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EFFECTS OF HIGH ECONOMIC IMPORTANCE OF INDUSTRIAL BRANCHES ON HUMAN LIFE QUALITY AND ENVIRONMENT

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Abstract: *Importance of industrialization which has a role in determination of the civilization levels of societies is increasing everyday due to meet rapidly increasing demands. However this process has led up to environmental problems with time and thus effects on quality of human life also brought along. In this study, three sectors were selected among different branches of industry according to their economical importance in Turkey. These sectors are paper, metal and construction chemicals industry. Production processes of selected sectors were examined and effects of production stages on the environment and human health as well as their contribution to sustainable development were investigated. Well known Turkish companies from each industrial branch were evaluated in detail. These industrial sectors having economic importance are compared to each other according to their effects on quality of human life and environment and the results are evaluated accordingly.*

Keywords: *Environmental effects, industrial branches, quality of life, sector of metal.*

1. INTRODUCTION

Population growth, housing, food and energy are among the most important ecological problems of the contemporary world. Increase in population and living conditions lead to an increase in human needs, by promoting the technological advancements and accelerating the use of natural resources. Industrialization shows the importance of resources whose necessity for different sectors are increasing every day. Increase in use of natural resources as raw materials for the industry give way to the prevalence of attempts to *recycle* or *reuse*. Therefore *principles of the ecological cycle* become important in reusing or recycling of glass, metal and paper. Due to common attitudes, the paper industry is perpetual and an important sector. In this sector, principles of the ecological cycle are enforced and the ecological effects are at their lowest. But the metal and glass industry are more dominant in terms of the use of end-products and their ecological effects are at different levels. In the long run, this process has created ecological problems and therefore its effects on the living conditions of people are negative.

For this study, three different sectors are selected from important industries in Turkey. These sectors are paper, metal and construction chemicals industries. Production processes of these sectors are examined and their effects on ecology, human health and sustainable development are questioned. Each sector is studied in detail through well-known major firms that represent their own sector.

1.1. Economic Sectors in Turkey and Their Ecological Importance

Turkey has abundant resources of raw material which are important components to the industry. Besides, it has large resources of metals such as iron, chrome, copper, zinc; and non-metal elements such as boron, raw materials that are used in cement, salt in lakes and sodium sulfate. Terrestrial resources such as forests are also among the significant resources in Turkey [URL 1]. Therefore, paper, construction chemicals and metal are selected as three industries to be examined in this study.

1.2. Paper Industry

After being invented in China in 105 BC, knowledge of paper-making was carried first to Africa and then to Europe; making paper and cardboard production one of the most significant industries in the world. Today, per-capita paper/cardboard consumption is one of the developmental indicators of a country. World's average per-capita consumption for paper and cardboard is 48.5kg. While this average is over 200kg in Finland, Belgium, Denmark, Netherlands and Germany; for Greece it is 62kg and for Turkey it is 32kg. Paper/cardboard producing countries have also the raw materials. Countries like Turkey, however, compete with other producers through importing cellulose, which is the main raw material of paper industry. With 1.5 million tons of installed capacity, Turkey's rank among the paper producing countries is 28. If Turkey's paper consumption reaches to the world average due to its economic development, total consumption will be 3.2 million tons. This fact shows that the significance of the paper industry will increase in the future [URL 2].

Paper/cardboard production technology is based on several stages including preparation of pulp which is made of wood, yearling plants or recycled paper, by the use of chemical, semi-chemical or mechanical techniques. This pulp is then processed through hammering, cutting, fraying and cleaning. After the filling and conditioning materials are added, sheets are formed on wire; they are dried and cut [URL 3]. Waste production, by the paper machine during the transformation of pulp into paper, constitutes the ecologically harmful part of the production process. The white colored waste water that is emitted at this stage contains less organic material and more artificial substance including phosphor, which has significant effects on its environment [1]. In addition to this, air pollution due to the emission of production based hazardous gases and the noise pollution are among the negative effects of the paper industry on the environment [2,3].

1.3. Construction Chemicals Industry

Construction chemicals are defined as chemical substances that are added into the construction materials in order to increase the quality of construction products or to ease their use [URL 4]. Advancements in the chemical industry, especially in polymer chemistry, lead to the proliferation of certain chemicals in the construction industry. As a result of this process various isolation materials are produced with different features [4].

Considering the ecological cycle of different chemicals, chlorine based chemical pollutants, which are used in isolation materials; need special attention because they are hazardous elements that deplete the ozone layer. Chlorofluorocarbon (CFC) is used in extruded polystyrene foam (XPS), polyurethane and phenolic foam production. There are international agreements to decrease the use of CFCs. Punishments are also in effect against the industrial firms in order to prevent the usage of materials that are hazardous to the ozone layer. Hydro chlorofluorocarbons (HCFC), which are related to extruded polystyrene production, are less

harmful types of construction materials and they are tested for their level of poison. It is known that CFCs and XPS are produced in Turkey [URL 5].

1.4. Iron and Steel Industry

With their durability, reliability, wide area of use and various technical superiorities, iron and steel are significant parts of the modern life, which are also strategic materials for industrialization and economic development. The iron and steel industry is accepted to be one of the most prevalent and strong industries of the globalized world, thanks to the continuous innovations in its fields of application and its technology, [URL 6]. Development of the iron and steel industry in Turkey paved the way for the development of other mining sectors as well. Stages of the iron and steel industry are based on the production of slab or billet through melting of the iron ore in blast furnaces or the scrap metal in arc furnaces. Various other processes are applied to produce different products with the desired chemical and physical properties [URL 7].

According to the World Steel Association (WSA) the world's steel production capacity is expected to increase 286 million tons between 2009 and 2011. With 115.3 million tons, China is expected to account for 40.6% of this increase, while including China the total increase in the Asian region will be 70.8% with an increase of 201 million tons. With 25 million tons of production, Turkey is the 10^{th} biggest producer in the world, and 2^{nd} in Europe. In addition, Turkey is expected to account for 10% of the total increase during the 2009-2011 production [URL 8]. The Environmental problems that occur in production plants of the iron and steel industry vary depending on the type of production. The most important factors are the elimination of the solid and liquid waste and the noise inside the building that is produced during the production process. Noise that is produced by the vibration of fans and other production elements lead to significant problems in the iron and steel industry, due to the lack of sound isolation systems.

2. SAMPLE FIRMS RELATED TO THE SECTORS

The case studies of this research are chosen from top ranking firms representing the above described industries and have proven to be environmentally responsible at the same time. Due to ethical concerns, the names of the examined firms are not disclosed, while only presenting the industrial origins of the companies. Letters are used instead as symbols; for paper (A), for construction chemicals (B) and for iron and steel (C) are used as symbols to indicate the industry.

Firm A is in the grey-cardboard and packaging industry. Waste management policy and the measures for waste management of Firm A are listed in Table 1. Total production capacity of the firm is 116.000 tons/year. The firm uses 100% recycled waste. A significant portion of vapor and electricity needed for the production is supplied through the auto producer plant that was installed in April 2002. This structure shows that the firm adopted principles of the ecological cycle.

Firm B is producing chemicals for fabrics and leather, supplementary materials and chemicals for dispersion and detergents in its plant which is located in Turkey. Thanks to the firms latest purchases it became the leading producer in construction chemicals sector. Types and amounts of waste that are produced by Firm B and the way it manages waste is listed in Table 2.

Firm C is one of the major companies in the iron and steel industry, which targets continuous progress in its business. After its latest investments they have achieved 6.5 million tons of raw steel production in 2009. Types of waste produced by the Firm C and its waste management techniques are listed in Table 3.

3. RESULTS AND ANALYSIS

The role of the industrial sector in Turkey's economy is increasing every day. While the number of people employed in the industrial sectors was around 600.000 in 1950, this number has since exceeded 2.5 million. The ratio of people employed in the industrial sectors to the whole population was 5% in 1950, whereas this number was 13.5% in 1990. This number still keeps increasing today [URL 1].

Whether or not the increase in population, the development of industry, the urbanization or the rapid consumption are the reasons of environmental pollution, it is a fact that we are at an irreversible point. Each sector that is examined in this study threatens the environment and human health for different reasons. However, among these sectors, the iron and steel industry needs special attention due to its big production capacity and the worldwide increase of demand for its end-products. Since there is direct consumption of energy during the iron and steel production, through the use of coal, oil, electricity and natural gas, it is one of the industries that consume the most energy. Share of energy costs in the iron and steel industry is 27-33% of the total cost of production; therefore rational use of energy is crucial in cost management [5]. CO_2 emissions related to energy use constituted 7% of the global CO_2 emissions. By the addition of indirect energy consumption necessary for the transportation of coal, iron ore pellets and lime, CO_2 emissions of the iron and steel industry

accounts for 10% of the global CO_2 emissions [URL 10].
Since the waste of iron and steel industry are also valuable, its reuse has both economic contributions to the sector, and positive contributions to human health.
Results of this study show that, among all other sectors, the iron and steel industry has the highest risk of environmental damage. However, its capability of reusing the waste that it produces also shows that it has the most potential to adopt the ecological principles, compared to the other sectors.

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Table 1. Waste types, amount of reused and eliminated wastes produced by the processes of Firm A

Waste Production	Sources	Elimination Method	Amount of Reused/Eliminated
Solid Wastes from Production Processes	Production	Sanitary Landfill	(115m^3/month) x (12month) = 1.380 m^3/year
Process Water	Production	Wastewater are treated, treated water is reused for mud prod.	241m^3/d x 340d = 81.940 m^3/year
Atmospheric Emissions	Stokehold	Stack Gas Treatment Plant	Max.1.700 m^3/d
Machinery Lubricants	Production	To Licensed Recycle Plant	1.560 kg/year
Electronic Wastes	Prod./Mang.	To Licensed Recycle Plant	740 kg/year
Waste Batteries	Prod./Mang.	To Battery Manufacturers and Importers Association	17.4 kg/year
Chemically Contaminated Wastes	Production	To Licensed Recycle Plant	4.095 kg/year
Treatment Plant Sludge	Wastewater Treatment Plant	To Sanitary Landfill	4.000 kg/year

Table 2. Waste types, amount of reused and eliminated wastes produced by the processes of Firm B

Waste	**Source**	**Amount of Waste**	**Control Method**	**Elimination Method**
Mixer Cleaning in the Resin Processing	Wastewater (hazardous)	20 tons/y	Hazardous Waste Analysis	To Licensed Elimination Plant
Concrete Additive Chemicals Tanks	Wastewater (hazardous)	20 tons/y	Hazardous Waste Analysis	To Licensed Elimination Plant
Production / Laboratory Activities	Industrial Waste (non-hazardous)	300 tons/y	Classification According to Hazard Signs	To Gebze Sanitary Landfill
Production/Lab/ Maintenance Activities	Contaminated Wastes (packages, thread wastes)	6 tons /y		To Licensed Elimination Plant
Production	Contaminated Wastes (IBC, barrels etc.)	18 tons/y		To Licensed Recycle Plant

Table 3. Waste types, amount of reused and eliminated wastes produced by the processes of Firm C

Waste	**Intermediate Collection Point**	**Elimination Method**
Minor wastes after Maintenance (conveyor belts, cables and non-ferric scraps)	Minor waste storage place	To recycle market
Ferric Scrap Materials	Scrap Preparation Site	Processing in steel mill
Scales resulting from process	Open Site	Used in Sintering factory for Sinter Prodc.
Stack Dust from Production	Open Site	Used in Sintering factory for Sinter Prodc.
Blast Furnace Cinder	Open Site	To Cement Factories for reuse
Steel Mill Cinder	Open Site	Some portion is used in Sinter the Rest is Used as road filling material
Waste Lubricants	Water Plants	Sent to İzaydaş for Recycle
Batteries	Minor waste storage place (in the hazardous waste section)	Being sold to licensed companies
Tar	Briquetting Facility in Plant	Charge to Coke Battery by briquetting
Acid Precipitate	Water Plants	To chemical Treatment Plant
Oil scale	Sludge Basins	Being Stored in Hazardous Waste Storage Area
Phenol Treatment Sludge, Oily Filters, Lamps and Fluorescent Lamps	Stored in Tanks	Being Eliminated in Hazardous Waste Storage Area