

Editorial

## Chemical Industry and Sustainability

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A discussion on chemical industry and sustainability implies, first of all, a consideration of the relationship between enterprise and sustainable development. In this regard, the 2030 United Nations Agenda gives a clear recommendation to consider altogether the three dimensions of sustainable development: the economic, the social and the environmental aspects. This is the guideline of the present analysis.<sup>1</sup>

Most of the data reported throughout this document are referred to the Italian chemical industry; however the same considerations can be made for other European countries.

The starting point is an indication given a few years ago, in 2009, by the High Level Group on the Competitiveness of the European Chemical Industry, an initiative of the European Commission joined by representatives of the Member States, industry experts, academics, environmental groups and trade unions.

The title page of the final report begins with a strong statement: «*European Chemical Industry, Enabler of a Sustainable Future*».<sup>2</sup>

In a nutshell, the report illustrates that the most important challenges that humanity has to face - such as food needs for a growing population, new needs related to ageing, climate changes and the most efficient use of resources - “require new solutions, many of which can be implemented only thanks to new materials and substances”, i.e., with a decisive contribution of the chemical research combined with the ability of the industry to convert scientific discoveries into technologies and products.

These considerations are valid also for many of the UN goals:<sup>3</sup> “Zero hunger”, “Good health and well-being”, “Clean Water and Sanitation”, “Affordable and clean energy”, “Responsible Consumption and Production”, “Climate action”, in addition to the two objectives that directly concern the industry, “Decent work and economic growth” and “Industry, innovation and infrastructure”.



In order to properly represent the sustainability of the chemical industry (as for any other sector or company) it is necessary to adopt the “concept of the three pillars”: true sustainability, as already underlined in the 1987 Brundtland Report, is based on the equilibrium of three type of sustainability: economic, social and environmental.

The following paragraphs will describe the facts that identify the chemical industry as an important actor of sustainability. After a brief reference to the results at the European level, the data will be further analyzed for Italy, as it represents a valid example for other industrialized countries.

### ECONOMIC SUSTAINABILITY

At the European level, economic sustainability of the chemical industry is well reflected by the very high trade balance, which is at the same time an indicator of

strong specialization and of high level of competitiveness. Although China is now the main chemical producer, Europe is still the biggest chemical exporter in the world.

The economic sustainability of the chemical industry is connected to its main feature: “a science and an industry come along with the same adjective”, i.e. chemical industry is a science-based industry.

This is not a trivial statement. Actually this fact historically implied the birth of genuine industrial research within chemical companies, through a continuous and intense interaction between the scientific and the industrial world, well represented in Italy first by two eminent scientists: Fauser and Natta with Montecatini.<sup>5</sup>

It is interesting to look closely to the famous picture taken during the 1911 *Solvay Physics Council* because it well represents this feature: together with Ernest Solvay (the third from the left), there are 11 Nobel Prizes, from Albert Einstein to Marie Curie, from Max Planck to Lord Rutherford, and great experts of different disciplines (e.g. Henry Poincaré). It is interesting to underline also the fact that Solvay was strongly interested not only in Chemistry.



In a “knowledge society” this feature is more and more recurrent, but the need of the chemical industry to anticipate trends and changes pervades many aspects of the enterprise life. In particular, this aspect determines the centrality of innovation, with a structured research activity involving a high percentage of companies (42% compared to a manufacturing average of 18%) and which sees more than 1200 companies in Germany and almost 700 in Italy: not only large chemical industries have R&D activities in Europe.

## R&D CENTRAL ROLE

Italian companies with intra-muros R&D  
(% of total companies)



Number of chemical European companies with intra-muros R&D

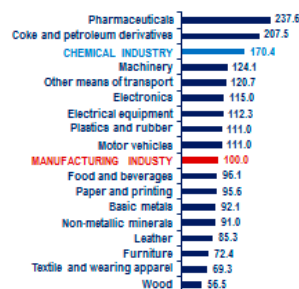
Germany	1,278
Italy	683
Spain	548
France	541
Netherlands	224

Companies with more than 10 employee. UK not available  
Source: Eurostat - Community Innovation Survey, 2014

For European chemical companies, research-based innovation, complex systems and technologies and capital intensity determine high productivity (the added value per employee is 70% above average in Europe) with the result that the high qualification and productivity of the employees allow on one hand a higher remuneration and on the other hand a greater defense from emerging competitors.

## HIGH PRODUCTIVITY DEFENDS FROM EMERGING COMPETITORS

Added value per employee  
(manufacturing industry index=100)



Source: Federchimica's elaboration on ISTAT data

In the European chemical industry these aspects are associated and closely interact with an international vocation; the European large trade surplus is a clear example. For Italy, ISTAT (the Italian central statistics institute) shows that chemical industry can boast the highest percentage of exporting companies, after phar-

maceutical industry: 56% against the manufacturing average of 23%.

Productive investments abroad are common in the global market, and it is worth to note that they do not lead to delocalization, as they allows either to tackle markets with on-site productions or to maintain commodity production abroad by focusing European activities on specialties and research.

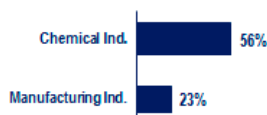
A fundamental contribution to participation in the global market is given by foreign capital companies that not only maintain a high share of production in the Europe Member States, but have also undergone a significant rise in exports. In this aspect Italy shows a very interesting fact: the foreign companies have an even greater increase than the average of chemical companies of % of turnover in the last 10 years.

In Italy, as well as in other countries, despite the heavy constraints of external conditions, such as the cost of energy, the role of these companies is a virtuous model, and experience shows that the acquisition of local companies has lead to a better development.

All these considerations converge into economic sustainability: the case of Italy is interesting for the strong effect of the 2007 economy crisis on the manufacturing industry and its outcome on the GDP. In fact chemistry related export has not only grown much more than the average in Italy, but also more than almost all the major chemical European producers. This aspect avoided a possible structural crisis of this sector due to the heavy drop in the internal demand.

**STRONG INTERNATIONAL VOCATION**

**Share of exporting companies**  
(% on total companies)



Source: Istat, 2016

**Export as a share of turnover in chemical companies in Italy (%)**



Source: Federchimica, Istat, 2016

At the European level and even more in Italy, this gratifying result is largely due to innovation and to the growing specialization in the most dynamic and more fitted sectors of the typical medium size company, i.e. those of fine chemicals and specialties. At the European level the share of trade surplus connected to these sec-

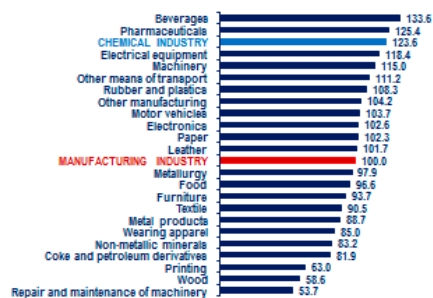
tors is more and more important. In Italy, the specific positive trade balance has more than tripled in 10 years and now reaches values that make this sector one of the new champions of the “Made in Italy”.

It is very interesting to analyze the results produced by ISCO, an indicator that ISTAT has been proposing in the last couple of years and that summarizes competitiveness through productivity, represented by the ratio between added value and labor cost, profitability, diffusion of innovation, percentage of exports on turnover and exports performance. The approach is not to verify the present level of competitiveness, but the possibility to stay competitive in the long term, in fact to stay sustainable.

It may be surprising that the chemical industry appears among the first three sectors and consequently has a better position than those that are traditionally regarded as the flagship of Italian industry. If this is right for Italy, it is certainly valid for most of the major European countries.

**CHEMICAL INDUSTRY AMONG ITALIAN SECTORS WITH THE HIGHEST LEVEL OF COMPETITIVENESS**

**ISCO, Synthetic Competitiveness Indicator**  
(indices manufacturing =100, year 2015)



Source: Istat

Ultimately, if competitiveness is considered a decisive factor in economic sustainability, the chemical industry shows excellent results.

**SOCIAL SUSTAINABILITY**

An outstanding issue of sustainability is its social issue, which can take various forms if referred to an industry. First of all, it means offering highly qualified job opportunities to the new generations.

This aspect is well represented by the percentage of graduates among the employees and in particular among new hires: in Europe this percentage is close to 40% (in

Italy it is close to 30%) and much higher than the average. The focus on human resources also determines the stability of employment relations and the commitment of companies to continuous training.

For example, in Italy the quality of employment relations results in a 95% share of employees having a permanent contract. Furthermore, chemical industry tackles continuous change through education, a topic which sees chemical industry in the top position in Italy as in other European countries: actually in Italy 42% of the employees is annually involved in training courses.

The Italian case is extremely interesting for an important aspect of social sustainability, i.e. Industrial Relations. In fact, the centrality of human resources and social responsibility in recent decades has led to Industrial Relations based on social dialogue that in turn allowed to develop significant innovations.

For those that are more concerned about social sustainability, it is important to recall the two sectoral funds for supplementary pensions and health insurance (Fonchim and FASCHIM): in both cases, the sector has been the forerunner precisely because of its sensitivity to the issues of social responsibility and the quality of relations between the social parts.<sup>6,7</sup>

#### PERCENTAGE OF GRADUATES ON EMPLOYEES AND NEW HIRES

	CHEMICAL INDUSTRY	TOTAL INDUSTRY
GRADUATES / EMPLOYEES	19%	11%
GRADUATES / NEW HIRES*	28%	19%

\*Hired workers under 30 years old

Employees involved in training courses  
42%

Employees with permanent labour contract  
95%

The first two sectoral funds for supplementary pensions and health insurance



Source: Istat

Another way to get the meaning and relevance of social sustainability deals with safety, i.e. accidents and occupational diseases: in Italy INAIL (the National Institute for Insurance against Accidents at Work) data show how the stereotyped image given by the mass media does not fit with chemical industry.

For sure chemical industry is under very stringent regulation and takes advantage from innovations in plants and processes, but above all this result is related to organizational aspects.

It is not by chance that there is a very evident inverse relationship between hours of training on health, safety and environment and number of injuries: in Italy a +55% growth of the former from 2005 corresponds to

#### HEALTH AND SAFETY: AN ABSOLUTE PRIORITY

##### Accidents

(numbers per million of hours worked)\*

Basic metals	21.9
Wood	19.4
Metal products	18.6
Non-metallic mineral products	17.7
Rubber and plastics	16.5
Food	16.0
Maintenance	15.5
Paper	15.5
Furniture	14.9
Other means of transport	13.5
<b>MANUFACTURING INDUSTRY</b>	<b>13.5</b>
Machinery	12.5
Electrical equipment	10.9
Printing	10.9
Auto-vehicles	10.7
Beverages	10.5
Textile	9.7
<b>CHEMICALS</b>	<b>8.9</b>
Other manufacturing industries	8.3
Tobacco	8.2
Leather	8.2
Pharmaceuticals	5.8
Electronics	5.4
Wearing apparel	5.2
Coke	3.9

Note: average 2015-2017, manufacturing industry = median

Source= Federchimica-Responsible Care®, Inail

#### TRAINING ROLE

##### Training and injuries in enterprise joining The Responsible Care program (% change 2005-2017)



Source= Federchimica-Responsible Care®, Inail

a 52% decrease in the latter.

#### ENVIRONMENTAL SUSTAINABILITY

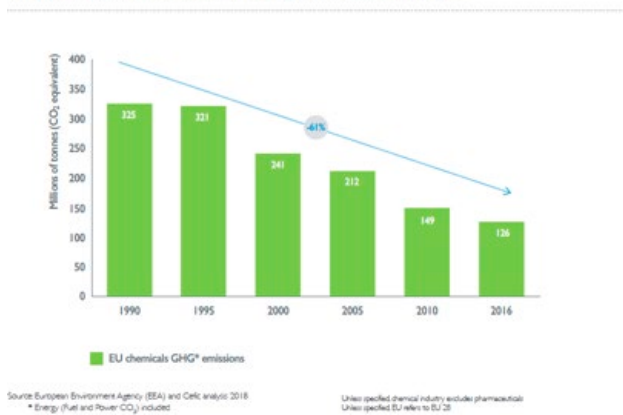
The relation between chemistry and environment is strictly linked to the role played by chemistry as a science and to its final purpose of transforming matter, which results into emissions, water effluents, energy consumption and waste.

The commonly used indicators focus on the improvement and not on the level of variables, as all the industrial activities have an environmental impact.

Thanks to the Responsible Care Program, a project joined by the most important enterprises involved in the environmental issue and present in all European countries, it is possible to report on the efforts, but also show of some measurable results.<sup>8</sup>

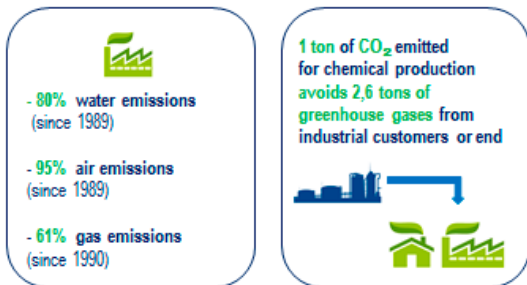
In the last thirty years the main variables have shown very significant decreases. To make an example, greenhouse gas emissions due to the chemical industry decreased by 61% from 1990 (both in Europe and in Italy) and the sector has already reached the levels of efficiency expected in 2030 by international agreements.

Total greenhouse gas emissions\* in the EU chemical industry



Another feature that casts a different light on the chemical industry is an international study conducted by McKinsey: a ton of CO<sub>2</sub> emitted during chemical productions avoids 2.6 tons of greenhouse gases from industrial customers or end because of the use of substances, materials and chemical products. An example is energy savings in buildings.

**ENVIRONMENTAL SUSTAINABILITY:  
TANGIBLE RESULTS AND CONTRIBUTION  
TO THE SUSTAINABILITY OF THE CUSTOMER SECTORS**



Source: Federchimica – Responsible Care ©, ENEA – Odyssee Project ISPRA, Istat ICCA - McKinsey

**CONCLUSIONS AND POLICY ISSUES**

In Italy, a few years ago, Fondazione Symbola - chaired by an environmental oriented organization - elaborated the Internal Quality Product (IQP) in order to identify indicators on sustainable development.

For this purpose a wide set of indicators of the three pillars of sustainability was used.

Although they were obtained in 2012, the data are still valid, as referred to structural assets and can be used not only for Italy but also for the European chemical industry.

**LEADER SECTOR IN SUSTAINABLE DEVELOPMENT**



The chemical and pharmaceutical industry holds the first place for sustainability development, with a conspicuous gap from other sectors.

A first conclusion that can be drawn is that chemical industry, in a medium-to-long term perspective, is particularly suited to a European country like Italy, as it offers good opportunities to the youngest.

A reflection is needed: sustainability deals with a context dominated by globalization and its consequences on competitiveness. Already in 1990 Michael Porter in his book *“The Competitive Advantage on Nations”* stated that *«in the global market, competition is not only between companies but also between nations»*.<sup>9</sup>

At that time, this was already acknowledged as the consequence of a process driven not only by the globalization of the market, but also by the availability at “zero time” of technologies, information and capital in the emerging areas.

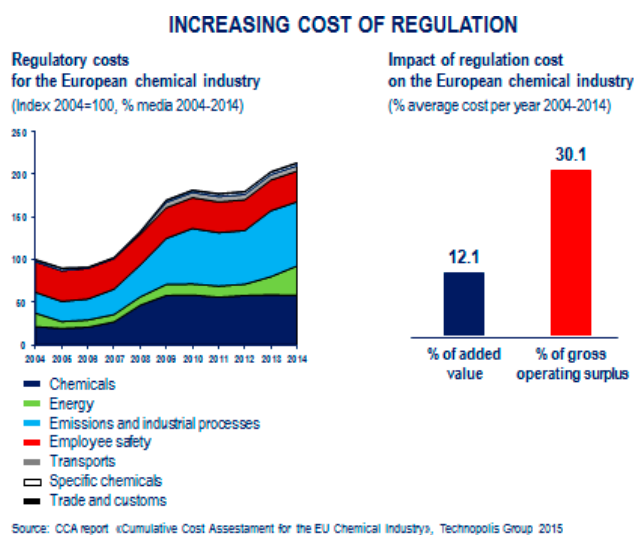
The consequence is that the competitiveness of a company depends more and more on what the “Coun-



trywide competitive conditions” transmits to it, because for most of the other factors the conditions are similar or almost so. If it was already true at that time, it is easy to get how central this aspect is now.

Chemical industry provides precise indications which appear to be more and more valid for the whole industry. Because of its characteristics the Countrywide competitive conditions influences many critical aspects of chemical competitiveness: the relationship with the environment determines a key system of rules and a role of the Public Administration in its application and control, infrastructural system in terms of availability and charges, cost of energy, relations with the territory, education and university system.

The single company has a very little influence over all these elements, which are very relevant instead, in term of cost and certainty. The European Commission has recently carried out a careful analysis of the costs of regulation in the chemical industry, and the results are very explanatory of what we just stated: they represent, on average, 12.1% of the added value and 30.1% of the gross operating surplus, even more for SMEs because the regulations mainly act as fixed costs.



It seems clear that a given regulation or a different application of it in different areas or countries has a very high impact on competitiveness, and this fact is of great importance also for sustainability.

In fact, it is based not on three, but rather on four pillars, the fourth represented by Institutions: on one hand because they have a direct role on many of the objectives indicated by the United Nations, but on the

other hand and above all because it is entrusted to them the very difficult task of ensuring that the three pillars support each other.

As many aspects of the competitiveness of the companies depend on external factors, on which they have little or no influence, the Intermediate Bodies (such as Industrial Associations) take on great importance, with the aim not only to protect interests and to involve their representatives on themes such as sustainability (for example with voluntary initiatives, training actions and with management models that include social responsibility), but also to proactively collaborate with the Institutions above all in the definition of the rules and in their application.

In conclusion, chemical industry shows a clear indication of the role of Institutions and Intermediate Bodies on the goals of sustainable development in a logic of collaboration arising from the awareness that the proposed objectives are mandatory but also very demanding.

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