpose
- One section is responsible for calibration of all instruments. As soon as list is prepared by the time validity is found expired

- All the instruments are covered at a time
- Checklist is not followed while calibration of instrument

1.12. Evaluation of Compliance

- Record on evaluation of compliance is not maintained
- Awareness regarding evaluation of compliance is not observed
- Compliance of legal requirements is not discussed in the Management Review Meeting
- As per frequency specified in the procedure, the compliance status is not discussed in the meeting
- All points as per acts and rules are not discussed for it compliance

1.13. Nonconformity, Corrective Action and Preventive Action

- Corrective and preventive actions are not taken
- And even meaning is not understood to most of the employees
- Corrective and preventive actions are not recorded as per format and record is not maintained
- Awareness regarding corrective and preventive actions is not observed

1.14. Control of Records

- Record are not maintained as per the procedure and clause
- Records are not stored and preserved properly
- No arrangement for preservation of record in case of fire
- No proper identification and legibility of record is observed

1.15. Internal Audit

- Audit is delayed because of minor reasons such as reshuffling of management, transfer of Management Representative(MR) and Change of MR.
- Effective audits are not conducted
- All the clauses are not covered
- Internal Audit Schedule and Internal Audit Calendar is not followed
- Importance is not given to Accounts and Finance departments
- Clauses understanding is not found at par

1.16. Management Review:

- Meeting is not conducted as per frequency
- As per agenda, meeting is not conducted and minutes are not prepared as per the discussions
- Input is found insufficient to address fruitful or effective meeting
- Previous minutes are not discussed properly
- Corrective and preventive actions are not discussed in detail
- Agenda is found changed as per the requirement
- Previous points are not discussed and no plan to achieve the required nonconformity

Conclusions

Potential impacts of proposed development activities need to be assessed and understood so that appropriate management and control strategies can be adopted. It is evident that both the public and private sectors of the industry are making a shift towards perfection. To compete in today's marketplace organizations must respond to these demands in an environmentally responsible and cost-effective manner.

It needs to be re-emphasized that communication between all stakeholders is essential for EMS to be implemented and maintained over a period of time in view of ISO-14001 effective implementation.

The United Nations Environment Programme (UNEP) viewed that participating organizations should have viewed each particular function of their business process and have applied a self-formulated quantitative/qualitative analysis to the each function.

It was observed that requirement for “self-formulation” that failed to provide positive incentives to the organization to add a level of independently verifiable transparency to the analysis process.

In 2004, (David *et al.*, 2005) found that the gap between policy formulation and implementation appeared to have continued to narrow.

A strategic environmental management system in view of performance indicators can improve products, save significant costs, improve production processes, reduce liabilities and waste management costs, enhance market responsiveness, lower insurance premiums and improve competitiveness.

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