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Technological Advances and Their Impact On Environment

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ABSTRACT
Environmental preservation is one of the key strategies addressing sustainable development. Preserving environment need assessment of impact of technological advances and their impact on environment. Regarding innovations in the environmental technology and a broad aspect of it is known as "green technology" innovation. Competitive advantage, governmental regulation, international trade, individual capability, and public pressure are all important factors that can stimulate such innovation and the technological advancements. The present paper suggests an understanding on the technological advances and their impact on environment. Regular assessment of technological advances and their impact on environment is necessary for making policies and decisions for a sustainable environment management.
Keywords*: Green technology, Environmentally Sound Technologies (ESTs), toxic chemicals, environment, technology innovation, Green Inventory*
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BACKGROUND

The use of chemicals in society is extensive (more than one lacs industrial chemicals). These chemical compounds are spread from a large number of sources and processes, leading to human and ecosystem exposure. Humans and all other living organisms that are exposed to these compounds risk harm. One example is the problem of an increasing number of endocrine disrupting chemicals and possible connections between reproductive disorders and hormone-related diseases, such as diabetes type II, obesity, neural development, cancer and allergies.

Chemical products have greatly improved health and life expectancies; increased agricultural production; raised comfort, convenience, and the general quality of life; and expanded economic opportunities. However, this industry, together with its products, has a particularly severe impact on the environment. It has given rise to a host of new problems of pollution. It continues to generate an increasingly wider range of products and wastes whose effects, especially long-term ones, on human health and the environment are not precisely known. Major accidents have taken place, and the safety record of the industry has been challenged in recent years.

By 1986, more than 500 chemicals and chemical products had been banned altogether or had their uses severely restricted in the country of origin. In addition, an unknown number of chemicals are withdrawn from clearance processes every year in the light of control agency concerns, or are never submitted to national control agencies for clearance. Some of these end up on the export market.

Third World importers have no way to effectively control trade in chemicals that have been banned or severely restricted in exporting countries. Thus these countries badly need the infrastructure to assess the risks associated with chemical use.

Some major accidents in chemical Industry -

Accidents involving toxic chemicals and radioactive materials can occur in plants in any region. According to a survey carried out by the U.S. Environmental Protection Agency, 6,928 accidents of varying severity occurred at U.S. plants between 1980 and 1965 - an average of five a day. Some of the major toxins are Chlorofluorocarbons (CFCs), DDT, Endocrine disruptors, Dioxin, Toxic heavy metals, Herbicides, Pesticides, PCB etc

- 1932-1968: The Minamata disaster was caused by the dumping of mercury compounds in Minamata Bay, Japan. The Chisso Corporation, a fertilizer and later petrochemical company, was

found responsible for polluting the bay for 37 years. It is estimated that over 3,000 people suffered various deformities, severe mercury poisoning symptoms or death from what became known as Minamata disease.

- 1948: A chemical tank wagon explosion within the BASF's Ludwigshafen, Germany site caused 207 fatalities.
- 1984- liquid gas storage tanks exploded in Mexico City, killing 1,000 people and leaving thousands more homeless
- 1984- Bhopal tragedy in India, which killed over 3,000 people after a highly toxic vapour, (methyl isocyanate), was released at a Union Carbide pesticides factory.
- 1986- a fire at a warehouse of a chemicals manufacturer in Basel, Switzerland, sent toxic fumes into France and the Federal Republic of Germany and released toxic chemicals into the Rhine, causing massive fish kills and affecting the vital water supply
- 1991: Sterlington, Louisiana. An explosion at the IMC operated Angus Chemical Nitro-paraffin Plant Sterlington, Louisiana killed 8 workers and injured 120 other people. There was severe damage to the surrounding community. The blasts were heard more than 8 miles away.
- 2001: Toulouse, France. An explosion at the AZF fertilizer factory killed 29 and injured 2,500.

To create a safe future chemical environment there is a need for increased knowledge and improved and novel test methods to assess exposure and chemical safety. To enable this, academic researchers, government and industry must collaborate. Scientific advances must be utilized, applied and developed into, for example, innovative and validated methods or changes in regulation and legislation. There must be collaborations between different research disciplines.
The environmental innovations supporting sustainable development may provide a unique leadership opportunity for global business to make a difference. Therefore, objectives for promoting such innovations would be –

• To provide an avenue by which innovations and solutions may be easily shared to accelerate and facilitate implementations to protect the environment and perhaps lead to further innovation.
• To promote and encourage cooperation and collaboration between businesses that pledge patents and potential users to foster further joint innovations and the advancement and development of solutions that benefit the environment.
Green technology referring the technology which may be used in production or consumption to prevent or reduce the pollutant emissions and conserve resources. Much research has been done on the innovation of such technologies. Patents are the most commonly used indicator of technology change.
In general, technology innovation encompasses three stages: invention, innovation and diffusion. Invention may be a new devices or process, while innovation is practical use of invention. Diffusion is the adoption of innovations by others. Patents measure invention activity and also important indicators for the understanding of adoption and diffusion, as patentee expect commercializing their inventions. The fact indicates that patents also imply the potential value in other processes such as diffusion. Therefore, the most accepted and widely used measure of innovation activity is patent counts
The chemical patents must be such innovations that provide 'environmental benefits.' These 'environmental benefits' may be a direct purpose of the patents, such as a technology to accelerate groundwater remediation, but can also be less direct as in manufacturing or business processes that lead to a reduction in hazardous waste generation or energy consumption.

Examples of inventions sustaining environment -
• Energy conservation or efficiency
• Pollution prevention (source reduction, waste reduction)
• Use of environmentally preferable materials or substances
• Materials reduction
• Increased recycling ability

DATA AND METHODOLOGY
Several different indicators are used to measure the pace of innovation. These include proxies such as the number of research publications, investment in research and development (R&D), number of scientists, and the number of patents.

Using PATENTSCOPE (World Intellectual Property organization (WIPO) international patent application search database) one can search 30 million patent documents including 2.2 million published international patent applications (PCT). Detailed coverage information can be found at http://patentscope.wipo.int/search/en/help/data_coverage.jsf

International Patent Classification (IPC):

Section A — human necessities
Section B — performing operations; transporting
Section C — chemistry; metallurgy
Section D — textiles; paper
Section E — fixed constructions
Section F — mechanical engineering; lighting; heating; weapons; blasting
Section G — physics
Section H — electricity

IPC Green Inventory

The "IPC Green Inventory" was developed by the IPC Committee of Experts in order to facilitate searches for patent information relating to so-called Environmentally Sound Technologies (ESTs), as listed by the United Nations Framework Convention on Climate Change (UNFCCC).

ESTs are currently scattered widely across the IPC in numerous technical fields. The Inventory attempts to collect ESTs in one place, although it should be noted that the Inventory does not purport to be fully exhaustive in its coverage.

ESTs are presented in a hierarchical structure. Clicking on the sign opens the hierarchy of the relevant technology. For each technology, the links in the IPC column direct the user to the corresponding place in the scheme.

It should be noted that each EST and its corresponding IPC place(s) do not necessarily coincide and that the EST may represent a subset of the corresponding IPC place.

The links in the PATENTSCOPE column allow the user to automatically search and display all international patent applications available through PATENTSCOPE which are classified in the relevant IPC place. In IPC search, results may additionally include irrelevant results not relating to ESTs.

For IPC place ranges (e.g. Fuel cells H01M 4/86-4/98), the search result is limited to the first symbol of the range (e.g. H01M 4/86). If searching additional symbols falling in the range is desirable, this can be done either manually in PATENTSCOPE or via the IPC scheme by using the "bridge" function ("magnifying lens" button).

TOPIC	IPC
ALTERNATIVE ENERGY PRODUCTION	
Bio-fuels	
Integrated gasification combined cycle (IGCC)	C10L 3/00, F02C 3/28
Fuel cells	H01M 4/86-4/98, 8/00-8/24, 12/00-12/08
Pyrolysis or gasification of biomass	C10B 53/00, C10J
Harnessing energy from manmade waste	
Hydro energy	
Ocean thermal energy conversion (OTEC)	F03G 7/05
Wind energy	F03D
Solar energy	
Geothermal energy	
Other production or use of heat, not derived from combustion, e.g. natural heat	F24J 1/00, 3/00, 3/06
Using waste heat	
Devices for producing mechanical power from muscle energy	F03G 5/00-5/08
TRANSPORTATION	
Vehicles in general	
Vehicles other than rail vehicles	
Rail vehicles	B61
Marine vessel propulsion	
Cosmonautic vehicles using solar energy	B64G 1/44

ENERGY CONSERVATION	
Storage of electrical energy	B60K 6/28 B60W 10/26 H01M 10/44-10/46 H01G 9/155 H02J 3/28, 7/00, 15/00
Power supply circuitry	H02J
Measurement of electricity consumption	B60L 3/00 G01R
Storage of thermal energy	C09K 5/00 F24H 7/00 F28D 20/00, 20/02
Low energy lighting	
Thermal building insulation, in general	E04B 1/62, 1/74-1/80, 1/88, 1/90
Recovering mechanical energy	F03G 7/08
WASTE MANAGEMENT	
Waste disposal	B09B B65F
Treatment of waste	
Consuming waste by combustion	F23G
Reuse of waste materials	
Pollution control	
AGRICULTURE / FORESTRY	
Forestry techniques	A01G 23/00
Alternative irrigation techniques	A01G 25/00
Pesticide alternatives	A01N 25/00-65/00
Soil improvement	C09K 17/00 E02D 3/00
ADMINISTRATIVE, REGULATORY OR DESIGN ASPECTS	
Commuting, e.g., HOV, teleworking, etc.	G06Q G08G
Carbon/emissions trading, e.g. pollution credits	G06Q
Static structure design	E04H 1/00
NUCLEAR POWER GENERATION	
Nuclear engineering	G21
Gas turbine power plants using heat source of nuclear origin	F02C 1/05

Since there are no specific patent classifications or sub classifications are assigned to environmental technologies, environmental technology may be involved in every classification or sub classification of patents.
A search has been conducted using key word "green technology" in PATENTSCOPE and the result is 3987 patent applications.
"Results **3,987** for Criteria: **First Page: (green technology)** Office(s): **all** Language: **English** Stemming: **true" found at http://patentscope.wipo.int/search/en/**

Main Countries and number of patents	
Name	**No**
PCT	1554
Russian Federation	933
United States	540
Republic of Korea	471
Japan	354
European Patent Office	117
Mexico	5

Main Countries and number of patents	
Name	**No**
Singapore	5
South Africa	4
Egypt	2
United Arab Emirates	1
Israel	1

Main International Patent Classification (IPC) and number of patents

IPC	No
A23L	857
H01L	285
G02F	225
C12P	202
A61K	182
C09K	161
G01N	152
H04N	143
C12N	142
H05B	124

International Patent Classification (IPC)

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Section B — performing operations; transporting
Section C — chemistry; metallurgy
Section D — textiles; paper
Section E — fixed constructions
Section F — mechanical engineering; lighting; heating; weapons; blasting
Section G — physics
Section H — electricity

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BOE HYDIS TECHNOLOGY CO., LTD.	51
TOSHIBA MATSUSHITA DISPLAY TECHNOLOGY CO LTD	46
KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY	45
Industrial Technology Research Institute	39
JOHNSON MATTHEY PUBLIC LIMITED COMPANY	38
TOSHIBA LIGHTING & TECHNOLOGY CORP	36
NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL & TECHNOLOGY	35
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	34
KOREA ELECTRONICS TECHNOLOGY INSTITUTE	34

Main Inventor and number of the patents	
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Квасенков Олег Иванович (RU)	409
Shiu Shian-Sung	17
Logvinchuk T.M. (RU)	14
Kvasenkov O.I. (RU)	13
ZHOU, Mingjie	10
BARKER, Jeremy	9
HAN, SANG BAE	9
KHAMBAY, Bhupinder, Pall, Singh	9
LADNER, Robert, C.	9

patent publication	
year	**No**
2003	199
2004	167
2005	228

patent publication	
year	No
2006	324
2007	265
2008	517
2009	546
2010	290
2011	278
2012	236
2013	110

FINDINGS

In view of above data, information and discussion, it is very clear that very few organizations are working on innovations like green technology creating a safe sustainable environment.

SUGGESTION

There is a need to strengthen national capabilities and the framework to combat with such environment toxicity and therefore, following may be suggested-

- survey hazardous industrial operations and adopt, and enforce regulations or guidelines on the safe operation of industrial plants and on the transport, handling, and disposal of hazardous materials;
- adopt land use policies or regional development plans that would require or provide incentives to industries that have a high pollution or accident potential to locate away from population centres, and that would discourage people from moving close to plants and waste disposal sites;
- ensure that plant workers are provided with full information about the products and technologies they handle, and are given adequate training in safe operational procedures and emergency preparedness; and
- involve local governments and community residents in major siting decisions and emergency preparedness planning.
- undertake that no new chemicals be placed on international markets until the health and environmental impacts have been tested and assessed;
- reinforce on-going efforts to obtain international agreement on the selection of existing chemicals for priority testing, on criteria and procedures for their assessment, and on a system for international sharing of the tasks and the resources required;
- strictly regulate the export to developing countries of those chemicals for which authorization for domestic sale has not been sought or given, by extending requirements for prior notification and information exchange to them; and
- support the establishment in existing regional organizations of units qualified to receive such prior notification and information, to assess it and to advise governments in the region on the risks associated with the use of these chemicals, in order to permit individual governments to weigh these risks against benefits they may perceive from importation of the chemicals.
- Innovations for customization and validation of software for risk assessment and consequence modeling
- Innovation and development of need based technologies for detection, protection, monitoring of toxicants and their effective management
- Development of safer and economical alternatives
- Adoption of safer and sustainable inventions

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