

Metallurgy – an industry between traditional and sustainable management

~ Ph. D. Associate Professor **Cornelia Nistor** (University of Bucharest, Faculty of Business and Administration, Bucharest, Romania)

E-mail: cornelia.nistor@faa.unibuc.ro

~ Ph. D. Lecturer **Radu Herman** (University of Bucharest, Faculty of Business and Administration, Bucharest, Romania)

E-mail: radu.herman@faa.unibuc.ro

Abstract: Currently, the industry is a very important economic branch because the industrial products have a high share in the total final and intermediate consumption. Apart from the positive effects on the global consumption, the industrial activities have some negative economic and social effects and also on the environment. The sustainable management in industry should increase efficiency and reduce waste, should find new production methods so that the economic growth can be made with fewer natural resources, fewer materials - especially the rare ones, with less energy consumption from traditional resources and with more efficient technologies, with less negative effects on the human health and on the environment. The transition to a greener industry is an important issue for all the national economies and it is very important to adapt the legislation to the new trends and standards, to adopt new payment schemes, grants and green funds schemes, so as to encourage the industrial enterprises to increase the efficiency of the total resources consumption, to make the transition to greener activities, to use more green capital inputs, to produce more green products, to increase the collaboration with the public and the private sector.

Keywords: sustainable management, metallurgy, steel industry, industrial policies, energy consumption, greenhouse gases.

JEL Classification: A12, D24, D62, F18, L52, L61, L72, M21, O10, Q25, Q42, Q52, Q57

1. Introduction

The sustainable management must be a priority in all national present economies and in all economic activities. By practicing the sustainable management in all the industry sub-branches, the production activities can be more efficient and friendlier to the environment, will improve living conditions and will reduce social inequalities in the long run between the consumers of the industrial products and between the employees or those that are looking for a job in industry. Together with the management strategies applied by the individual industrial enterprises the State's decisions are also very important in order to achieve the sustainable economic growth, which must take into account the concern for the resources such as energy or raw materials.

This article aims to underline the importance to introduce together with the elements of the traditional management, the new principles of the green economy, the sustainable management, which will improve the resource efficiency, especially in the resource-intensive industrial sub-branches. The metallurgy uses a large amount of raw materials, which determined prices increase since the XXI century. An important issue, together with the high consumption of energy, is related also to the industrial water consumption, which, worldwide, will increase with an average of 20% until 2030. In: "Towards a Green Economy. Pathways to Sustainable Development and Poverty Eradication", it is underlined that "This applies, in particular, to the highly resource-intensive value chains such as metals and car manufacturing. But for the manufacturing industries to make this transition they need to receive the appropriate policy and price signals." [4]

The paper presents the most important issues concerning the transition to a greener industry, especially metallurgy, because, currently the industry is a very important economic branch because the industrial products have a high share in the consumption of the households and of the enterprises.

Also at the European Union level, the industry was considered a very important economic activity. The European Union has acted continuously on the industrial activity through trade policies, scientific research policies and cohesion policies. The goal was the conversion of the industries that have no longer enough chances to develop, maintain and increase the European Union's comparative advantage in the international trade of the sub-branches which are considered to have much potential in the future.

In Romania, metallurgy is one of the basic sectors of the national industry because this branch can provide 90% of the metals national consumption. In our country, such as at the global level, among the industries, metallurgy is on the fourth place for the energy consumption after the electric power industry, oil and gas, chemical / fertilizer.

The sustainable management in industry should increase efficiency and reduce waste, should find new production methods so that the economic growth can be made with fewer natural resources, fewer materials - especially the rare ones, with less energy consumption from traditional resources and with more efficient technologies, with less negative effects on the human health and on the environment. All these transformations can be made with all the support of the owners, the managers and the states, which must understand the importance of these measures and realize that these transformations can cause an increase in the long-term efficiency.

2. Literature Review

Regarding the importance of the industry for the European Union countries, the "Eurostat regional yearbook – 2016 edition", page 130, [6] underlines, "The latest information available from national accounts suggests that gross value added from the EU-28's manufacturing sector accounted for 15.5 % of total gross value added in 2015. In its communication (COM (2014) 14 final), titled, 'For a European Industrial Renaissance', the European Commission set a target of taking the share of manufacturing back to 20 % of GDP by 2020, calling on EU and national decision-makers to recognise the central importance of modernising the industrial base, raising industrial competitiveness, and promoting production and investment as key drivers of economic growth and jobs. The communication also called, among others, for:

- mainstreaming industrial competitiveness in other policy areas;
- maximising the potential of the internal market;
- implementing the instruments of regional development in support of innovation, skills, and entrepreneurship;
- promoting access to critical inputs in order to encourage investment."

The industrial policy of Romania is focusing also on the metallurgy because it is an important branch of the Romanian industry. The Romanian Ministry of the Industry [7], underlines some objectives for the first years of the XXI century. „The period 2003 - 2005 was a milestone for the Romanian steel industry, which was marked by the following events:

- Completion of the privatization, through penetration of the global steel

known groups, of which MITTAL STEEL, the first steelmaker in the world;

- Completion of negotiations and mutual consultations with the European Commission on the Closing Chapter 6 - Competition and agree on all the strategic elements to this: capacities, production, investment, state aid, viability program;

- Approval by the Romanian Government of the Sector Restructuring Strategy and of the Individual Viability Plans and their appropriation by the European Commission;

- Agreed with the European Commission on the calendar to monitor the implementation of the restructuring process; Romanian side will draft and will submit to the Commission twice a year the Monitoring reports.

According to the above, the Romanian steel capacity is 9.1 mln. T / year and rolling capacity is 9.2 mln. T / year. In 2004, steel production was 6.1 million tons.

Implementation of the restructuring process, respecting all the strategic elements stipulated in the restructuring plan and agreed with the European Commission, will lead to the end of the period 2008 to viable steel plants, which meet all the criteria of viability practiced today in the developed steel industries."

The situation of Romania's metallurgy it is described by the Ministry of the Industry: "Metallurgy of Romania is privatized 100%, while the share of foreign capital is about 80%. The steel industry in Romania is a very important industry for the national economy because it is a multiplier of: added value, industrial production, jobs, generating taxes, etc. In 2012 realized \approx 2% of European Union steel production and contributed to

the country's macroeconomic indicators: $\approx 8\%$ of the industrial production, $\approx 11\%$ of the export 22,500 employees at the end of the year. Non-ferrous metallurgical industry is represented mainly by the largest aluminum producer in Central and Eastern Europe (excluding Russia). Over 80% of its output is sold to the international market through the London Metal Exchange and under the direct long-term contracts with customers in 25 countries, representing approximately 30% of exports made by metallurgy. Although the main companies in the metallurgy have been restructured in terms of technological, financial and social, the international economic and financial conjuncture meaning the stagnation or the decline in the construction market in the European Union, the increase of the energy tariffs, the rising of the raw materials prices, the currency devaluation etc. they have directly affected the financial results, the account of profit / loss being negative. In order to consolidate the financial statements, namely the reduction of the losses for four consecutive, the management teams from most companies were forced to implement restructuring measures such as stopping production capacity with decreased load factor, the shift in conservation / decommissioning of some flows, the sale of some assets unessential to the basic process flows, the implementation of staff mobility schemes, the reduction of working hours, the reduction of the staff by applying for voluntary departure schemes / layoffs etc. Also, several companies have requested the insolvency to find solutions for reorganization / restructuring. " [11]

According to the National Institute of Statistics: „In 2014 compared to 2013 the consumption of the cast iron was increased by 1.8% - total (including old cast iron)

accompanied by an increase in production of crude steel converter by 0.1%. They have observed an increase in the consumption of iron ores and concentrates, and the increase in the consumption of agglomerated iron (+ 3.4%) and pellets (+ 0.5%) led to an increase in blast furnace iron production by 2.0%. Also, there is a decrease in consumption of ferro-alloys for the production of crude steel electric, with 6.7%, registering an increase, however, for the crude electric steel production 9.9% compared to 2013." [12]

In „Towards a Green Economy. Pathways to Sustainable Development and Poverty Eradication" [4], it is underlined the important role of the industry in greening the economy: „The manufacturing sector can make a significant contribution in greening national economies by producing goods that are more resource-efficient and have lower environmental impacts over their life-cycles. This applies, in particular, to the highly resource-intensive value chains such as metals and car manufacturing. But for the manufacturing industries to make this transition they need to receive the appropriate policy and price signals. Under certain conditions it also needs institutional support from governments, in particular insuring that supportive investments in physical infrastructure and education are sufficient to enable a transition that requires new systems and skills."

3. Characteristics of the metallurgy

Currently, the industry is a very important economic branch because the industrial products have a high share in the consumption of the households and of the enterprises. In the last century, the total industrial production increased significantly, such as the sub-branches production.

Apart from the positive effects on the global consumption, the industrial activities have some negative economic and social effects and also on the environment - global industry consumes between 20 – 30% of the total electricity and of the total primary natural resources consumption and produces a fifth of the total CO₂, provides over a fifth of the total employment and contributes with 17% to the health problems of the population.

In the total energy consumption of the European Union, the industrial one was, on average, over 35% during the last 21 years, this value being greater than the consumption made by households or by other economic branches. In Romania, the manufacturing consumption, on average, is a half of the country's total energy consumption, the main source being the hydroelectricity resulting from domestic production.

Worldwide, in 2014, the industry contribution to the total emissions of greenhouse gases was 21%, the industrial main activities which contribute at these emissions being burning of fossil fuels, general energy use, chemical industry, metallurgy and waste management activities. European Union industry's contribution to the greenhouse gas emissions is less than 10% as average because the European Union applied some green industrial production methods and, on the other hand, because the share of the industrial activities in the total European Union GDP is declining.

"Metallurgy includes mineral processing, extraction of metals from ores, metal refining, producing metal alloys, metal pressure manufacture, metal parts castings, heat, thermo-chemical and thermo-mechanical processing, welding and soldering metals and alloys, surface coating with metals."

Metallurgy can be ferrous, from which it results the steel, or nonferrous. [15]

The negative effects resulting from the metals use are: the growth of solid, liquid and gaseous or radioactive waste; toxic emissions from the chemical industry and from the transport; acid rains, affecting the water, the forests and the buildings; gases emissions; using large areas of land over a long period of time for mining, for passageways, for industrial constructions and for waste storage; noise, vibration and radiation.

It has been estimated that if the development of the economies will continue in the current manner, based on existing traditional management, the methods for cost controlling policies of industrial pollution of air, water and soil will increase by 3 times until 2030. The share of the water consumption in the steel industry is very high. The steel industry is one of the largest activities which causes toxicity problems by the emitted metals form the high temperature processes.

One major problem is that the metallurgy uses a large amount of raw materials. For some metals does not exist yet the shortage problem - such as iron or bauxite - as worldwide it exist a large quantity of those metals and, in addition, they were discovered new products that may substitute them. However, their use should be done in a sustainable way. The quick development of the industrial activities in some countries, especially in the emerging economies, increased significantly the global metal demand, so worldwide it appeared the necessity to use deposits with a low-useful metal content. The increasing demand of metals determined prices increase in the last 15 years. Because the raw materials have a low-useful mineral content, it takes more energy to extract it.

One way to reduce the amount of raw materials and to consume less of the resources is to increase the product life-cycle. It has been demonstrated that the increase by a certain percentage of the product life-cycle determines the same percentage reduction of the extracted natural resources. One of the most affected natural resources is water, from which a half is used as cooling water. Worldwide, the average of the water consumption in industry will increase by 20% until 2030. From some sub-branches (such as steel production and metal finishing), the water results polluted and requires future treatments involving high costs.

Chart 1. Raw steel production since 1950



Source: http://www.arcelormittalinfrance.com/our-business/historyofsteelmaking.aspx?sc_lang=e

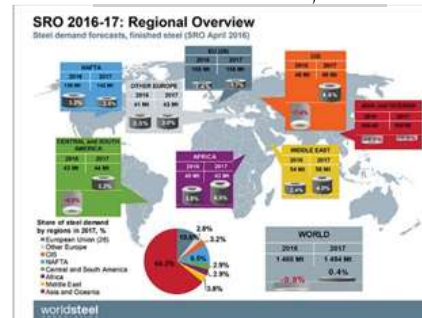
Between 1950 and 2000, steel production increased by 6 times. Between 1980 and 2000, aluminum production increased by 2 times. There are over 2,200 types of special steels. China consumes 25% of world steel production. The highest consumption per capita of steel production is in South Korea.

Chart 2. Top 20 steel producing countries in 2015



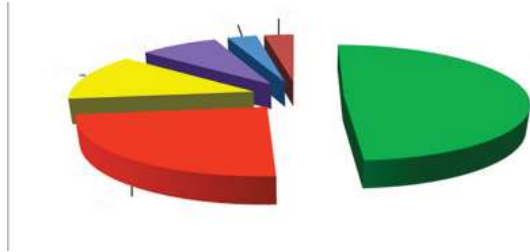
Source: https://www.google.ro/search?q=steel+production&espv=2&biw=1127&bih=787&source=lnms&tbm=isch&sa=X&ved=0ahUKEwigsqPezabQAhWBtRQKHbKaA9kQ_AUIBigB#tbm=isch&q=world+steel+production&imgsrc=2mGvsyqZhmXYLM%3A

Chart 3. Steel demand forecast



Source: <https://www.worldsteel.org/media-centre/press-releases/2016/worldsteel-Short-Range-Outlook-2016-2017.html>

Chart 4. World steel consumption in 2008

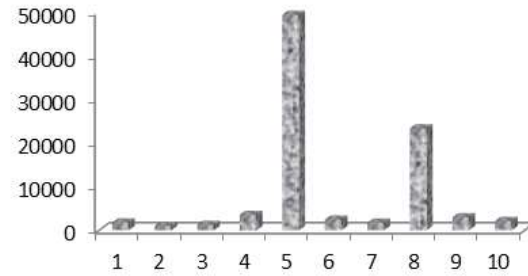


Source: *Towards a Green Economy. Pathways to Sustainable Development and Poverty Eradication*”, www.unep.org/greeneconomy, ISBN: 978-92-807-3143-9, Layout by UNEP/GRID-Arendal, www.grida.no, Version -- 02.11.2011, Copyright © United Nations Environment Programme, 2011 - - processed by the author

Aluminum is one of the most used metals. It was first discovered and obtained in 1825 and since 1886 it began to be produced on the electrolytic way from the bauxite. Aluminum is found in nature only in combinations, and the industrial one is obtained from bauxite. Probable world’s reserves of bauxite are about 55-75 billion tons, concentrated at a rate of nearly 70% in the first three countries where it exists.

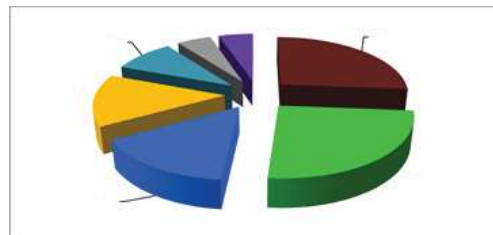
Aluminum is used in: aeronautics, ship-building, cars, automobiles, aerospace, nuclear reactors, electric transmission cables, construction, household goods, packaging, furniture etc.

Chart 5. Top 10 aluminum producing countries in 2014



1 = Australia, 2 = Bahrain, 3 = Brazil, 4 = Canada, 5 = People’s Republic of China, 6 = India, 7 = Norway, 8 = Russia, 9 = United Arab Emirates, 10 = United States of America
Source: https://en.wikipedia.org/wiki/List_of_countries_by_aluminium_production- processed by the author

Chart 6. World aluminum semi-finished products demand in 2015



Transport 27%, Constructions 25%, Packaging 15%, Electric Engineering 14%, Machinery and Equipment 9%, Durable consumption goods 5%, Other 5%

Source: <https://www.statista.com/statistics/280983/share-of-aluminum-consumption-by-sector> - processed by the author

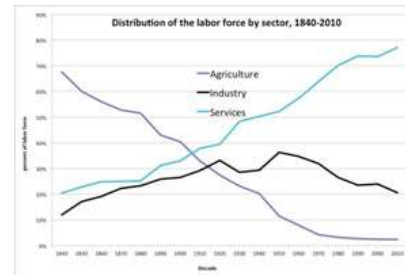
In 2014, the world leading producers are:

- Australia, followed by China, Brazil and Guinea for bauxite
- Chile, followed by China, Peru United States of America for copper
- China, followed by Australia, Russia, United States of America for gold
- China, followed by Australia, Brazil, India for iron
- Mexico, followed by China, Peru, Russia for silver
- South Africa, followed by Russia, Zimbabwe, Canada for platinum.

Regarding water consumption, the problem is more serious in those countries that have a physical deficit of water, but an efficient use of water is required worldwide. The industrial water consumption is a more serious problem in those countries which have developed water-intensive industries, such as China. If the enterprises can be built near the shores, the sea water can be used as a coolant.

Regarding the number of jobs in the whole industry, they will grow where industries will have a significant grow, especially in the developing countries. In the developed countries, the labor force will refocus on service branches. The trend in the number of jobs is keeping constant or decrease in certain industries, including the steel and iron processing, along with paper and cement industries. In addition to increase the labor and capital productivity, one explanation for reducing the number of jobs in metallurgy is the hazardous working conditions.

Chart 7. Distribution of the labor force by sector, 1840 - 2010



Source: <https://www.google.ro/search?q=world+raw+materials+consumption+in+metallurgy&espv=2&biw=1127&bih=787&source=lnms&tbn=isch&sa=X&ved=0ahUKEwjvtduDndjQAhXsa5oKHcseB7oQAUIBigB&dpr=1.1#tbn=isch&q=world+employment+in+industry&imgsrc=IY2ggAfkGnednM%3A>

4. Industry and metallurgy in the European Union

The industry was a fundamental activity for the majority of the countries during the last century. Although the European Union industry was always an important economic activity, but the Treaty of Rome has not provided a common industrial policy. References to the industrial activities can be found only in the Treaty of Maastricht, where it is recommended that all the member countries have to promote cooperation between enterprises and structural adjustments, based on scientific research and innovation's stimulation. The European Union has acted continuously on the industrial activity through trade policies, scientific research policies and cohesion policies. The goal was the conversion of the industries that have no longer enough chances to develop, maintain and increase the

European Union's comparative advantage in the international trade of the sub-branches which are considered to have much potential in the future.

"80% of European Union exports and registered patents are the result of the industrial activities. For every 100 jobs created in the industrial sector, it is estimated that between 60 and 200 jobs are created in the rest of the economy" [14]

According to the European Commission, the main actions that have to be followed in the period 2014 - 2020 refer to:

"1) Markets for advanced production technologies for the organic production

2) Markets of the Key Enabling Technologies (industrial microelectronics, photonics, nanotechnology and advanced manufacturing systems)

3) Markets of the organic products

4) Sustainable industrial policy, construction and sustainable raw materials

5) Ecological vehicles and boats - marketing the green vehicles (hybrid vehicles, electrical etc.) by providing the necessary legal framework and measures to improve the specific infrastructure, including alternative fuels

6) Smart grids for energy transmission and distribution." [14]

The most serious problems of the European Union industry in the XXI century are considered to be the deindustrialization by the migration of the labor force in other

sectors and the relocation. Currently, the loss of jobs caused by relocation are not worrying, but it is believed that may be a problem in the future, especially because this matter affects other areas related directly or indirectly to the industry, such as outsourced services by the enterprises. The most developed sub-sectors of the European Union industry are chemical, automotive, pharmaceutical and engineering industry. It has been demonstrated that the European Union industry, whose development should be encouraged, should be based more on the new member states where, although productivity is not very high, the efficiency can result through the low labor costs.

One of the most regulated industrial branch is the European steel industry, even since the Economic Community of Coal and Steel was founded, in 1951, by the Treaty of Paris, which ended in 2002. The European Union steel industry was affected by discovering the ways to substitute steel with other materials such as aluminum and plastic and by increasing the total supply of steel on the world market because of the emerging economies. European Union regulations were multiplied beginning with the ninth decade of the previous century, by the intermediate of the Etienne Davignon Plans, in order to reduce the production capacity, to modernize the capital, to reduce the imports from other countries, especially from Eastern countries.

Table 1. The goals of the European Union Davignon Plans in Steel Industry:

Davignon Plans	Period	The quantity that had to be cut from the total production	The quantity that had to be cut from the total jobs
The First Plan	1981 – 1985	32 million tons	250.000
The Second Plan	1988 - 1990	30 million tons	80.000
The Third Plan	1993 - 1995	30 million tons for crude steel and 19 million tons for laminated	50.000

Source: M.-A. Barthe (2011), "Economie de l'Union européenne", 4e édition, Editura Economica, Paris, pag 141, ISBN 978-2-7178-6007- processed by the author

After 2002, the balance of the European steel production was achieved due to the large increase of China's steel demand. The liberalization of the steel market requires careful commercial policy measures, especially against USA, which often applies protectionist policy measures.

It should be noted the RESIDER Community Program, which ended in 1999 and which has the goal to realize the economic and social conversion of the steel basins. Currently, they still exists only the aids for the environmental protection and those for the scientific research and the development activities.

Since one of the most important goals of the European Union is to become an advanced knowledge economy, the research and the development policy becomes a major economic common policies. In this framework programs for research and development are included elements of the transition to a more efficient and greener economy.

For example, "the Seventh Framework Program for the period 2007 - 2013 contains measures on priority areas such as - health; food agriculture and fisheries; biotechnology; information and communication technologies; nano-sciences, nanotechnologies,

materials and new production technologies; energy; environment, including climate change; transport, including aeronautics; the space; security; socio-economic sciences and humanities; EURATOM." [1]

The European Commission aims to increase the employment rates, to ensure that 75 % of 20–64 year-olds are employed by 2020, by focusing "in four priority areas:

- improving the flexibility and functioning of labour markets (flexicurity) to reduce chronically high structural unemployment;
- equipping people with the right skills for the jobs available in the labour market, in particular by ensuring the labour force can benefit from technological changes and adapt to new patterns of work organisation, while ensuring that skills mismatches are eliminated, for example, by promoting intra-EU mobility and non-member migrant inflows;
- increasing the quality of jobs and ensuring better working conditions, in an attempt to promote labour productivity gains and higher employment participation;
- promoting policies which encourage job creation, in particular, among those enterprises which require high skills and R & D-intensive business models" [6]

The average share of non-financial

business economy employment is 0.1% for mining of metal ores, 0.2% for other mining and quarrying, 0.8% for manufacturing of basic metals and 2.7% for manufacturing of fabricated metal products.

5. Industry and metallurgy in Romania

In Romania, metallurgy is one of the most important sectors of the national industry because this branch can provide 90% of the metals national consumption. In our country, such as at the global level, among the industries, metallurgy is on the fourth place for the energy consumption after the electric power industry, oil and gas, chemical / fertilizer, with a total average energy consumption of 1904890 toe / year.

The share of the total energy consumption in the production cost was, in 2013, about 15% in metallurgy, lower than the corresponding share of the cement industry, which had a maximum value of 23.5% and higher than the corresponding share of the automotive industry, which have the minimum value of 2.7%.

In Romania, the industrial policy measures after 2000 have provided “amplification of the remodeling process capacity and production structures, restructuring of energy-intensive industrial sub-branches”, [2] given that Romania’s industry was, for the most part, energy-intensive. As regards the steel industry, restructuring means promoting the production processes with the highest added value, such as production of stainless steels.

“In the “National Strategy on Climate Change of Romania 2013 - 2020” are established the following objectives assumed by Romania by 2020 (compared to 1990):

- reducing the greenhouse gas emissions by 20%;
- reducing the final energy consumption by 20% through increased energy efficiency;
- generate 20% of the energy needs from renewable sources” [10]

The most used raw materials in Romania in the metallurgy, which demonstrates a large quantity of natural and produced resources, are:

Table 2. Raw materials consumption in metallurgy in Romania in 2014 –base 2013

Product	Iron ore and concentrates	Cast iron, including old cast iron	Iron alloys	F e r r o u s conglomerate	Pellets
F e r r o u s conglomerate	1936	-	-	-	-
Furnace cast iron	35	-	-	2166	425
Crude converter steel	-	1625	28	-	-
Crude electric steel	1	16	28	-	-
Cast iron mold-ed pieces	-	2	-	-	-

Source: <http://www.insse.ro/cms/files/publicatii/publicatii%20statistice%20operative/Activitatea%20sectorului%20metalurgic%20in%20anul%202014.pdf> – processed by the author

In 2015, the resident labor force in the Romanian metallurgy was around 35,000 people.

The Romanian steel industry has an increasing demand for its products, due to increased consumption within other industries. The advantages of the Romanian steel industry are that most of the enterprises were restructured and modernized, they are almost evenly distributed all over the country's territory, having a various production and this is an area of interest to strong economic foreign investors. Because steel industry is a traditional industrial branch in Romania, the workforce is adequately qualified.

As negative aspects, the prices of the steel industry product are affected by the increase of energy resources prices and by the competition, on the national, European and global level, by steel industry products coming from other countries, especially from China. This issue is due also to the full liberalization of the trade with steel products, which disadvantage Romanian producers and exporters, while national raw material scarcity increases the dependence on imports.

6. Greening the metallurgy

In the future, given the worldwide trend of the population growth, sustainable economies should apply a sustainable management, should find new production methods so that the economic growth can be made with fewer natural resources, fewer materials - especially the rare ones, with less energy consumption from traditional resources and with more efficient technologies, with less negative effects on the human health and on the environment. But, all these transformations through a greener industry which can

increase efficiency can be made only if the owners and the managers understand the importance of these measures and realize that these transformations can cause an increase in the long-term efficiency. Also the awareness of the industrial products consumers, such families, enterprises, the State it is important because they can orient their consumption to the green industrial products.

The most important issue in the modern industries refers to the energy consumption, the consumption of natural primary resources used as production factors, to the pollution and the health problems. The green development of the industry means that mankind must find ways to increase the product life-cycle and to produce more based on the green energy. In order to complete the transition to a greener industry, it is very important to develop the secondary activities, such as recycling, remanufacturing, repair, reuse, reconditioning.

Of all existing metals (about 80 are pure), only 30 were fully exploited and only 20 are very important. The greatest variety of metals exists in Australia and Russia.

For an industrial sustainable management, recycling metals is an important present and future activity because of the requirement of growing the industrial activities efficiency given that the useful content of the metal ores is decreasing. Recycling metals will allow save energy and not extract a quantity of primary resources. Metals have different recycling rates. Currently the recycling rate for steel is between 80-90%, for copper between 30-40%, for aluminum and lead between 90-100%.

The only disadvantage of the metals recycling process is that some recycled metals do not preserve the original properties,

meaning they do not have the same degree of malleability, but they can be used with success for other type of products.

As the "International Panel on Sustainable Resource Management of UNEP" underlines: „Policies and practices that could stimulate improved recycling need to consider:

- Taking a holistic view on life cycles and recycling chains in order to identify interactions and interlinkages between different metal cycles and also between product and metal cycles
- Measuring discard streams to identify what is actually being lost
- Managing materials through the recycling sequence
- Employing effective and appropriate technologies
- Carrying out each step of the recycling sequence in an environmentally sound manner
- Enhancing interregional stakeholder cooperation to more effectively track global material flows." [5 – page 23]

In some countries, recycling is already an important activity. percent in the total of the inputs. For example, in the USA, a half of the inputs used for the carbon steel production is represented by the scrap. Remanufacturing is an increasingly important activity in some fields like electronic goods, machinery, equipment, office furniture etc.

Remanufacturing means "rebuilding of the product to the specifications of the original manufactured product using a combination of reused, repaired and new parts. It requires the repair or replacement.. of some components of the product. [13]

Some of the major companies, wanting to get the lowest possible production cost,

they produce the remanufactured components in other countries, where they find a lower price of the employment. Sometimes even the different parts of the replaced component can be produced in several countries. A challenge that must face this process is that the new parts should fit perfectly with the existing ones, so that, from the technical point of view, they can work well together with the existing components. Another issue is that many of the products are sold to the customers by the intermediate companies, and if these intermediate companies are running the remanufacturing activity, it is impossible for the company that originally produced the goods to take the responsibility for remanufacturing.

A barrier for this sustainable activity is that some of the enterprises are hesitant to promote remanufacturing because they does not wish that the remanufactured products, even if there are their own products, compete with the new modern products that they want to launch on the market. In addition, consumers are encouraged through advertising means and through the education that they receive, to replace the old products with completely new products.

For the developing countries, the government decides to import old products in order to remanufacture them, so in these countries remanufacturing offers a large possibility to create jobs and the possibility for the consumers to find on the market some useful products at a lower price than the new ones.

Doing a sustainable management which can provide a greener metallurgy the managers can also contribute to the increase of the number of jobs in the greener activities. Because of the hazardous working

conditions, the sustainable management of metallurgy means increasing the number of jobs in the secondary activities such as collection, sorting, recycling.

According to the foresights, in the next half of the century, the greatest development will have chemicals and plastics industry, followed by the steel industry, paper, textile, leather and aluminum. Transition to the green metallurgy will increase significantly the energy efficiency and will decrease the greenhouse gas emissions almost at a half. Developing the eco-parks is an important form of industrial development because they will enhance the links between the industries and will provide green jobs, which means also increasing government investment in infrastructure and waste processing activities. Another measure is the cogeneration of heat and energy that is appropriate especially for some industries, such the steel and aluminum industries.

In order to develop a sustainable management at the national level, it is very important to adapt the legislation to the new trends and standards, to adopt new payment schemes, grants and green funds schemes, so as to encourage the industrial enterprises to increase the efficiency of the resources consumption, to develop more green activities, to use more green capital inputs, to produce more green products. Not least, states should increase their collaboration with the private sector, especially with the small and medium enterprises which can carry out the actions to integrate the concepts of sustainability in their current work and to raise population awareness so that the consumers realize the importance of the green products.

Among the economic policy measures adopted in Romania in the first decade of

the XXI century, is streamline the mining industry and metallurgy, because they are considered to be vulnerable in economic and financial terms. Following the trade liberalization with the European Union, some Romanian industries have advantages, others were disadvantaged. Among the advantaged industries is metallurgy "for which comparative advantage in the trade with the European Union has remained relatively constant, to a positive value of 0.8 between 1992 and 2002, but lower than the trade with the rest of the world, which demonstrates a higher potential of this sector." [2 – page 171]

6. Conclusions

The transition to a more efficient and environmentally friendly economy, to a greenest one, must be an objective of all the individuals, all the industrial enterprises and of all the states. Sustainable management strategies should take into consideration the raw materials, the energy, the water and all the other resources that will need and benefit the future generations. There are necessary some new economic policy strategies, together with the population awareness and the voluntary action of the private sector enterprises. It is particularly important internal and international cooperation, national and international agreements between all those involved in the implementation of the economic policies.

It has been estimated that if, worldwide, the development of the economies will continue in the current manner, based on existing traditional management, the methods for cost controlling policies of industrial pollution of air, water and soil will increase by 3 times until 2030.

Regarding the number of jobs in the whole industry, they will grow where industries will have a significant grow, especially in the developing countries. In the developed countries, the labor force will refocus on service branches or on the secondary activities, on recycling, remanufacturing, reusing and repairing the industrial products. The trend in the number of jobs is keeping constant or decrease in certain industries, including the steel and iron processing industries. One explanation for reducing the number of jobs in metallurgy is the hazardous working conditions. The most serious problems of the European Union industry in the XXI century are considered to be the deindustrialization by the migration of the labor force in other sectors and the relocation.

One of the most regulated industrial branches is the European steel industry which was affected by discovering the ways to substitute steel with other materials such as aluminum and plastic and by increasing the total supply of steel on the world market because of the new industrialized economies.

In Romania, the industrial policy measures after 2000 have provided "amplification

of the remodeling process capacity and production structures, restructuring of energy-intensive industrial sub-branches" [2]

Since the modern industries are intensive-energy consumers, they consume a large amount of natural primary resources and they produce pollution and health problems, the sustainable management for greening the industry means that mankind must find ways to increase the product life-cycle, to produce more based on the green energy, to complete the transition to a greener industry, to develop the secondary activities, such as recycling, remanufacturing, repair, reuse, reconditioning.

The modern sustainable management in industry means, at the national level, to adapt the legislation, to adopt new payment schemes, to encourage the industrial enterprises to increase the efficiency of the resources consumption, to increase the number of the greenest production activities, to use more elements of green inputs, especially capital elements, to produce more green products, to increase the collaboration with the private sector, especially with the small and medium enterprises.

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