

# Industrial development effects on ecological sustainability in developing countries

Mona Saleh El-Basha

Alexandria Technical College, El-Shatby, Alexandria, Egypt

Most of the developing countries look forward to achieve economical advancing. Therefore these countries aimed to reinforce their industrial bases and develop the different branches of industrial production as a tool to support the economic development and increase the national income; in order to modernize their urban life style and upgrade the physical and social conditions. On the other hand, the developing countries - including Egypt - aimed to transfer readily from the agricultural economy towards industrial economy as a way to create new investment chances and to open new industrial labors. In the sequence of these urgent orientations towards fast industrialization, most of the developing countries ignored many of serious requirements such as: the opportunity of industrial types and the adopted technology, the special distribution of industrial enterprises over the regions and its relevant impacts on the natural resources and ecosystems, the integration between physical, economical, and environmental planning, and also, the international effects that generated as a result of transferring the environmental cost from the developed industrialized nations to Third World. Even, this paper aims to establish a balanced framework for the industrial development in developing countries, taking into account the basic environmental considerations and sustaining possibilities of the ecosystems within urban regions of such countries. The three main topics in this paper are: first, the environmental resources and ecological sustainability, that presents the nature of environmental resources, the ecological footprints of industrial cities, and the need of urban sustainable development. Second, industrial development challenges, which discuss the industrial development within the sustainability context, also the environmental challenges of industrial development in Third World countries are outlined. Third, the environmental policies for achieving the ecological sustainability, that briefly discusses the new role of planning, the institutional framework, the various roles of both central and local governments, and the responsibilities of industrial sector .

إن معظم البلدان النامية في تطلعها الدائب لتحقيق التقدم الإقتصادي تعمل على دعم قواعدها الصناعية وتطوير أفرع إنتاجها الصناعي كوسيلة لدفع عجلة التنمية الإقتصادية وتحقيق دخل قومي يمكن من خلاله تحديث أوجه الحياه الحضرية والإرتقاء بمختلف المجالات المادية والإجتماعية بها . وفي سياق ذلك فإن هذه البلدان – ومن بينها مصر – عمدت إلى التحول السريع من الإقتصاد الزراعي إلى الإقتصاد الصناعي كوسيلة لخلق فرص جديدة للإستثمار وإستيعاب الأعداد المتزايدة من السكان في سوق العمل الذي تتجه المشروعات الصناعية الجديدة . وفي سياق هذه التوجهات السريعة نحو التصنيع ؛ أغفلت معظم هذه البلدان إعتبرات هامة كثيرة على رأسها : إختيار أنماط الصناعات الملائمة وإنتقاء التقنيات الصناعية التي يتم تطبيقها ، التوزيع الإقليمي للمشروعات الصناعية بما يتناسب مع الأهداف التنموية على المستوى القومي ، التكامل بين التخطيط العمراني والإقتصادي والبيئي الذي يضمن تحقيق أهداف الحفاظ على البيئة وكذلك التأثيرات الدولية الناجمة عن تحويل بعض التكاليف البيئية من البلدان الصناعية المتقدمة إلى تلك البلدان . ولذا فإن هذه الورقة البحثية تهدف إلى إرساء صيغة متوازنة للتنمية الصناعية في البلدان النامية ؛ آخذة في الحسبان الإعتبرات البيئية الأساسية وإمكانيات التواصل للنظم الأيكولوجية في الأقاليم الحضرية بهذه البلدان . وتتضمن المحاور الرئيسية لهذه الورقة ثلاث موضوعات رئيسية على النحو التالي : المحور الأول : البيئة والتواصل الأيكولوجي : وهو يعرض لطبيعة الموارد البيئية ، البصمة الأيكولوجية للمدن الصناعية ، ومدى الإحتياج إلى إستدامة التنمية الحضرية . المحور الثاني : تحديات التنمية الصناعية : ومن خلاله تناقش التنمية الصناعية في سياق الإستدامة ، وكذلك التحديات البيئية التي تواجه التنمية الصناعية في بلدان العالم الثالث . المحور الثالث : السياسات البيئية الرامية لتحقيق التواصل الأيكولوجي : ويعرض للدور الحديث للتخطيط ، الإطار المؤسسي لتطبيق التنمية المستدامة ، وكذلك الأدوار المختلفة لكل من الحكومات المركزية والمحلية ومسئوليات القطاع الصناعي في هذا الصدد .

**Keywords:** Sustainable urban development, Industrial development, Sustainable development, Ecological sustainability, Developing countries

## 1. The environment and ecological sustainability

### 1.1. The nature of environmental resources

The environment is often viewed in term of the resources it provides for human and natural ecosystems. A useful way of thinking about natural resources is in term of their renewability and non-renewability (fig. 1). According to this way, resources can classified as follow:

- *Renewable resources*: they are constantly renewed by processes external to their use by humans, these resources reproduced at rates which may equal those of their use . The critical feature of the use of renewable resources is thus the rate at which they are replenished relative to the rate at which they used, at the extreme, the resource may be exhausted . There are two categories of such resources, First, the non-critical zone resources (such as flow energy sources, like: wind, solar, and hydrological power). These resources are limited in quantity, although they are not destroyed by use, some of human activities can alter that amount (as recent debates concerning the greenhouse effect suggest) Second, the critical zone resources, in such category the rate at which the resource is used is crucial. If it exceeds the rate at which the resource is reproduced naturally, the resource will be depleted, eventually reaching a stage at which reproduction ceases and resource is exhausted (such as: plants, corps, fishes, and animals..) [1]. Also this category includes the environmental quality that can be altered by the pollution which generated as a result to human activities (such as: soil, water, air pollution) .

- *Non-renewable resources*: they are inanimate component of the Earth, and are therefore fixed in quantity, and effectively their stokes are finite. So, human use of them must be limited; once their stock has been exhausted, it is no longer available [2]. Non-renewables may only be regenerated over geological time scales, availability depends on the cost recovering deposits, potential for recycling (that impossible for fossil fuels, but technically feasible for most minerals), and development of acceptable substitutes [3].

### 1.2. The ecological footprints of industrial cities

All cities draw on natural resources produced on land outside their built-up areas (such as: agricultural crops, wood, Fuel.); the total area of land required to sustain a city, which can be termed (according to William Rees) its “*ecological footprint*” [4], that is typically at least ten times or more greater than that contained within the city boundaries or associated built-up area. In fact, through trade and natural flows of ecological goods and services, all cities appropriate the carrying capacity of other areas, and draw on the material resources and productivity of a vast scattered hinterland.

Carrying capacity defined as the population of given species that can be supported indefinitely in given habitat without permanently damaging the ecosystem upon which it is dependent. For human beings, carrying capacity can be interpreted as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a given region without progressively impairing the functional integrity and productivity of relevant ecosystems.

Preliminary data for industrial cities suggest that per capita primary consumption of such things as food, wood products, fuel, and waste-processing capacity co-opts on a continuous basis several hectares of productive ecosystem, the exact amount depending on individual material standards of living. This average per capita index can be used to estimate the land area functionally required to support any given population. The resultant aggregate aria can be called the relevant community’s total “*ecological footprint*” on the Earth [5].

Practically, many of industrial cities (especially the wealthy cities) can greatly exceed the ecological carrying capacity of its region, because natural resources can be imported from distant regions or even from other nations. But this does not become evident in environmental deterioration in that city’s surrounds, because city-based activities depend so much on natural resources brought from other regions, whose production draw on the carrying capacity of these regions . The

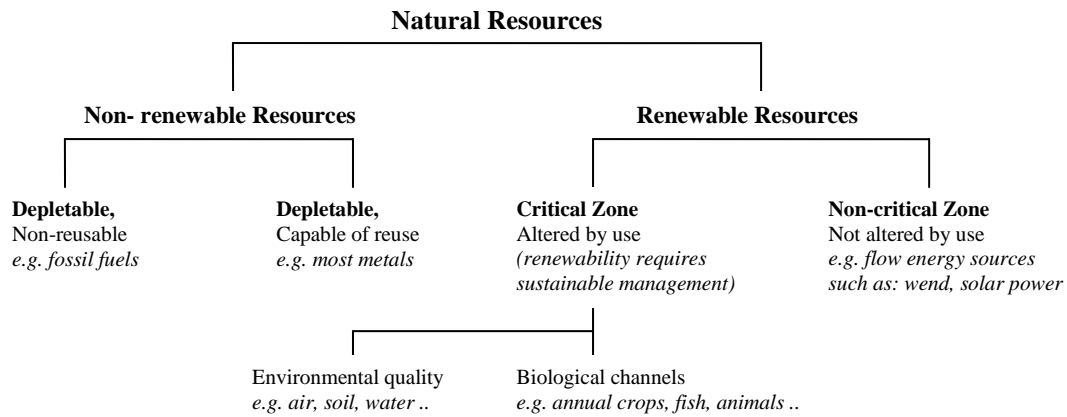


Fig. 1. A classification of natural resources [3].

consideration of city’s footprint can also reveal the extent to which it draw in carrying capacities of other nations (as in imported goods) or on the whole biosphere (as in emissions of greenhouse gases) [6].

Regional ecological deficits do not necessarily pose a problem if import-dependent regions are drawing on true ecological surpluses in the exporting regions. A group of trading regions remains within net carrying capacity as long as total consumption does not exceed aggregate sustainable production. The problem is that prevailing economic logic and trade agreements ignore carrying capacity and sustainability considerations. In this circumstances, the terms of trade may actually accelerate the depletion of essential natural capital thereby undermining global carrying capacity.

### 1.3. The need of sustainable development

There is uneasy balance to strike between the continued stability of natural systems and the welfare of communities who depend, directly or indirectly, on the exploitation of resources. As a general principle, economic and community development must be work within the constraints set by ecological systems in order to attain the sustainability in development [7]. Although the concepts of resource conservation and sustainable development have deep roots in the theory of resource management but have most recently been popularized by “*Our Common Future*” the 1987 report of the World Commission on Environment and

Development, as the basis for overall environment-economy integration. The commission defined sustainable development as “development that meets the need of the present without compromising the ability of future generation to meet their own needs” [8] . In the other words the sustainable development means that we should leave the next generation with a stoke of assets no less than that which we originally inherited. There are two interpretation of this idea:

- Each generation should inherit an aggregate stoke of man-made and environment assets no less than the stoke inherited by the previous generation,
- Each generation should inherit a stoke of environmental assets no less than the stoke of such assets inherited by the previous generation (fig. 2).

*The first* interpretation reflect the common economic assumption that man-made and natural assets are substitutes, that natural assets can be traded of through development as long as the resultant growth of man-made capital provides an equivalent endowment to the next generation . *The second* emphasizes natural capital alone because of the unique services it provides and the changing human needs, so that each generation should inherit at least equivalent natural environment [9]. There is a strong emphasis that if we are serious about sustainability we should adopt the second option and prevent the further depletion of our natural capital. Only this inter

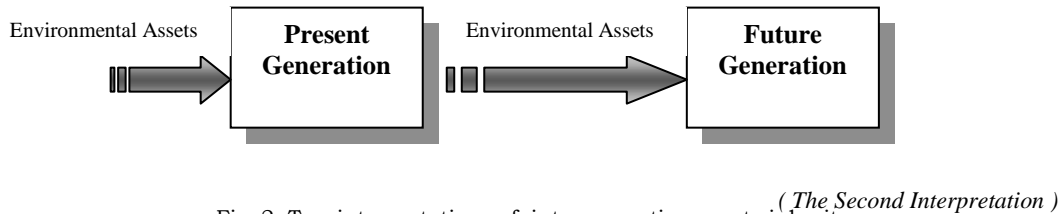
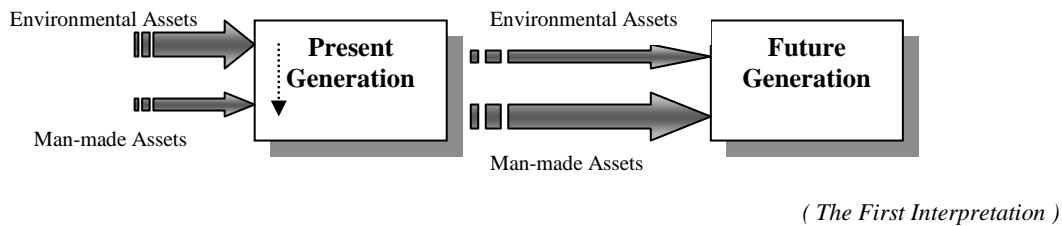


Fig. 2. Two interpretations of intergeneration assets inheritance.

pretation of *constant capital stock* is option and prevent the further depletion of our natural capital. Only this interpretation of *constant capital stock* is consistent with achieving inter-generation equity, maintaining ecological resilience, and avoiding irreversible damage to life-supporting ecological processes [10].

## 2. The industrial development challenges

### 2.1. The industrial development within the sustainability context

Since 1900, the World's population has multiplied more than *three* times, Meanwhile, its economy has expanded more than *twenty* times. Most of the World's economic growth centered in industrial sector, that the industrial production has increased by factor of fifty and consumption of fossil fuels has increased by a factor of thirty, about four-fifth of this growth has occurred since 1950 [11]. With the beginnings of the 21<sup>st</sup> century, the new changes in social, cultural, political, and economic trends that imposed by the new global order, burden different countries - especially developing countries - with new challenges related to accelerate their development rates. Most of such countries resort to industrialization as a mean for obtaining the hopeful economical advancing. Although some of them achieved a significant success towards

their economical goals [12], but on the other hand, these accelerated growth rates of the economic have a negative reflection on the limited resources and the fragile ecosystems. This is not mean that the developing countries should be put a stop to industrial development, but they must do this within acceptable bounds that do not threat the environment quality.

One of the basic premises for sustainable development is the recognition that environment and development are not exclusive of one another, but are complementary and interdependent and, in the long run, mutually reinforcing [13]. So that, the Third World nations must be transfer to "*sustainable industrial development*" to attain the balance between economical targets and environmental considerations. The adoption of this type of development require such countries to restrict with some requirements related to the nature of the industrial activities. In general, from the a broad overview, industrial activities which are considered to be "sustainable" in the ecological sense must be meet one or more of any three criteria:

- *First*, the activity does not damage natural resources significantly; so that the same quantity and quality of such resources are available for further use as if the project never happened.
- *Second*, the activity does damage some natural resources but it has positive impact

on other natural resources; such that the net effect – when assessed on some common scale – is judged to be resource neutral .

- *Third*, the activity does not damage the natural resources required for completing the activity itself [14] .

## 2.2. *The environmental challenges of industrial development in developing countries:*

There are several challenges related to industrial development and its impact on the ecological sustainability can be faced most industrial cities within the newly-industrialized countries of Third World, that attempt to develop their economy. Third World cities (or city-regions) with high concentrations of industries –especially heavy industries– suffer comparable industrial pollution problems to those in developed industrialized countries. In many industrial Third World cities, environmental problems are far more serious. The most common and important challenges that threaten the environment of such countries are:

- The industrial production has increased very rapidly in many Third World nations in last 40 years in the absence of an effective planning and regulation systems . The more rapid the growth in industrial production, the more serious the environmental problems related to industrial pollution are likely to be since time is required to identify and act on such problems, and the dominant political circumstances may slow or halt such action . Until recently, very few governments have shown much interest in controlling industrial pollution. When the new manufacturing investment proposed, governments' concern to create jobs usually has the priority, while a little or no attention give to the likely environmental impacts [15].
- The industrial pollution can be particularly serious in such nations, because the concentration of industries in relatively few locations . In most Third World countries, industrial production is heavily concentrated in one or two city regions or core regions within each nation (for instance, Cairo and Alexandria, Egypt), such industrial centers usually include a high proportion of their nation's industrial output [16]. While some governments

have managed to support a decentralization of industry away from the largest cities. Many of new industrial plants have set up outside the main city but still within or close to its metropolitan areas (for instance, 6<sup>th</sup> October, 10<sup>th</sup> Ramadan within Cairo region, and Burg-El-Arab within Alexandria region, Egypt).

- In the most developing countries, industrial pollution is not only cause of air and water pollution, the high proportions of households and businesses not served by sewers, drains, and garbage collection add greatly to land and water pollution problems. While very congested traffic and inefficient, and poorly maintained engines in most road vehicles add greatly to air pollution.
- In addition, there are serious problems related to the disposal of hazardous wastes by domestic industries within Third World nations or by branches of multinational firms. In most nations, there is little or no control of the dumping of hazardous wastes and little or no provision for the special facilities needed to safely store or treat such wastes. Most hazardous wastes are currently dumped with other wastes on open sites with no provision to ensure these remain isolated from contact with plants, animals, and humans. Or they are simply dumped within liquid wastes into sewers, drains, and wells or nearby watercourses.
- The export of outdated industrial technology which brings with it substantial environmental hazards, and transfer of dirty industries or dangerous industrial equipment from the developed countries to the Third World countries. To meet demand for the products of certain “dirty industries” in industrialized developed countries, multinational corporation may increasingly transfer production to Third World cities to avoid the costs of meeting workplace safety and pollution standard . There are many instances of multinational industrial corporations within Third World nations that have serious problems of pollution or occupational health or both. Most of these cases arise in chemical, metal-smelt, lead refining and asbestos-related industries. The lessons learnt in industrialized developed countries on the enormous health costs associated with occupational exposures in particular industries and with uncontrolled disposal of toxic wastes by certain industries

do not seem to be heeded by Third World governments and are often ignored by the industrial sector [17].

- There is also the issue of the export of the hazardous wastes to the Third World. A number of European or North-American businesses or municipal authorities have sought to transport toxic wastes to certain Third World nations with little or no consideration of the possible consequences for local population, because the cost of transporting toxic wastes to Third World nations is only a fraction of the cost of safely incinerating or storing them in the West and meeting government regulations in doing so [18]. The local authorities at disposal sites in Third World are often unaware of the composition of the wastes and the hazards that they presented, while the miss of transparency in the official procedure within such countries some times encourage these authorities to deal with that issues with little or no responsibility.
- Even, the excessive bureaucratic intervention, the absence of coordination between concerned authorities, agencies, and institutions, the lack of legislation that regulate the economic and urban growth and its relevant environmental impacts, and the need to active urban management systems... become current challenges of sustainable industrial development in most of Third World countries.

### **3. The environmental policies for achieving the ecological sustainability**

It's obvious as previous discussion described that the industrial cities within the developing nations have been borne a bulky environmental problems, a part of such problems generated by national causes and another by the international circumstances. Although the industrialized countries are responsible for about 80 per cent of the world's pollution, and probably the same proportion of the rapid depletion of the Earth's ecological capital, even though much of that depletion occurs in the Third World. Today's financial flows and trading patterns result in a massive transfer of environmental costs of gross product from the richer industrialized countries to the poorer resource-based economics of Third World [19]. Perhaps the greatest

challenge for developing countries is that, how to adopt the sustainability without conflicting with development progress and, how to subdue the present degenerated environmental conditions. In fact, there are many of varied roles for planning and for different concerned institutions that ranged from the macro-levels into micro-levels within such countries (fig. 3).

#### *3.1. The new role of planning*

For achieving the sustainable development there are many of fundamental concerns of planning and, as such, it is both reasonable and legitimate to consider how planning can best accommodate and implement this resurgence of interest in the management of the environment. As long as the development should be sustainable in environmental terms, there is a need to emphasis on the role of land use planning in the adoption of principles of sustainable development. So as, to ensure ecological protection and economic preservation of the best of our present environment for future generations. In practice, the danger is that the concept of sustainability may be divorced from the mainstream of planning through the separate programmes of action. In order to avoid this consequence, its important for planning to seek to re-define its goals on environmental matters, and to encompass comprehensive environmental management within its sphere of influence and activity [20]. This new role for planning should be attainable, given its traditional concern with extensive management of land and other resources, and concern with the long-term strategic planning and management of change [21].

#### *3.2. The institutional framework*

One of the most important policy issues in implementing sustainable development (and within this, sustainable pattern of natural resources use) is building the institutional framework within each region, city, and district that can develop and implement sustainable development strategies. Adding a concern for sustainability into existing development concerns further strengthens the rationale for

institution-building at local level [22]. Developing nations can not meet the development goals without effective *developmental institutions*. Such institutions are also important in any move towards more sustainable levels of resource use.

### 3.3. The role of central governments

The new orientation of development policies tend to encourage the role of central government as an *enabler*, this concept assumes that the main task of such government is to support the local governments, communities, enterprises, and individuals to undertake economic or social activities with a high proportion of governmental plans. On the other hand, the substantial concerns of the central governments must be tend to maintain the sustainability requirements, such concerns include:

- Formulating the national economy framework and the budgets .
- Formation a long-term national strategies and policies to encourage and maintain development that is sustainable [23] .
- Regulation the tax and fiscal incentives, pricing and marketing policies, exchange-rate, and trade protection policies with a regard to the environmental requirements [24].
- Improve the acts and regulations that can support the environmental conservation .
- Coordination between local governments and formation the mechanisms to allow the inter-local government area resource transfer .

### 3.4. The role of local governments

At the local levels, the priority for each society to develop its own response to local environment problems and resources limitation using the tools must appropriate to own unique situation. Therefore, local governments have an essential role for achieving the development and sustainability goals. Local governments can not take on these roles without the support of central government and a strong financial base. In general, the most important roles of such governments are:

- Implementation of the national environmental strategies, policies, and plans.

- Management of land and other resources in order to promote more sustainable pattern of resource use and urban form [25].
- Investment in needed infrastructure and services by the work in partnership with community organizations, non-governmental organizations, private sector, and non-profit foundations; in order to ordinate all of their tasks towards the sustainable development targets [26].
- Undertaking the environmental actions such as pollution sources control, management of industrial and civil wastes, environmental monitoring systems, and environmental impact assessment of the new industrial activities [27].

### 3.5. The responsibilities of industrial sector

Industrial sector has a key role to play for achieving the sustainable development, the fundamental interest of its role can be outlined in two main axis as follows:

- *First*, the continuing role of industry in creating wealth, economic development, and other community benefits such as jobs, goods, and various facilities. This role is essential to attain the developmental goals.
- *Second*, the role that industry should be performance in a more responsible way towards environmental issues, in order to achieve the ecological, social, and economical sustainability . This role was, in the previous stages, carried out with little or no concern for long-term impact on environment, but it has been earned a progressive attention.

There is no doubt about the need to consider environmental protection in a light of industrial development. But the hard part is to decide how this should be done, and what the role and responsibility of industrial companies in helping strike the right balance between industrial development and environmental impact. The following directed headlines may make the answer:

- Solve its own environmental pollution and conservation problems.
- Prevent pollution at source wherever and whenever possible [28].

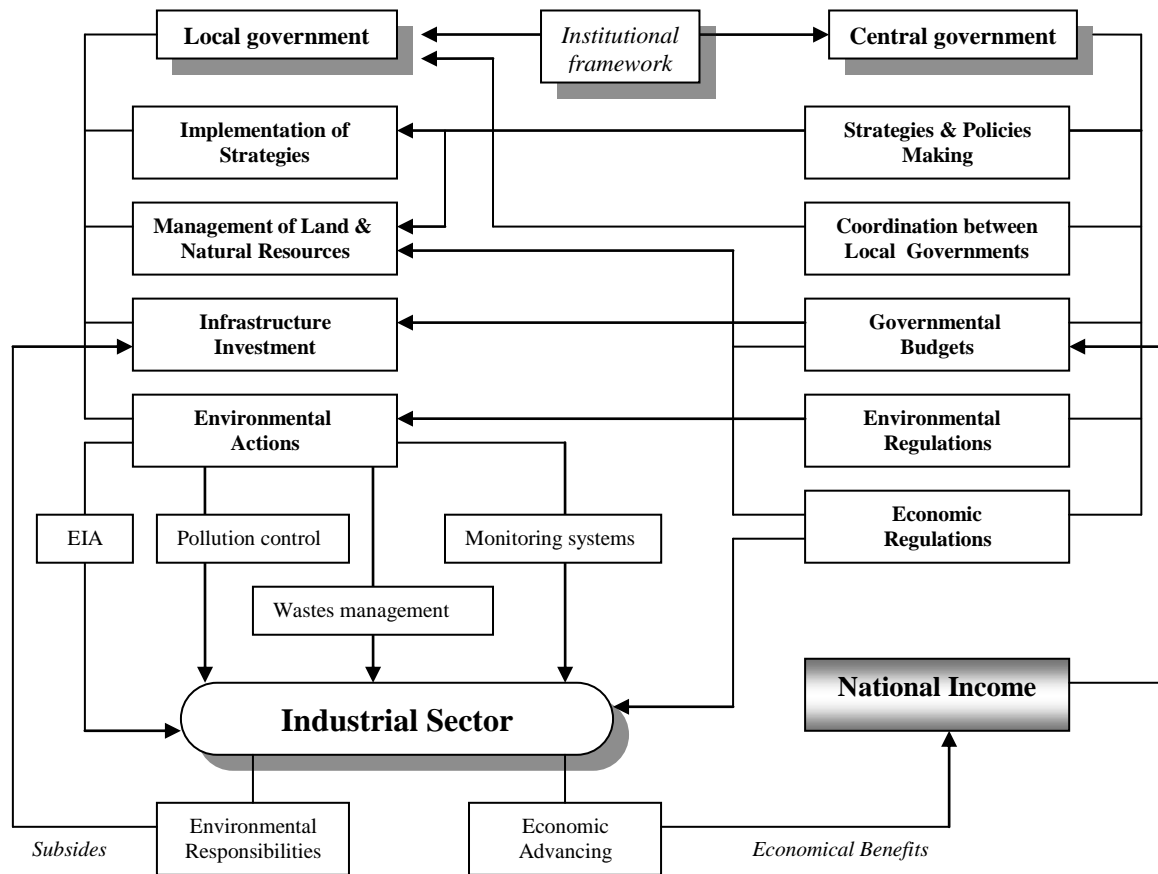


Fig. 3. The functional reactions between central, local governments and industrial sector.

- Reduce consumption rates of environmental resources as a raw materials, and adopt recycling methods as possible.
- Develop traditional industrial process and support the invention of new technical methods.
- Attempt to use the renewable forms of power and to develop some new and more benign forms of power [29].
- Develop products that will have a minimum effect on the environment.
- Assure that its facilities and products meet and sustain the regulations of all local environment agencies.
- Assist, whenever possible, governmental agencies and other official organizations engaged in environmental activities [30].

#### 4. Conclusions

The translation of sustainability from academic theories into an agenda for action will require a fundamental re-orientation of certain dominant modes of decision-making in central and local governments, industries, and other sectors that associated in the development projects. In practice, the adoption of positive attitudes towards industrial sustainable development within developing countries should include the adjustment of thinking across the full range of strategies and policies making, and implementation of sustainable policies by both governmental agencies and industrial sector at all levels from the local to the regional and national.



## References

- [1] R.J. Johnston, *Environmental Problems: Nature, Economy, and State*, Belhaven Press, London, pp. 73-74 (1992).
- [2] Ibid. , p.72 .
- [3] P. Selman, *Environmental Planning*, Paul Chapman Publishing Ltd. , London, p. 6 (1992).
- [4] M. Wachernagel, and W. Rees, *Our Ecological footprint: Reducing Human Impact on Earth* , New Society Publishers, Philadelphia, p. 158 (1996).
- [5] W. Rees, "Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves out", *Environmental and Urbanization*, Vol. 4 (2), p. 122 (1992).
- [6] J.E. Hardoy and others, *Environmental Problems in Third World Cities*, Earthscan Publication Ltd. , London, p. 120 (1992).
- [7] World Bank, *World Development Report 2003: Sustainable Development in Dynamic World*, Washington (2003).
- [8] World Commission on Environment and Development, *The Brundtland Commission Report: Our Common Future*, Oxford, p. 43 (1987).
- [9] D. Pearce, A. Markandya and E. Barbier, *Blueprint for a Green Economy*, Earthscan, London, p. 3 (1989).
- [10] W. Rees, "Sustainable Development as Capitalism with a Green Face". *Town Planning Review*. Vol. 62 (1), p. 92 (1990).
- [11] J. MacNeill, "Sustainable Development: Meeting the Growth Imperative for 21<sup>st</sup> Century", In: Angell, D. J., Comer, J. D. and Wilkinson, M.L. (ed.). *Sustaining Earth: Response to the Environmental Threats*, MacMillan, London, p. 191 (1990).
- [12] G. Henderson, "The East Asian Miracle". *Development Debates* (6), pp. 20-22 (1999).
- [13] UNEP, *Guidelines to Environmental Impact Assessment in Developing Countries*, London (1985).
- [14] J.E. Hardoy and others. *Environmental Problems in Third World Cities*, Opt., pp. 175-176 (1992).
- [15] Ibid. , p.p. 63-64 .
- [16] كوستيللو، د.ف.ف. . *التحضر في الشرق الأوسط* ( ترجمة : خليف الله ، ٨٢ رمضان عربي ) ، المنشأة العامة للنشر والتوزيع والإعلان ، طرابلس ، ص . (١٩٨٤).
- [17] M.R. Hamed, "Developing Countries and Economic Globalization: The Need of Different Course of interaction", In: *Developing Issues*, Vol. (16), pp. 144-145 (2000).
- [18] J.E. Hardoy and others, *Environmental Problems in Third World Cities*, Opt. , pp. 69-71 (1992).
- [19] J. MacNeill, "Sustainable Development: Meeting the Growth Imperative for 21<sup>st</sup> Century , Opt. , p. 192 (1990).
- [20] Department of the Environment (Dep. E) . *This Common Inheritance*, HMSO, London (1990) .
- [21] P. Roberts, "Environmental Priorities and the Challenges of Environmental Management", *Town Planning Review*, Vol. 62 (4), pp. 464-465 (1991).
- [22] J.E. Hardoy, and others. *Environmental Problems in Third World Cities*, Opt. , p. 196 (1992).
- [23] Ibid. , p. 197 .
- [24] J. MacNeill, "Sustainable Development: Meeting the Growth Imperative for 21<sup>st</sup> Century , Opt. , pp. 197-198 (1990).
- [25] T. Beatley, "Planning and Sustainability: The Elements of a New (Improved?) Paradigm", *Journal of Planning Literature*, Vol. 9 (4), pp. 385-386 (1995).
- [26] World Bank, *World Development Report 1999/2000, Entering the 21<sup>st</sup> Century*, Washington (2000).
- [27] Habitat & UNIP. *Environmental Planning and Management Source book*, Vol. 1. p. 53 (1997).
- [28] C. Hampson, "Industry and the Environment: A Question of Balance". In: Angell, D.J., Comer & Others. *Sustaining Earth: Response to the Environmental Threats*, Opt. , pp. 109-111 (1990).
- [29] J. MacNeill, "Sustainable Development: Meeting the Growth Imperative for 21<sup>st</sup> Century, Opt., pp. 198-199 (1990).
- [30] Ch. Hampson, "Industry and the Environment: A Question of Balance", Opt., p. 113 (1990).

Received February 8, 2004  
Accepted June 26, 2004

