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# Environmental Performance Indicators of Oleo-Chemical Based Industrial Park in Indonesia: The Conceptual Model

**Esther S M Nababan[1], Delvian Delvian[2] and Nelson Siahaan[3]**

*[1)] Department of Mathematics, [2)]SPS Environment and Natural Resources [3)]Department of Architecture Universitas Sumatera Utara, Medan – Indonesia.*

*[1)] corresponding author;*
*[1]ORCID ID: 0000-0001-7346-1500*

**Abstract**

This article presents the initial stage of the development of environmental performance measurement system of oleo chemical based industrial park in Indonesia.

The purpose of this article is to propose a conceptual model to describe environmental performance indicators of oleochemical based industrial park as a clearly defined concept, with a clearly defined structure of distinguishable sub-concepts, with logic relationship between these sub-concepts and with unambiguous information and data items. The study case was Sei Mangkei Special Economic Zone (SM-SEZ), the largest Oleo Chemical based eco-industrial park in Indonesia. This study uses primary and secondary research data which is collected from different sources. A visit survey and direct observation to the industrial region and its neighborhoods were conducted. Environmental performance indicators identified referred to 14031 and Indonesian Sustainable Palm Oil (ISPO) standard in Indonesia. The conceptual model is developed using systems thinking approach.

**Keywords:** environmental performance**,** oleo-chemical based**,** eco-efficiency, interrelationship

## INTRODUCTION

Indonesia is one of the world largest palm oil producer after Malaysia. Export on palm oil product has made contribution 12.3 % of total export of Indonesia. In 2015, Indonesias CPO production had reached 32.5 million tons, with exports reaching 26.4 million tons. The export value went down from US$21.1 billion in 2014 to $18.6 billion in 2015. Indonesias exports of CPO and its derivatives fell by five percent to 25.1 million tons in 2016, from 26.4 million tons in 2015. In 2016, palm oil industry played important role in providing 4.2 million direct worker and 12 million indirect workers in Indonesia, and will absorb 1.3 million workers in 2020 According to data from Indonesia's Statistics Agency (BPS) the total area of oil palm plantations in Indonesia is currently around 11.9 million hectares; a figure that is about three times higher than in the year 2000 when around four million hectares of Indonesian soil was used for palm oil plantations. This figure is expected to increase to 13 million hectares by the year 2020. [1] [2]

There have been wide spread complaints that palm oil is not sustainable and proposals to have all future forest land conversion halted or restricted. The industry is linked to major issues such as deforestation, habitat degradation, climate change, animal cruelty and indigenous rights abuses in the countries where it is produced, as the land and forests must be cleared for the development of the oil palm plantations. It is widely known that a negative side-effect of palm oil production is that the palm oil business is a key driver of deforestation in countries such as Indonesia and Malaysia. Indonesia is the world's largest producer and exporter of palm oil but it is also the largest greenhouse gas emitter after China and the United States. [3]

However, the industry also contributes to regional development as a significant source of poverty alleviation through farm cultivation and downstream processing. Palm oil production provides a reliable form of income for a large number of Indonesia’s rural poor. Employment generated from palm oil production in Indonesia could potentially reach over 6 million lives and take them out of poverty. It provides developing nations and the poor a path out of poverty. Expanding efficient and sustainable agriculture such as Palm Oil Plantations provides small and large plantation owners and their workers with a means to improve their standard of living [4][5].

In fact, the existence of palm oil industry is a significant contributor to production in Indonesia. Therefore, sustainability of palm plantations and palm oil industry is ought to be conserved and maintained. One of the ways that can be done is to optimize the benefits of palm oil industry to the country or a region, while at the same time to minimize its negative effects to the sustainability of the environment.

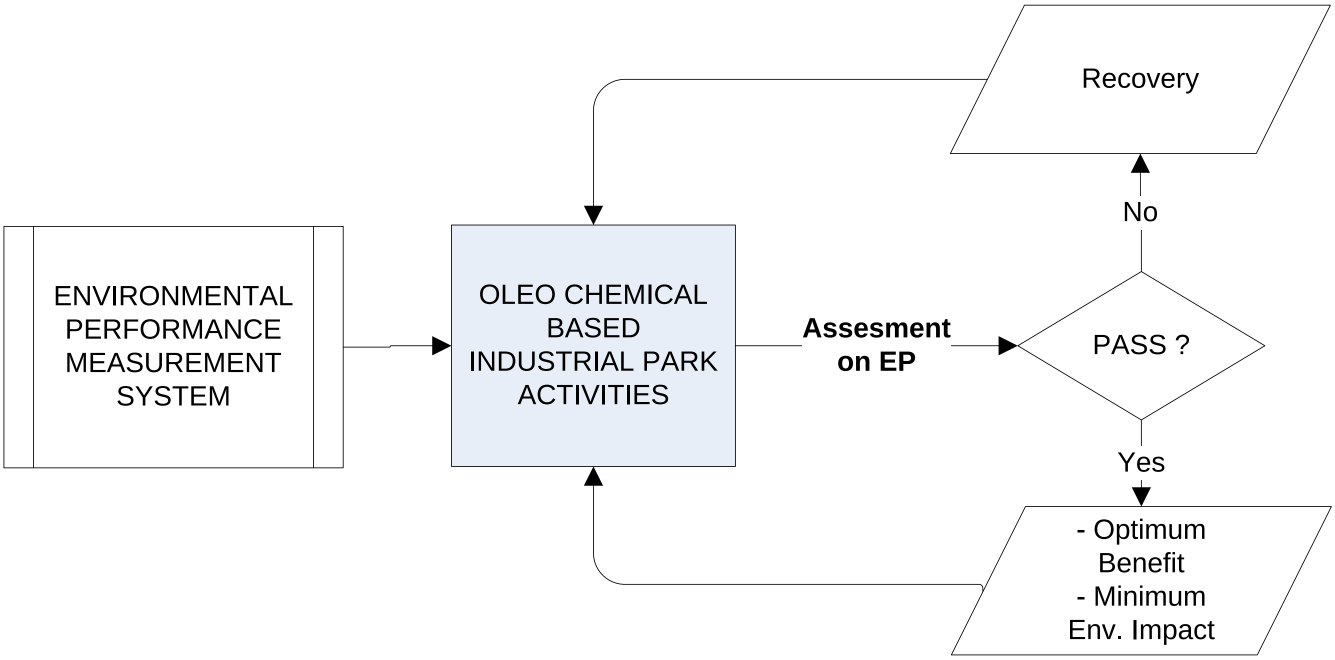


**Figure 1:** Conseptual model of EP assessment on Oleo chemical based Industrial Parks

One of the tools to prevent from environment degradation is the evaluation system of environmental performance which can be used to evaluate and scoring the environmental performance of a system. Environmental Performance evaluation is a process and a tool for the internal administration designed to give a continuous amount of reliable and validated information to determine if the organization complies with a previous determined criteria developed by the management of the organization. An organization concerning evaluations of environmental performance of Palm Oil Industry was established and has developed a set of environmental and social criteria which companies must comply with in order to produce Certified Sustainable Palm Oil (CSPO) namely Roundtable Sustainable Palm Oil (RSPO). Besides RSPO certification, this organization also provide Supply Chain Certification, and International Sustainablity and Carbon Certification (ISCC). Palm Oil Industry or estate are also strive to be certified and accredited by globally recognized bodies in various areas of quality and international standards compliance.

Environmental Performance Indicator (EPI) is specific expression that gives information of the local, regional, national or global environmental conditions. EPI concern an organization's impacts on living and non-living natural systems, including ecosystems, land, air and water. EPI can show clearly how the organization is performing, and provide a firm basis for future targets and improvements. Environmental Performance evaluation is used to score the environmental performance of the whole activities within the industrial region as well as its neighborhood. This score can then be used for taking further action to either recovering or controlling the environmental performance of the system. Environmental Performance (EP) criteria is environmental objective, goal or any other level of performance established by the Head of the organization and is applicable for the evaluation of the environmental performance. When they are properly applied, these criteria can help to minimize the negative impact of palm oil cultivation on the environment and communities in palm oil-producing regions.

Some of the components of the environmental performance criteria depends on the government regulation, stake holder, and operational manager of the industrial park.

Hence, each industrial park might has each own system for environmental performance assessment, evaluation or measurement.

## RESEARCH METHODOLOGY

In this initial stage in developing the measurement system of environmental performance of the system, we identified environmental indicators of the SEZ-SM.

The indicators identified referred to ISO 14031 and to Indonesian Sustainable Palm Oil (ISPO) standard [6].

In selecting the appropriate indicators, the main criteria used was adopted from [7]

This study uses primary and secondary research data collected from different sources.

A visit survey and direct observation to the industrial region and its neighborhoods were conducted. All identified indicators then organized and put into structures, substructures

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contain component of indicators and sub indicators. Besides that the data (input) needed to produce the descriptions of cases also came from an extensive literature search which was conducted to identify and select relevant reference cases for this study from scientific journals, magazines, conference proceedings, publicly available consultancy reports, local, state and federal government reports, as well as web-based case studies. Typical search terms used include among others, the following: For Google database search: “Oleo chemical based eco-industrial Park”, “Environmental systems analysis and industrial ecology” “Environmental performance indicators”. Information contained in the majority of the consulted literature includes basically qualitative and to some extent, quantitative data of the selected reference cases. Attempts were made to generate data for each reference case, but for the constraints of corporate confidentiality regarding release of data, the process was stalled

### Overview Special Economic Zone Sei Mangkei (SEZ SM)

Special Economic Zone Sei Mangkei (SEZ SM) is the biggest oleo chemical based industrial park in Indonesia is It started to operate in 2015. It used to be Sei Mangke Integrated Sustainable Palm Oil Industrial Cluster (SM-ISPOIC).

SEZ SM is a business development approach in special zone for industrial center based on palm oil. SEZ SM is an industrial area located in the center of raw materials based on agro that are not owned by other industrial area in Indonesia. In the future this SEZ will be also developed as a satellite city with supporting facilities such as dry port, hotel, golf court, hospital, apartment, residential and others. This SEZ is expected to be the main factor of the company to acquire sustainable added value.

SEZ Sei Mangkei is one of Indonesia’s first SEZ established by Indonesian Government located in in Bosar Maligas sub-regency, Simalungun regency, North Sumatra province.

Sei Mangkei KEK has major activities in the form of industrial downstream palm oil and rubber. Besides the main activities are supporting activities such as logistics, various industries and tourism. The products produced by this KEK include fatty acids, fatty alcohol, surfactants, biodiesel, and biogas. SEZ Sei Mangkei is divided become three zones namely : Industrial Zones, Logistic Zones and Tourism Zones. In this paper, we limit the focus on industrial zones.

### Existing Condition of SEZ Sei Mangkei

At the moment there is a consumer goods giant factory of PT Unilever Oleochemical Indonesia (UOI) that employs 400 employees out of a total number of 900 employees working in SEZ Sei Mangkei. Of the total area 640 hectares, 27 hectares is used by PT UOI. The IDR 2 trillion plant, which will be run and managed by PT Unilever Oleochemical Indonesia, will mostly process crude palm oil at a capacity of 200,000 tons a year. The rest is used by PT Perkebunan Nusantara 3 (PTPN 3), PTPN 5, and Perusahaan Listrik Negara (PLN).


**Figure 2:** Infrastructure and Industries in SEZ SM

Source : ptpn3.com

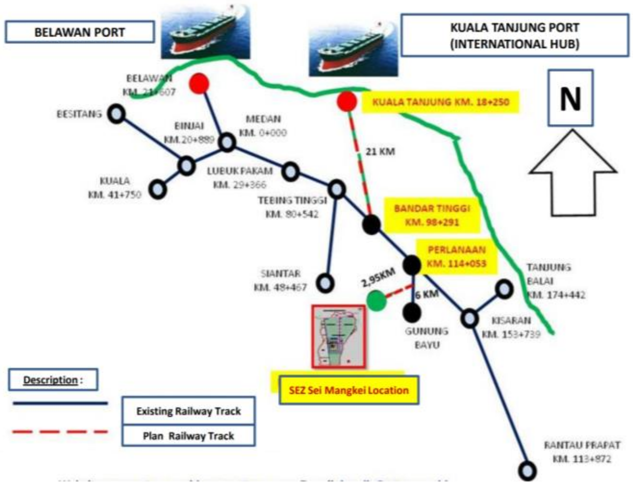


**Figure 3:** Railway Track Connectivity from SEZ SM to Kuala Tanjung and Belawan Port

Source : ptpn3.com

Other infrastructure is prepared by PTPN 3 as Manager SEZ SM is a joint venture with PT PLN and PT Sejahtera Dignity to provide power ± 12 MW. PT PLN has also prepared the construction of 150 KV Mains Substation capacity of 60 MVA and will be developed into 120 MVA growth in accordance with the needs of electrical energy in the region.

**Table 1:** Regional Infrastructure

| No. | Facilities | Capacity | Function |
|---|---|---|---|
| 1. | Substation PT PLN / electricity | 60 MW | |
| 2. | Network Transmission pipeline | | Transmission between Belawan – SM |
| 3. | Multipurpose Port Kuala Tanjung | | |
| 4. | National Road Access | | SM – Port Kuala Tanjung/Belawan |
| 5. | Railway access | | SM – Port Kuala Tanjung/Belawan |
| 6. | Kualanamu International Airport | | |

**Table 2:** Facilities at SEZ Sei Mangkei

| No. | Facilities | Capacity | Function |
|---|---|---|---|
| 1. | Waste Water Treatment Plant | 250 M3 / hour | |
| 2. | Dry Port | 5,300 TRUs | One stop service for Quarantine, Immigration and Custom |
| 3. | Railway Track | 2.95 km length | |
| 4. | Tank Farm | 2 x 3,000 ton | For raw material CPKO |
| | | 2 x 5,000 ton | For raw material CPO |
| 5. | Road Axis ROW 62 and ROW 30 | 4,785 length | Main drainage |
| 6. | Tank Farm | 6 (six) units | Fro derivative products of palm oil |
| 7. | ROW water and intake pond | 500 m3 / hour | Water Treatment Plant (primary distribution network) |
| 8. | Ground tank capacity | 500 m3/hour | Water Treatment Plant (secondary distribution network) |
| 9. | Road ROW 34 | | Main drainage |
| 10. | Main Office Building | 7,000 m2 | Office |
| 11. | Palm Oil Mill cap | 75 ton FFB/hour | Produce CPO as raw material for biodiesel industry, refinery industry, and oleochemical industry |
| 12. | Biomass power palnt | n.a | |
| 13. | Palm Kernel Crushing cap | 400 ton / day | Produce CPKO as raw material for surfactant industry and fatty alcohol |
| 14. | Electricity | 60 MW | |
| 15. | IT Network & telephone, Cable Network | | |
| 16. | Palm Oil Innovation Centre | | |
| 17. | Palm Oil Mill : 12 units | 585 ton FFB/ hour | |

Currently available land which is hundreds hectares is for palm oil plantation industry development 245 hectares, for various industry 600 hectares, 150 hectare for electronic industry, for tourism 117 hectares and other industries.

Development of infrastructure is managed by PT Perkebunan Nusantara 3 (PTPN 3), while operational on industrial region is managed by PT Kawasan Industri Nusantara

(PT KINRA) [1][2][3].

**Indicators Identifications**

Sustainable development of palm oil plantations and growth of the palm oil industry in developing nations can and will be achieved through consultation and collaboration with industry, growers, lobby groups and the wider community [5]. Then, the environmental performance can be scored or measured using any mathematical methods such as eco-efficiency, life cycle analysis etc. Indicators observed and identified were : Operational Indicators, Management Indicators, Social and Economic Impact Indicators, and Environment Indicators.

Operational Indicators are measured by its activities, outputs, quality, and program costs.

Social and Economic Impact Indicators are measured by outcomes, outcomes costs, systemic Impact generated.

Environmantal Indicators :

- Land use
- Biodiversity
- Energy consumption
- Water consumption
- Air, land, water emissions
- Material consumption

This environmental indicators should comprehensively describing the environmental impacts in the short term, medium term and long term on every cycle of projects or activities. Environmental indicators are hard to quantify, therefore it is suggested that the used a list of indicators and the sign (positive or negative) of the environmental impact with the estimation of distance from minor to major [20].

Environmental Performance Evaluation (EPE) provides a robust and repeatable process to compare past and present environmental performance using KPIs. It helps organizations determine trends, evaluate risk and identify its strategic objectives and targets. EPE can also be used to report and communicate information on the organization’s environmental performance to demonstrate its commitment to improvement. [6]

ISO 14031 sets out three types of indicators:

- Environmental condition indicators (ECI), for presenting achievements in context
- Operational performance indicators (OPI), used to demonstrate change in resource use
- Management performance indicators (MPI), for showing cost savings and improvements in training

The report presents this detailed model at 4 different levels, with consecutively increasing level of detail. Environmental performance conceptually an informal description of the meaning and the intentions of environmental performance, and describes how environmental performance is applied, presented and interpreted.

- The concepts of environmental performance: a formal description of the concepts of environmental performance and their semantic, functional and logic relations.
- The information of environmental performance: a general overview of the information needed to calculate and present an environmental performance value.
- The data of environmental performance: a detailed overview of each individual data item needed to calculate an environmental performance value.
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**Tabel 3:** Tabel of Environmental Indicators

| No | Enviromental Impact | Indicators |
|---|---|---|
| 1 | Greenhouse gas emissions | Total annual carbon dioxide emissions |
| 2 | Water consumption | Total annual water consumption |
| 3 | Waste output | Total annual waste |
| 4 | Resources use and materials | Total tones of raw material |
| 5 | Transport | 1. Total fuel consumption |
| | | 2. CO2 emissions per 1000 km travelled |
| | | 3. Employee kilometers covered on business travel (road/air/rail) |
| | | 4. Vehicle fill percent, and empty running per cent |
| | | 5. Proportion of employees traveling alone by car when commuting |
| 6 | Energy | 1. CO2 emissions by energy type or major use |
| | | 2. Consumption by type |
| 7 | Water Polutants | 1. CO2 emissions by energy type or major use |
| | | 2. Consumption by type |
| 8 | Hazardous Waste | 1. Total tonnes of hazardous waste generated by type |

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Because the emphasis was basically on the different material-exchange types as selection criterion, models of eco-industrial parks proposed by [7] [8] [9]was adopted from which three out of the originally proposed taxonomy of five were considered necessary for this study. In this regard, the development of a successful industrial ecosystem has been maintained with the aim of achieving significant Industrial Symbiosis, it is important to ensure the co-location of two or preferably even more major process industries.

The table below present the elements of environmental indicators adopted from [11][12]

## DISCUSSION

Different with in Thailand and Malaysia where Industrial Estate is located in distance from residential area, SEZ Sei Mangkei is located closed to resident area namely sub district Bosar Maligas and sub district Bandar. Referred to [13][14] and references therein, the residence living in the neighborhood of the industrial region must be of the environmental quality concern. Some research has been carried out about the impact of the residence living closed to the industrial area. To some extent, the involvement of the residents in the management of industrial region yields positive effects on both sides including indirectly to economic growth of the industrial activities in the region.

There is a substantial amount of complimentary between the objectives of environmental quality and economic growth. Preservation of environmental resources must also ensure that these resources are made available to the residents in the neighborhood. These objectives together are often difficult when there are too many polluters and too many affected parties. The expenditure on Environmental Quality will technically reduce the profit margin of the firm, which may lead to discouragement of to include Environmental Quality in Economic Growth objective. The questions then arise whether or not the inclusion of environmental quality and support to the neighborhood in a firm's management objectives results in an increase in profit. The degree of success itself in terms of environmental performance expected from Industrial Symbiosis was measured indirectly. For example, assessing environmental performance by using information gathered from a wide range of literature search across the disciplines was sufficient to answer the key questions earlier stipulated in the aim and objectives section of chapter one. However, indicators used to assess environmental performance originated from the definition of an eco-industrial park are: - Water - Energy - Material flows [14]. These criterions were based on placing emphasis on the type of symbiotic associations that operates in the respective parks as described in consulted literature..

### Conceptual Model Development

Classical methods on oleo chemical based industrial park management has been widely known to rely on the limitation of the components chosen to involve in the system. Integrated management takes account on related environmental components to be intervened simultaneously. In sustainable environmental performance, the three areas, the Economic Growth, Environmental Quality and Intergenerational Concern are interrelated. The interrelation means that any intervention onto a component will mutually impact the other components. Knowledge on the interrelations acquired from various experts is the core for developing management strategy [15][16][17].

Interaction table is then built, which consist of interaction between each subcomponent, required data, and the role of each component in the interaction. The interaction between each component is then identified and categorized as "direct" interaction or "indirect" interaction.

For instance:

The influence of component of EG on component of EQ:

```
IF EG objective is Maximum Profit THEN
  water treatment is not to be installed
ENDIF
```

On the other hand, the influence of component EQ on component EG:

```
IF Water Treatment is not to be installed, THEN
  negative impact on EQ
ENDIF
```

etc.

There are a few indirect interactions between each subcomponent of each system. For interaction yields harm to other component, intervention or strategy should be put into the interaction line. Cause and effect on each subcomponent is the tabulated. The next stage is find strategy to be injected or is said as element of intervention.

In managing environmental resources with sustainability in mind, the trick will be to find a concept for this term which is sufficiently broad to embrace most acceptable usages, and also sufficiently practicable to be applicable in the everyday management of the environment. Several areas must be addressed in maintaining distinctions between economic efficiency and equity, more thoroughly about prospects for resource substitution and resource-enhancing technical change, and encouraging the empirical investigation of sustainability issues. One of them is to increase "efficiency" in all aspect of management.

There are many ways in which environmental costs. Loses or benefits may go unrecorded in traditional accounting systems. One broad approach to calculating full environmental cost is to distinguish between internal costs (those borne by the organization) and external costs (those passed on to society e.g. environmental and health costs). In this approach, internal environmental costs to the firm are composed of direct costs, indirect costs, and contingent cost. These typically include such things as remediation or restoration costs, waste management costs or other compliance and environmental management costs. Internal costs can usually be estimated and allocated using the standard costing models that are available to the firm.

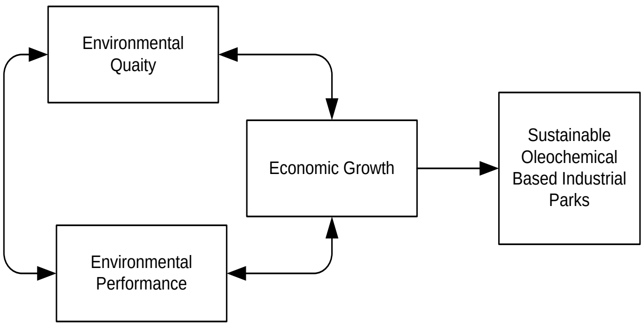


**Figure 3:** System interrelationship conceptual model.

The introduction of a systems perspective in the analysis of the interaction of industrial (human) systems and ecological systems aims to overcome the limitations of the traditional approach by introducing the whole system perspective and the evolutionary approach in the understanding of interaction between industrial and natural systems. Industrial systems are, therefore, not seen in isolation but within the ecological systems of which they are a part. [20] proposed to analyse the industrial system as a subsystem within the complex-metasystem. Both, the subsystem and the host system, are connected to each other by a multiplicity of linkages and dependency relations. The industrial system, thus, is embedded in the ecological systems, but it is also a complex system on its own, formed by a network of interacting units, the enterprises.

According to systems theory, all these units have autonomy but are also dependent from one to another, through direct and undirected links. The understanding of these linkages is thus a first step towards the better integration of natural and industrial systemsDirect costs can be traced to a particular product, site, type of pollution or pollution prevention program (e.g., waste management or remediation costs at a particular site). Indirect costs such as environmental training, Resource & Development, record keeping and reporting are allocated to cost centers such as products and departments or activities. External costs are the costs of environmental damage external to the firm. These costs can be "monetized" (i.e., their monetary equivalent values can be assessed) by economic methods that determine the maximum amount that people would be willing to pay to avoid the damage, or the minimum amount of compensation, that they would accept to incur it [20]

Full environmental costs = (internal + external costs)

where:

Internal costs = (direct + indirect + contingent)

External costs = the costs of external environmental and health damage

(e.g., the costs of uncompensated health effects and environmental impacts –Stratospheric ozone depletion; biodiversity loss; climate change)

EG caused by increased productivity, and better technology can enable higher living standards and higher GDP without depleting the earth's resources. There is no reason why this growth cannot be sustainable forever. The impact of nonrenewable resources on existing theories of economic growth have continuing significance for the economics of sustainability. In managing environmental resources with sustainability in mind, the trick will be to find a concept for this term which is sufficiently broad to embrace most acceptable usages, and also sufficiently practicable to be applicable in the everyday management of the environment. Several areas must be addressed in maintaining distinctions between economic efficiency and equity, more thoroughly about prospects for resource substitution and resource-enhancing technical change, and encouraging the empirical investigation of sustainability issues. Concern about sustainability helped to launch a new agenda for development and environmental economics and challenged many of the fundamental goals assumptions of the conventional economics of growth and development. There are many ways can be implemented to increase profit when the management includes EQ in its objectives. One of them is to increase "efficiency" in all aspect of management.

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From the perspective of society as a whole (i.e., the firm and the rest of society), economic efficiency is achieved (i.e., full environmental costs are minimized) when the firm takes internal measures to protect the environment up to the point where the sum of internal and external costs is minimized. Contingent or intangible environmental costs are costs that may arise in the future to impact the operations of the firm. Contingent costs can fall into both internal and external cost categories, and include:

1. Changes in product quality as a result of regulatory changes that affect material inputs,
2. Methods of production, or allowable emissions;
3. An unforeseen liability or remediation cost;
4. Employee health and satisfaction;
5. Customer perception and relationship costs; and
6. Investment financing costs or the ability to raise capital.

From a perspective of Environmental Management Strategy, there are three motivating factors to account for implementing environmental accounting in order of priority:

1. Compliance with standards;

2. A moral commitment to environmental stewardship;

3. The desire to promote good relations with the residents of local communities.

Within the corporation, environmental accounting concerns the definition, assessment and allocation of environmental costs and expenditures for the purposes of cost and resource management, compliance reporting, and capital budgeting, planning, and. operational decision making. Environmental accounting can be further delineated into two main areas: financial environmental accounting and managerial environmental accounting.

Managerial environmental accounting has a different focus. It supports the internal management and decision-making process through various techniques of cost allocation, performance measurement and business analysis. This type of environmental accounting is interdisciplinary in scope. On the one hand, scientists, economists, and policy advisors can identify internal and external environmental costs. On the other hand, the management accounting profession can use its expertise to allocate these costs within existing and emerging environmental and sustainability accounting frameworks.

Given the two main areas of environmental accounting and the fact that both accountants and environmental experts are required to delineate and allocate internal and external costs, it is not surprising to find different methods related to environmental accounting in the literature. These include:

1. Activity-Based Costing/activity-based management
2. Total Quality Management/total quality environmental management
3. Business Process Re-engineering/cost reduction
4. Design for Environment/life-cycle design and assessment
5. Life-Cycle Assessment/life-cycle costing
6. Total Cost Assessment

- Full Cost Assessment

Managerial environmental accounting provides a comprehensive means for incorporating environmental considerations into business decision making. The inclusion of internal environmental costs in its accounting will assist a company in working to maximize its current profitability [20]. A firm can further be guided in maximizing its long-run profitability by taking into account external environmental costs, especially to the extent that it may be required to internalize these costs in the future. The adoption of these methods can help put a firm in a stronger competitive position in relation to firms that apply only conventional accounting. The extent of this advantage will depend on how extensively and creatively the firm makes use of these methods in its decision-making.

For instance, the influence of component of EG on component of EQ:

```
IF EG objective is maximum profit THEN
    IF water treatment is to be installed THEN,
        IF efficiency is implemented, THEN
            Lower the marginal cost
                    Increase Profit
        ENDIF
    ENDIF
ENDIF
```

Sustainable Economic Growth can be achieved by comprising intervention on each component of EG which has interrelationship and dominant interaction on EQ and on NLS.

Efficiency is one of many ways to deduct marginal cost directly and hence increase profit. It can be put as intervention or strategy to include in the interaction line between objective of EG and EQ. The positive impact on efficiency is obvious. The conceptual model above can be implemented in managing local environment where the objective of EG and EQ is to be achieved.

## CONCLUSION

The environment-economy framework and model described above is an attempt to integrate the environment within a macroeconomic framework. The fundamental strength of the model is its ability to establish qualitative and quantitative links between objective of economy growth, environmental quality and neighbors within a general framework. Efficiency can be achieved by delineate and allocate internal and external costs, and implement the most suitable method related to environmental management and environmental accounting. The discussion of sustainable economic growth is the ability to model the project to likely economic and environmental quality impacts of a given configuration of the economy in the future.

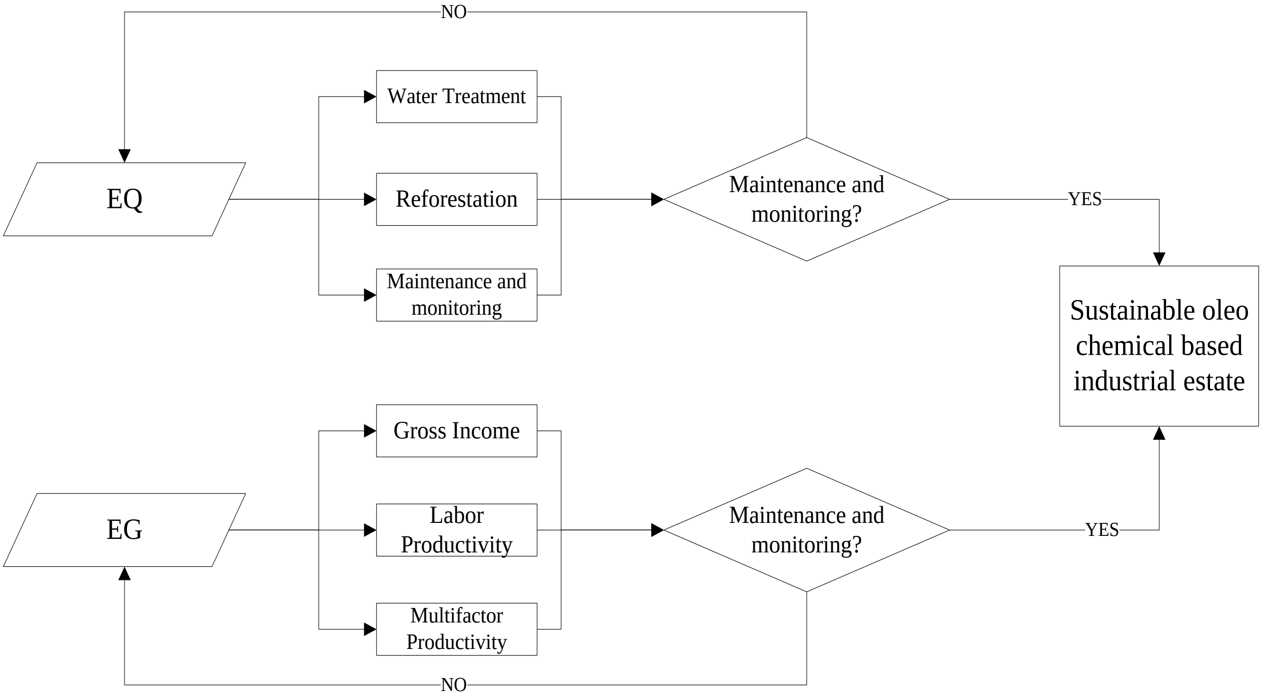


**Figure 4.** Flowchart of EG and EQ components toward sustainable EG.

Much effort has been given to transparently state relevant and significant assumptions and limitations concerning the nature and logic of the concept and the sub-concepts of environmental performance. This is done not as an attempt to enforce how environmental performance measurement is to be understood, interpreted and applied, but to facilitate for readers to make their own judgments about whether they agree with the statements or not. The transparent documentation is intended to support a development of a consensus about environmental performance information by stimulating the readers' awareness of agreement or disagreement and to invite to points for discussion.

Slightly different from industrial parks in Thailand and in Malaysia where the industrial parks is located within distance form residential area, in Indonesia the Industrial region is surrounded by residential area. This will affect the social indicators and economic indicators which will also give direct or indirect affect to the environmental performance of SEZ SM. Research on the effects of the residents in sub district Bosar Maligas, and of the residents in sub district Bandar on the environmental performance of SEZ Sei Mangkei is ongoing. The result will shows how significant the existence of residents living in the neighborhood of SEZ Sei Mangkei affects the environmental performance of SEZ Sei Mangkei.

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