EUROPEAN COMMISSION

Community research



European Steel Technology Platform

Strategic Research Agenda

Executive Summary

ESTEP

A vision for the future of the steel sector

April 2005

Credits:
Cover page right: Ph. M. Monteaux, Architect: Sir Norman Foster, courtesy of photothèque Groupe Arcelor
Cover page background: D. Sarraute, Usinor, courtesy of photothèque Groupe Arcelor
Sources of all the figures: Eurofer

EUROPEAN COMMISSION

Directorate-General for Research
Directorate Industrial Technologies
Unit G/05 Research Fund for Coal and Steel

E-mail: rtd-steel@cec.eu.int
http://www.cordis.lu/coal-steel-rtd/home.html

This brochure has been produced thanks to the contribution of the European Confederation of Iron and Steel Industries (www.eurofer.org)

EUROFER
European Confederation of Iron and Steel Industries

European Steel Technology Platform

Strategic Research Agenda

endorsed by the steering committee on 15th December 2004

Executive Summary

A vision for the future of the steel sector

April 2005

Europe Direct is a service to help you find answers to your questions about the European Union

Freephone number:
00 800 6 7 8 9 10 11

A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server (http://europa.eu.int).

ISBN 92-894-8966-9

Printed in Belgium

PRINTED ON WHITE CHLORINE-FREE PAPER

Abstract

This document is the first version of the **Strategic Research Agenda of the European Steel Technology Platform (Vision 2030)**, which was officially launched on March 12, 2004. It offers a global vision on the innovation and R&D initiatives which will lead to the achievement of the objectives identified in the frame of a sustainable leadership of the steel sector in the coming decades.

The ambition of the European steel industry is to maintain and reinforce a global leadership, which is both sustainable and competitive, given the strong development in other parts of the world, notably Asia. To maintain its **competitiveness**, the European steel industry will have to meet the challenging combined targets of **environmental friendliness and economic growth.**

To meet the strategic objectives of the European Steel Technology Platform, in March 2004, the Group of personalities decided to launch a determined, long-term and structured R&D action.

Five working groups involving around 80 persons and corresponding to the **4 pillars of the sustainable development framework of the Platform** were set up (profit, partners involving both automotive and construction sectors, planet and people) and have developed **three large and complementary R&D industrial programmes with large societal impacts**, each of them encompassing several R&D themes and research areas.

Three industrial programmes with large societal impacts are proposed:

- Safe, clean, cost-effective and low capital intensive technologies
- Rational use of energy resources and residues management
- Appealing steel solutions for end users

Together they aim to play a major role in **boosting competitiveness**, **economic growth and the related impact on employment in Europe**. The corresponding R&D themes and areas that have been identified in these programmes are bringing a strong **contribution to the sustainable development approach.**

Protecting the environment (greenhouse gas emissions and more particularly CO_2 emissions) and increasing **energy efficiency** both constitute major transversal issues in the universe of the RTD programmes that are proposed. **Security and safety** represent the third very important objective to be addressed, not only in the relevant industries but also in customers' every day lives as users of steel solutions (cars, buildings, energy production and transport, etc.) by developing new **intelligent and safer steel solutions.**

A major transversal theme regarding the **human resources** aspects has also been taken into consideration (attracting and securing qualified **people** to help meeting the steel sector ambition). In this respect:

- A large European network (TIME, 41 universities), involved in education, training, communication and dissemination activities has been identified among the stakeholders of the EU steel technology platform. This network should play a leading role in analysing how the education system could meet the future requirements for qualified people of the European steel industry, and in devising effective approaches to address its anticipated shortcomings.
- Human resources, as the holders of a company's core competencies, represent a key asset that should be dynamically optimised. A survey of the steps taken by European steel producers in terms of change management and progression towards "knowledge organisations", leading to exchanges of best practices, should significantly contribute to such optimisation process.

The European steel industry has already measured up to the challenge of lowering CO_2 emissions by creating a consortium of industries and of research organisation that has taken up the

mission of developing breakthrough processes, the **ULCOS** (**U**ltra **L**ow **CO_2** **S**teelmaking) consortium.

This large-scale consortium (48 European participants) which was set up in the spirit of a joint initiative in 2004 plans to develop a **breakthrough steelmaking process** that has the potential of meeting the target of drastically reducing greenhouse gas emissions beyond 2020. The full development of the process, from basic concept to fully-fledged industrial implementation would cover both medium- and long-terms and consist of a number of consecutive projects.

Breakthrough technologies must be developed to achieve the technological advances of the three large industrial programmes of the platform. A **critical mass** (both skills and financial) is necessary to meet the challenges of the long term ambition.

The Steel Technology Platform will further integrate and **broaden the scope of the European RTD partnership** built in the frame of the ECSC Treaty (more than 8,300 researchers). Indeed it will constitute large partnerships involving the whole European steel industry, its suppliers and customers (automotive industry and construction sector and the energy sector in a second stage), SMEs, private and public research, public authorities and representatives of trade unions.

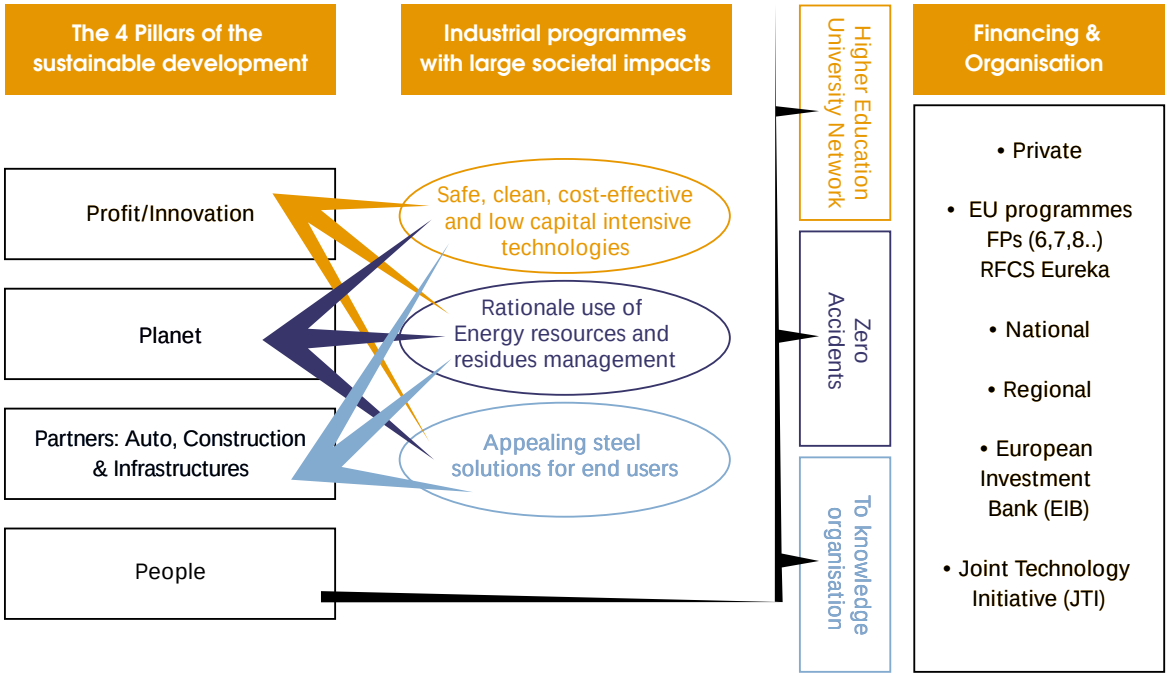
As regards implementation of the SRA, sources of **both private and public funding will be** necessary to meet the ambitious objectives of the European steel sector.

It is envisaged that all necessary resources of the existing instruments will be combined at different levels:

- EU programmes (Framework programmes, RFCS, Eureka, etc.)
- National programmes and even
- Regional programmes.

The Joint Technology Initiatives together with loans from the European investment bank will enable the development of emergent breakthrough technologies and their implementation at large industrial scale, in the coming decades.

Implementation of the S.R.A.



Implementation of the S.R.A.: need for a critical mass of means

Table of contents

Figures index

Ambition

to assume a sustainable and global leadership
in the coming 30 years

Main challenges

- Growing impact of globalisation
- Matching steel supply to demand
- Environmental constraints
- Changing EU regulation
- The EU enlargement

Strategic objectives

- Profit trough innovation
- Meet society's needs in close partnership with its customers
- Meet environmental requirements
- Attract and secure qualified people

Recommendations

Creation of a European Steel Technology Platform
to boost innovation, to develop new breakthrough
technologies and new steel solutions

Creation of a steering committee
to select priorities and monitor progress

Development of a strategic research agenda to
implement new breakthrough technologies
and new steel solutions

Fig. 1: Ambition
(from the March 2004 GOP document – European Steel Technology Platform - vision 2030)

Background

Steel is a key sector for Europe's economy and competitiveness. The EU-25 steel industry has a total annual production of approximately 184 million tonnes and generates more than €100 billion in annual turnover. It provides direct employment for around 350,000 European Union citizens, and several times this number are employed indirectly in its processing, in the user and in the recycling industries. In addition, steel is a worldwide commodity and world crude steel production should exceed 1 billion tonnes in 2004.

The steel industry is the source of millions of other jobs, in many industrial activities, as steel is a key material for many of them (road, rail, maritime and air Transportation, Construction, Energy, Chemical Industry, household appliances, etc.). For example, the European constructionsteel industry and the automotive sector represent more than 1,300,00 jobs (EU-15). It is vital for the future of Europe and its citizens to maintain an active and competitive steel industry.

Ambition and long-term vision of the steel sector

The ambition of the European steel industry is to maintain and reinforce a global leadership, which is both sustainable and competitive, given the strong development in other parts of the world, notably Asia.

Main challenges to sustainable global competitiveness

1. The growing impact of globalisation

The globalisation of steel customers results in increased market power, stricter product requirements, and standardisation.

Collaboration with its traditional customers is so deeply rooted that the European steel industry has taken the necessary measures to continue to satisfy their needs in terms of services, quality and prices wherever they are located. Thus, many of the European steel companies have established facilities in other regions of the world or developed strategic alliances worldwide.

However, the steel industry remains much less concentrated than its major supplier or client industries. Thus it is hard pressed to accelerate its concentration and rationalisation on a global scale, which would give it increased negotiating power with its main clients and suppliers, and would boost its capacity to serve its customers, worldwide with the same quality of products and services they already enjoy, locally.

Moreover, the trend towards further liberalisation of international steel trade, and thus increased international competition, has manifested itself clearly. The steel industry, faced with this growing impact of globalisation, and to respond to the pressures on its markets, requires that the rules of fair trade be applied and respected worldwide.

2. Matching steel supply and demand

Past experience shows that crises in the steel industry usually have their roots in imbalances caused by rapid fluctuations in demand combined with somewhat rigid supply structures and global overcapacity. Fluctuations in demand are related to business cycles but also have structural backgrounds. Economic cycles influence steel demand to a large extent, bearing in mind that steel is used for both consumer and capital goods. In terms of volume, global steel demand is expected to increase more in the future than it did in the past, owing to the increased growth of developing countries like China and India. Accordingly, the stronger market growth will take place outside mature steel markets like the EU, Japan and the US, and particularly in favour of Asian and Latin American countries. Indeed, the situation worldwide is very heterogeneous: in 2002, per capita steel consumption was 163 kg for China, 363 kg for western Europe and 562 kg for Japan. This presupposes a huge potential for growth in China and a potential change in the centre of gravity for steel from Europe to Asia. The main reason for this is the potential demand for steel products, particularly for infrastructure upgrading. In terms of quality, however, the industry expects an important potential for increased demand of high added value steel

products in highly developed countries (durable consumer products, capital goods) as a result of further product development. It is expected that European steel exports will focus increasingly on higher value-added products.

3. New EU environmental regulations

As far as environmental policies are concerned, various instruments are being introduced or considered, nationally and at EU level. For the steel industry, initiatives with a potentially significant impact include: integrated pollution prevention and control permits, air quality standards and the Clean Air For Europe programme, new product and waste legislation (such as the end-of-life vehicles directive) and the thematic strategies on natural resources and waste prevention and recycling, as well as new EU legislation on chemicals ("REACH").

Another new piece of EU legislation that is important for the EU steel industry is the greenhouse gas emissions trading scheme, which is being introduced in order to implement commitments made by EU Member States in the Kyoto Protocol. Across the whole EU economy the costs for implementing these commitments could be considerable. The risk that European steel producers could see a loss of business to non-EU competitors, which are not subject to any CO_2 emissions limitations, cannot be neglected.

4. EU enlargement

The steel companies in the new member states and in the candidate countries exhibit several characteristics, such as relatively low labour costs and a good level of technical qualification. However, production units would benefit from the implementation of modern production techniques, along with higher energy efficiency, better organisation, and quality and services. This would result in higher productivity levels, better product standards, and much needed environmental improvement.

To maintain its competitiveness, the European steel industry will have to meet the challenging combined targets of both environmental friendliness and profitable growth.

Strategic Objectives

The strategic objectives are developed around the concepts based on the principles of sustainable growth: profit, partners, planet and people.

Profit: ensuring profit through innovation and new technologies

- Innovation and new production technologies
- Strengthening intelligent manufacturing
- Innovative products
- Reducing time to market and implementing the supply chain concept

Partners: respond to society's needs with the partners of the steel sector

- The automotive sector
- The construction sector
- Other industrial priorities like the energy sector

Planet: develop breakthrough technologies to meet the environmental requirements

People: attract and secure human resources and skills

- Become a worldwide reference for health and safety at work
- Dynamically attract and secure human resources/skills…
- Optimisation of deployment of human resources is key to the successful implementation of the steel industry's competitive strategies
- External concerns (clever and safer steel products)

The R&D approach: towards 3 industrial programmes with large societal impacts

To face such important challenges and to meet the objectives of the Technology Platform of the Steel Sector, it was decided by the Group of personalities in March 2004 to launch a resolute and structured long term R&D action.

Five working groups corresponding to the 4 pillars of the sustainable development framework of the Platform were set up (Fig 2) and have developed 3 industrial programmes with large societal impacts each of them encompassing several R&D themes and research areas (Figs 3 and 4).

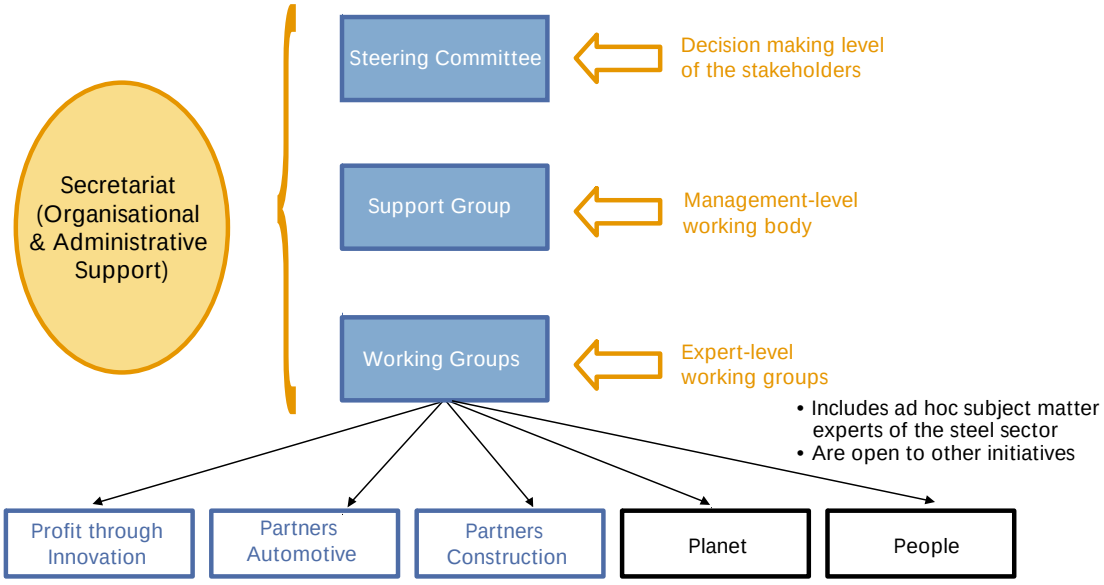


Fig. 2: The Steel Technology Platform

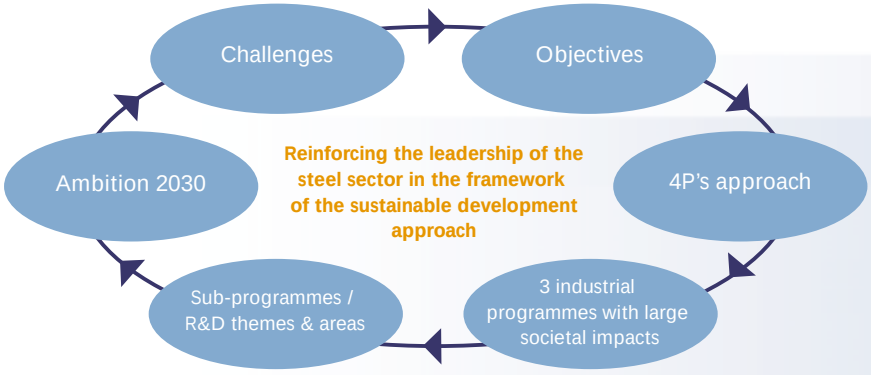


Fig. 3: The way to achieve our long term ambition through innovation and R&D

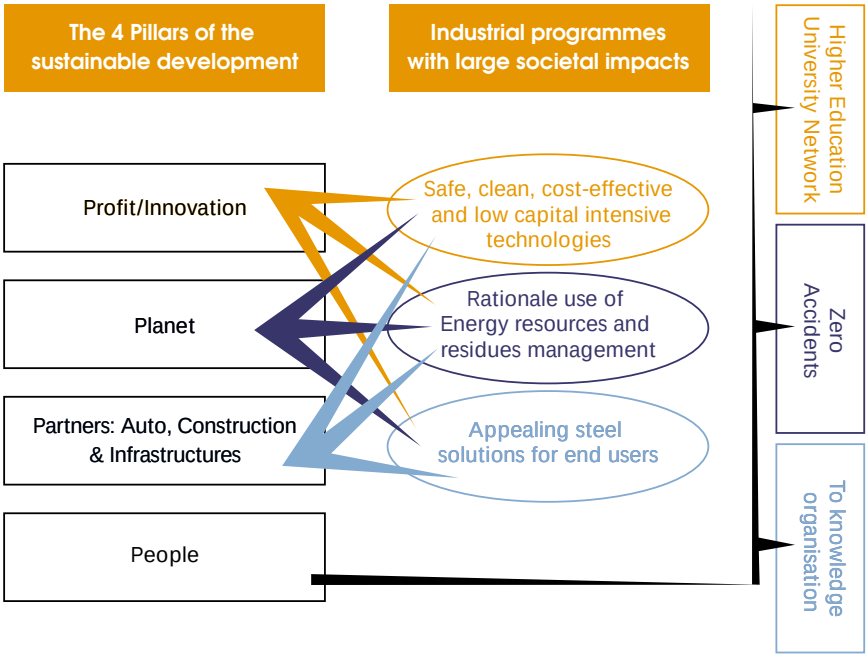


Fig. 4: Three industrial programmes with large societal impacts based on sustainable approach

The 3 industrial programmes with large societal impacts are the following:

- Safe, clean, cost-effective and low capital intensive technologies
- Rational use of energy resources and residues management
- Appealing steel solutions for end users

To which a transversal activity regarding human resources has been added:

- Attracting and securing qualified people to help meeting the steel sector's ambition

A. Safe, clean, cost-effective and low capital intensive technologies

1. Introduction

Strengthening its competitiveness is a major issue for the European Steel Sector.

To fulfil this global ambition in the long term, innovation is required in the production processes and manufacturing technologies in order to meet essential key challenges:

- To achieve highest standards of quality with highly productive, **safe** and efficient processes
- To renew continuously steel products on offer
- To ensure a short time to market
- To favour sustainable development **and clean operations** of the steel industry

The **promotion of cost-effective processing solutions** while preserving the natural resources constitutes a mandatory and permanent target for the steel sector.

Driven by the continuous quest for improved competitiveness, the steel industry, together with the downstream primary processing sector, has recently made large investment in the reduction of production costs and improvement of quality (advanced computer systems, extensive use of measurement sensors, artificial intelligence and modelling, etc.). Subsequently, significant benefits have been obtained with regard to the reliability and robustness of facilities, leading to higher production rates, greater yields and **better consistency of products delivered to the customers.**

The most recent industrial development is the so-called "**thin slab casting**". Here, a semi-finished product is cast with reduced thickness and sent directly to the hot rolling mill. However, **further innovation is required to achieve the development of much more integrated and flexible process**, to go further in reducing the successive steps of heating and cooling quite often associated with rolling/shaping operations or specific thermo-mechanical treatments. During many of these operations, **a large portion of the product surface is exposed to oxidising conditions** that results in the formation of scale, a **major cause of iron loss and a potential source of defects.**

Following the successful industrial development of thin slab casting, the research work led to the development of a more integrated process, the "**thin strip casting**" process which operates in a few industrial pilot plants for producing stainless steel. However, **many problems remain to be solved before thin strip casting can be applied to the mass production of high quality grades such as those used in automobile manufacturing and to other complex steels.** Furthermore, very costly developments must still be performed prior to the construction of industrial pilot plants and final implementation of new solutions for production lines.

Great flexibility is needed in the whole steel industry production chain to cope with the expanding range of products that will have to be supplied at low cost. Much more compact lines with very short response times and extended ranges of capability would be of benefit to the steel sector.

On the other hand, where conventional technologies are mature and robust enough to guarantee stable performance, **intelligent manufacturing technology should contribute to developing the more flexible processes.**

New production concepts, such as intelligent manufacturing processes, efficient production organisation, need to be designed and developed, based on breakthrough concepts to ensure the evolution of new processes, products and services.

To meet these challenges, ambitious R&D efforts must be launched during the coming decades. **Three major themes have been identified in this respect (Fig. 5):**

- Novel integrated routes for an "oxide free" and energy efficient processing
- Flexible and multifunction production chain
- Intelligent manufacturing

2. R&D themes and areas

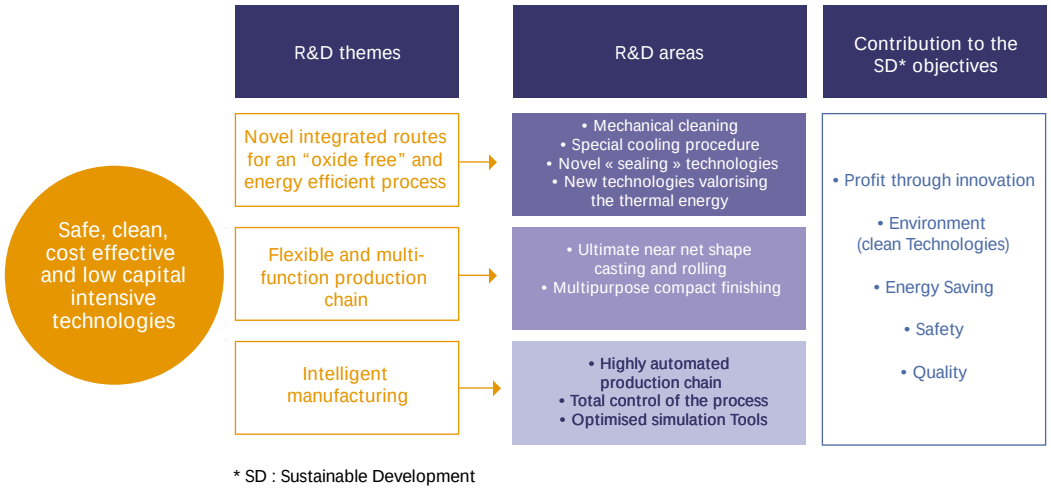


Fig. 5: Safe, clean, cost-effective and low capital intensive technologies: achieving the SD objectives through R&D

3. Socio-economic aspects

In the shorter term, enhanced control of product oxidation and minimisation of the scale thickness, combined with mechanical de-scaling methods would allow a dramatic reduction in demand on pickling units and of acid consumption.

Reducing scale formation in a first step and suppressing it in a final application would lead to very interesting results:

- The **iron yield** would be **drastically improved** with a potential saving of 3 to 3.5 kg of iron per tonne of product when the scale formation is avoided.
- Considering that the operating costs of a pickling unit amounts between €15 to 20 /tonne of treated product at least for carbon steel, **a potential saving of about €1 billion** could be expected for the European steel production of pickled products.
- **Protection of the environment** by avoiding the generation of pickling liquors and their subsequent treatments (associated economic gain).

However, these new developments offer a unique opportunity to **enhance markedly the quality** of the products and services offered to the customers in a very short time-to-market while reaching a high **processing efficiency and productivity.**

The beneficial impact of a **highly automated** and **totally controlled manufacturing** may be evaluated from the maintenance and quality cost aspects. The average maintenance costs can be estimated at about €45/tonne and the quality costs at about €40 /tonne of total production. Considering only the current production of 184 million tonnes of steel in Europe and anticipating an improvement, owing to the implementation of techniques outlined above, of 15 and 20% respectively, a total saving of **about €2.7 billion** could be achieved.

Another expected benefit resulting from the use of a totally controlled process and advanced simulation tools is the shortening of the development time, which represents a very important advantage. This would make the steel industry more flexible and permit faster reaction to customers' requests.

Owing to the use of computational materials science, it will also be possible to decrease the number of practical trials, which leads to lower the development costs.

4. Contributors

- Steel industry
- Equipment manufacturers
- Research institutes
- Universities

5. Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
Novel integrated oxide free routes	X	X	X
Flexible and multi-function production chain	X	X	X
Intelligent manufacturing	X	X	X

Fig. 6: Safe, clean, cost-effective and low capital intensive technologies: time frame[1]

1) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

B. Rational use of energy, resources and residues management

1. Introduction

Driven by mass production, quality control and cost reduction, **technical progress has led to large energy savings and to the systematic use of lean and clean processes.** As a result, energy consumption and CO_2 generation in the European steel industry have **decreased by 50% and 60%**, respectively, **over the past 40 years.** Furthermore, this does not result simply from recession in the sector, as the trends in specific values show. Behind these seemingly simple figures there exists a complex set of circumstances where change and modernisation have been carried out in various ways, including the movement from integrated mills to electric arc furnace mills for the manufacture of various types of long products.

This continuous trend has resulted in very significant progress. Since the beginning of the 1990s, blast furnace processes have approached their physical upper limits with respect to energy efficiency.

The EU integrated steel industry is based on intensive material and energy utilisation. It relies on overseas suppliers for a large part of its raw materials (e.g. iron ore and coking coal). Today, the three largest producers of iron ore worldwide account for 70% of all shipments.

Ferrous scrap is the principal raw material for electric arc steelmaking and, in order to obtain better quality scrap, initiatives are being taken to improve its collection and recycling. The latter is not only an environmental priority, but is also intrinsically profitable owing to **energy savings and economies in materials.**

In order to **extend** their **raw materials base**, and following the drive towards higher-value-added products, electric arc steel producers increasingly combine scrap with sponge iron, hot "briquetted" iron and/or cold or hot metal from the blast furnace.

A further group of raw materials, essential for the production of special steels, is that of ferroalloys. These materials are largely imported and constitute an important and increasing part of production costs. Long-term supplies must be secured through facilitating market access and increased competition between suppliers.

Electricity and natural gas supplies make up a significant part of steel production costs. Within the EU, electricity and natural gas prices exhibit marked differences, in part because of taxation but also because of different pricing structures and regulation of the supply industries. There may still be scope for improvement in that respect.

As far as environmental policies are concerned, various legal instruments are being introduced or considered, nationally and at EU level. For the steel industry, initiatives with a potentially significant impact include: integrated pollution prevention and control permits, air quality standards and the Clean Air for Europe programme, new product and waste legislation (such as the end-of-life vehicles directive) and the thematic strategies on natural resources and waste prevention and recycling, as well as new EU legislation on chemicals ("REACH").

Another new piece of EU legislation that is important for the EU steel industry is the **greenhouse gas emissions trading scheme** which is being introduced in order to implement commitments made by EU Member States in the Kyoto Protocol. Across the whole EU economy the costs for implementing these commitments could be considerable. The risk that European steel producers could see a loss of business to non-EU competitors which are not subject to any CO_2 emissions limitations cannot be neglected.

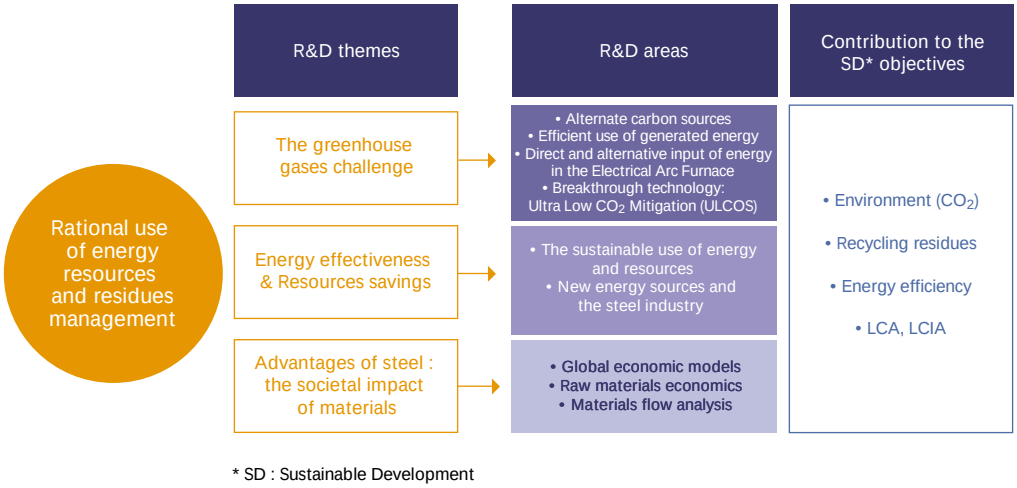
A **sustainable approach towards by-products and residues** is a must. Conservation of resources and waste prevention are now common goals which can generate opportunities and profit while minimising environmental nuisance.

To achieve its sustainability, the European steel industry will have to meet the challenging combined targets of environmental friendliness and profitable growth.

Three major themes have been identified (Fig. 7)

- The greenhouse gases challenge
- Energy effectiveness & resources savings
- Advantages of steel: the social impact of materials

2. R&D themes and areas



* SD : Sustainable Development

Fig. 7: Rational use of energy resources and residues management: achieving the SD objectives through R&D

3. Socio-economic aspects

This programme will contribute to the **global climate change challenge.** Transitory benefits are already expected in the medium term.

The ULCOS project should lead to a huge contribution to reducing **greenhouse gas emissions reductions:** it is aimed at achieving a **50% CO_2 reduction in the long term**. These carbon resources should be managed in an LCA way and deliver a completely new process.

Optimising energy effectiveness and conservation of natural resources (fuels) will also bring a significant contribution to the global warming issue.

An overall global modelling tool concerning the social impact of materials would bring a very valuable contribution to the two main long-term objectives of the steel sector:

- It would allow strengthening the competitive position of steel products, because current materials assessment tools / dematerialisation studies do not effectively take into account the main advantages of steel applications;
- It would improve the sustainability of steel production processes and steel solutions.

In addition, the aforementioned redefinition of the methodology for LCIA will contribute to an improvement in the social acceptance of the steelmaking industry and of the steel products as well as the position of the stakeholders towards such industry. Nowadays, there are many LCA and LCI methodologies, but not all of them are suitable to assess the real impact of steel primary and secondary products and by-products on the environment.

4. Contributors

- Steel research centres
- Suppliers of gas and energy
- Suppliers of iron ores and coals
- Equipment suppliers
- Steel industry
- IISI
- Non ferrous metals producers,
- Other energy intensive industries (cement, pulp & paper, chemicals, glass, etc.)
- Transportation and Community sectors
- Electricity producers,
- Nuclear plant designers,

- Public authorities
- Recycling industry
- Downstream users of by-products (Cement & construction sectors, road construction sector, non ferrous metals producers)
- Modelling laboratories for Eco-design and LCIA studies
- Modelling laboratories for global economic modelling (i.e. JRC/IPTS Seville)
- Specialised universities for dematerialization, for policy modelling
- Accrediting companies

5. Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
The greenhouse gases challenge (ULCOS)		X	X
Energy effectiveness & resources savings	X	X	X
Advantages of steel: the societal impact of materials	X	X	X

Fig. 8: Rational use of energy resources and residues management: time frame[2]

2) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

C. Appealing steel solutions for end users

1. Introduction

Partnerships developed by the steel industry cover a vast range of industrial sectors, such as raw materials, energy and equipment suppliers, transport sectors, manufacturers, customers and recyclers, standardisation bodies, national and international authorities and financial institutions.

Almost all European manufacturing sectors are largely based on the utilisation of steel in various forms. **In addition to the automotive and construction sectors, important application areas including marine technology, packaging and engineering** can all benefit from the development of new steel grades and manufacturing technologies. **Shipbuilding, offshore construction as well as oil and gas transport via pipelines** in Arctic or deep sea areas **need collaboration from suitable partners to develop and process the necessary steel grades.** The development of steel plate for use in long-distance, large diameter, sour –gas-resistant pipelines is being performed in partnership with pipe manufacturers, the oil and gas industry, and testing authorities. The work in this area is aimed at developing the production of **high-strength steels**, with high toughness and good weldability, suitable for use in low-temperature and high-pressure conditions.

Equipment manufacturers work in close co-operation with special steel producers. Stainless steel is very often the best value option over the total life of a project or product. **Corrosion resistance, cryogenic properties, easy cleaning ability and aesthetic appearance, strength-to-weight advantage, and fire and heat resistance are unique properties afforded by more than 60 different grades of stainless steel.**

The European steel sector constantly addresses the challenge of meeting customers' demands for a broad variety of ever more sophisticated high-performance materials. To meet these needs, direct partnerships between steel producers and their immediate customers are a strong requirement. Such collaborations are major features of new product development in the steel industry and an essential element in the promotion of steel use. In the framework of **this Strategic Research Agenda, the automotive and the construction sectors are regarded as the first priorities.**

Optimal processing of the steel products of the future is a challenge that must be addressed by improving existing production technologies or by developing new processes or technologies.

This industrial programme encompasses three R&D sub-programmes.

- Cost-effective processing of complex steel products for the future (Fig. 9)
- Automotive sector
- Construction and infrastructure sector

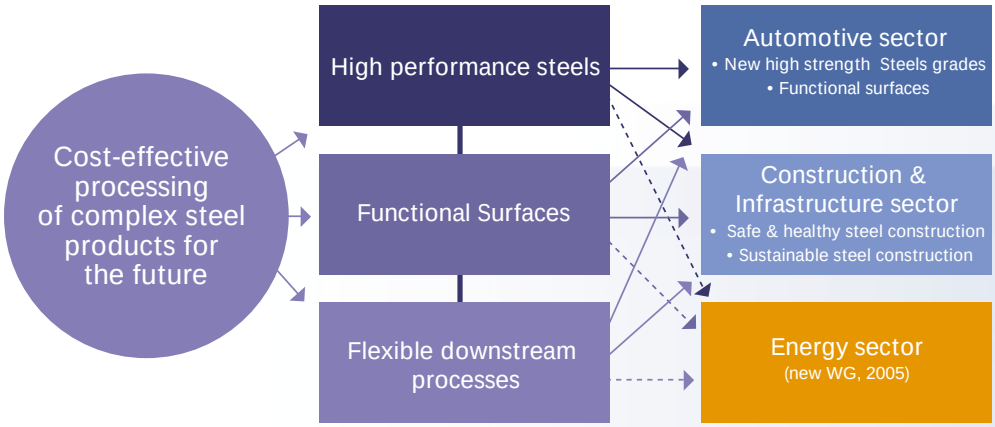


Fig. 9: Appealing steel solutions for end users: cost-effective processing of complex steel products to meet society's needs.

2. Sub-programme: cost-effective processing of complex steel products for the future

Background

Considering the demand of the market for a broader variety of ever more sophisticated high-performance materials, it is mandatory for the steel industry to develop appropriate manufacturing technologies fulfilling these requirements.

This challenge must be addressed through dramatic improvements inexisting technologies and by introducing novel processes. It implies the development of new transversal skills in different fields of interest for the market sectors (automotive industry, construction and structural applications, energy transport…).

Basically, different axes of developments have to be considered (Fig. 10):

- Breakthrough development of new families of high strength steels
- Processing for critical applications
- Manufacturing lightweight multi-materials
- Engineering of downstream processes

Socio-economic aspects

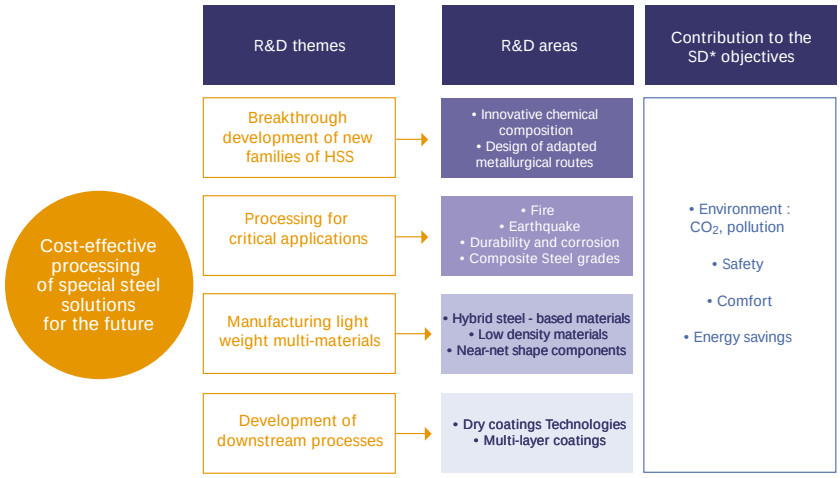
The development of special steel solutions in close partnership with the stakeholders will allow the renewal of the products on offer and will bring to the end users more efficient functionalities regarding several aspects:

- Health and Safety
- Prevention of disasters
- Comfort
- Energy savings
- Pollution avoidance
- Aesthetics
- Affordability

Contributors

- Steel producers
- Equipment manufacturers
- Steel research centres
- Research institutes
- Universities
- SMEs
- Automotive sector
- Construction sector
- Energy sector

R&D Themes and areas



* SD : Sustainable Development

Fig. 10: Appealing steel solutions for end users: achieving the SD objectives through R&D

Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
Break though development of new families of HSS	X	X	X
Processing for critical applications		X	X
Manufacturing light weight multimaterials		X	X
Development of downstream processes		X	X

Fig. 11: Appealing steel solutions for end users: achieving the SD objectives through R&D: time frame[3]

3. Sub-programme: automotive sector

Background

Mobility is a basic requirement for people in modern industrial and knowledge-based societies. In the EU freedom of movement for both persons and goods is also a prerequisite of the European integration. Value creation and economic prosperity have only been made possible by the spatial mobility of people and goods.

Energy consumption in the traffic and transport sector is dominated by road (73%) and air transport (12%). Worldwide, the transport sector is responsible for about 20% of greenhouse gas (GHG) emissions. The decrease in the specific fuel consumption of cars has been counterbalanced by trends towards bigger cars, high-power engines, the increasing number of cars and lower passenger occupancy of cars. In addition to new fuel technologies, new transport concepts and construction methods are required in order to be able to reduce greenhouse gas emissions despite increasing passenger and goods traffic.

Every year some tens of thousands of people are killed in Europe in traffic accidents and more than 1.7 million people are injured. Road deaths are still the prime cause of mortality among the young. New strategies for maintaining mobility and for mitigating the consequences of accidents will therefore be necessary in the future. In this context, safety of passengers and drivers is increasingly becoming an important priority, as recommended by the EU Commission (a decrease by a factor two).

3) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

Challenges of the Automotive Sector

The automotive industry is dedicated to respond to the mobility needs of individuals and those of society as a whole. The targets to be derived from these challenges are:

- **Environmental sustainability owing to energy consumption, CO_2 emissions, resource efficiency, dismantling and recycling behaviour,…**
- **Safety**
- **Reliability**
- **Cost effectiveness**
- **Comfort**

Those societal challenges will be addressed collectively by working in close co-operation with all relevant stakeholders.

Common challenges to Steel and Automotive Sectors

The steel industry and the automotive industry in the EU have to maintain their leadership in the world market. Simultaneous engineering and concurrent engineering are tools to meet the challenges of the world market for the targeted manufacturing of vehicles. The steel industry, with its competence in production processes and tailoring of material properties, and the automotive sector, with its vision for the future development of vehicles, are well prepared for an EU joint action to achieve a quantitative leap in the construction of the car of the future, which would not be attainable through the partnership of individual steel and automotive companies.

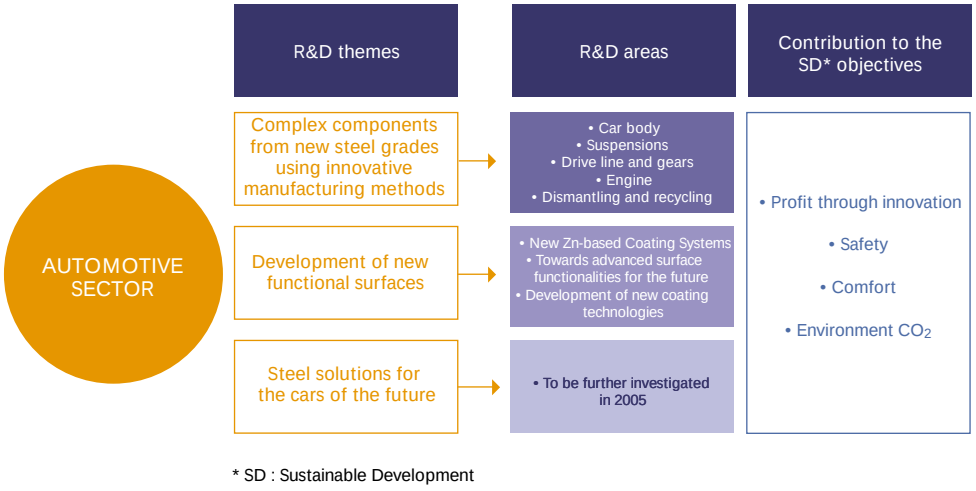
The automotive industry stimulates light construction innovations. It is essential for the steel industry to exploit its material expertise through material development and component design for use in mass production and, in co-operation with the automotive sector, to achieve further improvements or totally new solutions for vehicle concepts.

The targeted development of a production and manufacturing chain using new high performance steels for lightweight constructions including new forming and joining techniques and new coating processes will be a very ambitious RTD aim.

The **R&D themes** to be derived (Fig. 12) from these challenges are

- Complex components from new steel grades using innovative manufacturing methods
- Development of new functional surfaces
- Development of steel solutions for the cars of the future (to be further investigated in 2005)

R&D Themes and areas



* SD : Sustainable Development

Fig. 12: Appealing steel solutions for end users (automotive sector): achieving the SD objectives through R & D

Socio-economic aspects

Steel has an important transversal role to play in enabling the technologies necessary to achieve the challenges faced by the automotive industry. The automotive sector programme would facilitate the integrated approach – design, materials and processes – needed for further innovation and value addition in the automotive industry. Several aspects are covered:

- *Ecological aspects.* In an ecological comparison of the products, taking life cycles and the recycling ability of steel into account car bodies, made with high-tensile steels and tailored blanks with more than 20% saving in weight, can be far less detrimental to the environment than today's conventional bodies regarding the resource efficiency indicator "total material requirement" (TMR), and the "global warming potential" (GWP). Improving the drive train efficiency would bring a strong contribution to decrease CO_2 emissions.
- The implementation of innovative technologies has in the past contributed to reducing the impact of motor vehicles on the environment. To give a few examples: 100 of today's cars produce the same amount of emissions as an average car built in the 1970s, the amount of local pollutants has been reduced 20-fold in the last 20 years, while vehicle noise levels have been reduced by 90% since 1970. Such progress should be pursued in the coming decades.
- Steel is a material easy to recycle (370 million tonnes per year)
- Societal aspect of increasing the integrated safety for all road users.

Contributors

- Steel industry
- Steel research centres
- Automotive sector
- Suppliers (surface treatments and chemical industry)
- Suppliers to the automotive industry
- Universities

Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
Complex components from new steel grades using innovative manufacturing methods	X	X	
Development of new functional surfaces	X	X	X
Steel solutions for the cars of the future			X

Fig. 13: Appealing steel solutions for end users (automotive sector): Time Frame[4]

4) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

4. Sub-programme: construction and infrastructure sector

Background

The European construction industry has a total annual turnover of approximately €910 billion. It provides employment directly to 12 million workers accounting for 7% of total employment and 28% of industrial employment. It is estimated that 26 million workers depend in one way or another on the construction sector. The provision of buildings and infrastructure is recognised as being essential for economic development.

Steel is one of the most important construction materials, competing to some extent with other materials but also opening up completely new possibilities. Almost half of the steel produced is used for construction purposes. New applications for steel can be found through the development of new grades, building components and systems, composite structures, and construction technologies.

The quality of the built environment greatly influences the performance of individuals, organisations and the well-being of society in general.

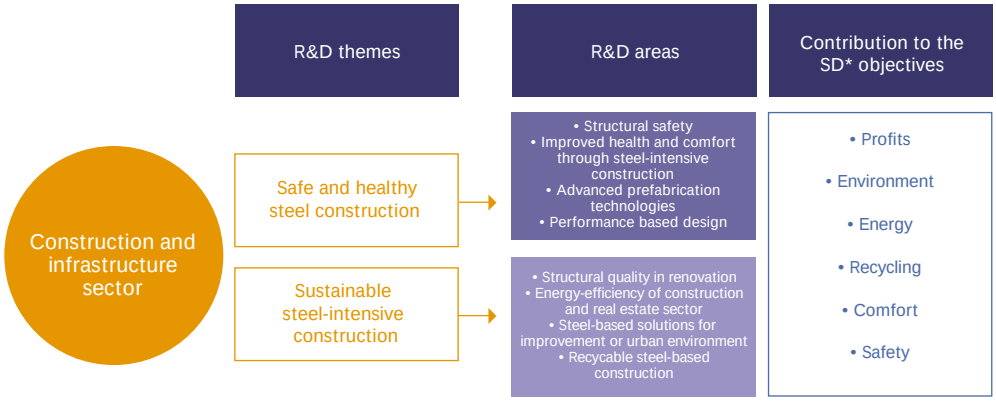
Nevertheless, the percentage level of funding from European and national programmes reflects neither the significance of construction as an economic activity nor the significance of the built environment as a fundamental contributor to quality of life.

The construction industry is highly fragmented and there is need for much closer cooperation between leading suppliers and major construction companies. A key aspect of the steel industry strategic plan over the next 30 years is therefore to work more closely with customers seeking technical and commercial alliances.

Different challenges should be addressed to meet Society's needs:

- Sustainable development
- Urbanisation
- Demographic changes
- Information and communication technology
- Safety and health
- Recycling and reuse of construction material
- Earthquakes and other accidental loadings
- New EU directives

R&D Themes and areas



* SD : Sustainable Development

Fig. 14: Appealing steel solutions for end users (Construction and infrastructure sector): achieving the objectives through R&D

Socio-economic aspects

Research themes are relevant in various fields including new buildings, renovation of old buildings, infrastructure, developing new materials, improving value chain, standardisation, and dissemination of results.

Contributors

- Steel industries
- Suppliers
- Architects, designers
- Construction sector
- Raw material producers
- Steel Research Centres
- Universities
- Public authorities and communities

Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
Safe and Healthy Steel Construction	X	X	X
Sustainable Steel-intensive Construction	X	X	X

Fig. 15: Appealing steel solutions (Construction & Infrastructure Sector): time frame[5]

5) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

D. Attracting and securing qualified people to help meeting the steel sector ambition

1. Introduction

From now to 2030, the world will undergo major changes, many of which will be brought about by the evolution of science and technology. The European steel industry will contribute its share with new processes and new products conceived to strengthen its competitiveness, answer evolving customer demands and to preserve the environment. Other changes will come from the increasing globalisation of the world economy and the world steel market, which will induce continuing rationalisation and concentration in the steel industry. Further changes will come from the evolution of society in a dynamic exchange with its own altered surroundings.

People, in the steel industry and in society in general, will be the drivers who make such changes happen, but they will also be those who will have to live through them, and may in some instances oppose them. This illustrates the **key role of people in the success of the change processes, as well as the need to prepare people to address constructively the changes ahead.**

During this period the European steel industry will also be faced with an unprecedented and demanding situation. The age structure in most steel producing companies is such that more than 20% of its workforce will leave it during the next ten years, and close to 30% during the following ten years. Needless to say, this huge transformation will not only be quantitative, but will also have a crucial qualitative dimension. It represents, at the same time, a daunting challenge and a welcome opportunity.

The opportunity comes from the possibility to use this substantial transformation in the composition of the industry's workforce as an instrument of change.

The challenges lie in making sure that the education system will keep the capacity to supply the steel industry with the number of people and with the competencies it needs, while developing the steel industry's capacity to attract relatively scarce highly skilled people in a competitive labor market.

However, both the **old and new parts of the workforce will need to espouse life long learning to cope with new technologies and processes, acquire new competencies**, and secure the positive evolution of their career. In this context, new approaches should be devised to ensure that appropriate training is available and that its quality is such that it maintains the excellence of the workforce. In addition, **life-long learning** should be part of the proactive process of developing positive attitudes towards change. On the other hand, in a world where people would anticipate that their career will cover various functions, potentially exerted in several companies from different sectors, the quality and flexibility of the life-long learning schemes offered by the steel industry might become a differentiating element in the competition for contracting highly skilled people.

The continuously improving record of the steel industry in the field of **health and safety** should also contribute to the attractiveness of the sector. **The high priority given by the industry to its "zero accident" objective and the elimination of fatalities is a guarantee of further progress**. Further, as reaching these objectives implies significant behavioral changes, improving health and safety at work also comes to be a potent agent of change management.

All these trends converge on and represent different facets of human resources management. During the last thirty years, human resources management has become the nexus of steel companies' competitive strategies, securing the coherence of their implementation and, more generally, seeking the optimisation of one of their key assets. Indeed, human resources are the holders of a company's core competencies, which are one of the main sources of its competitive advantages.

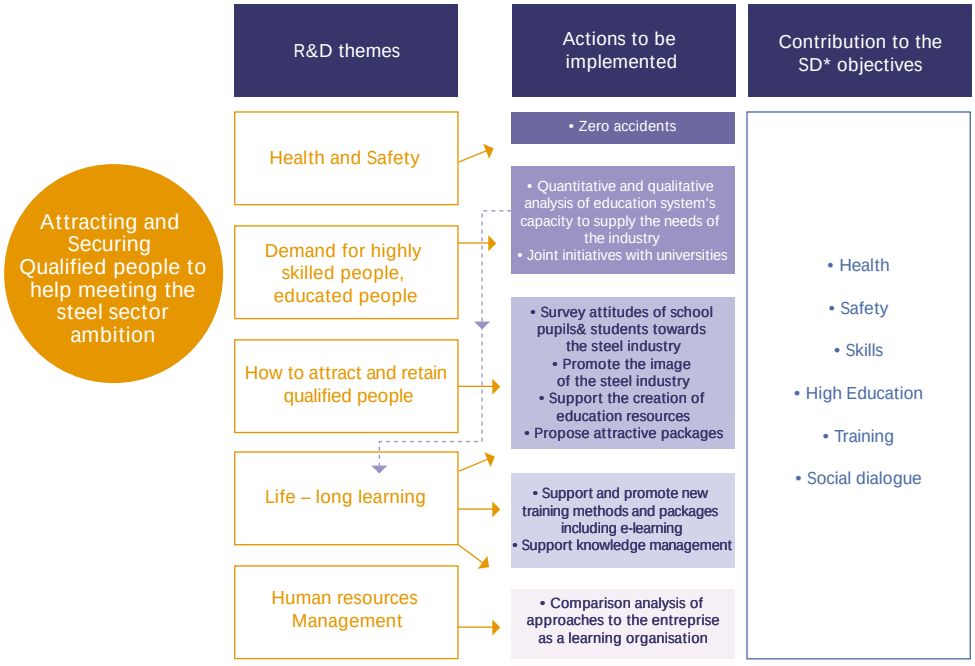
Thus, it comes as no surprise that most steel companies, in a way or another, have been pursuing new organisational configurations tending to transform enterprises into a "knowledge organisations".

Human resources management also plays a key role in change management. In this capacity, it is instrumental in developing an industrial relations

system supportive of innovation, improvement of job quality, and competitiveness, thanks to a constructive social dialogue.

In the end, an effective human resources management is essential to the successful implementation of the steel sector's long term vision regarding profit, partners, the planet, and people.

2. Research themes and implementation of actions



* SD : Sustainable Development

Fig. 16: Attracting and securing qualified people to help meeting the steel sector ambition

3. Socio-economic aspects

- Ensuring safe work conditions;
- Exchange of practices in view of the "zero accident" target;
- Close relationships with a network of top level universities taking initiatives to attract the best students in the steel industry; disseminate a steel culture;
- Support and development of training at European level; support EUROMASTER initiative.

4. Contributors

- Steel sector
- The TIME network (European universities)
- Steel research centres
- Stakeholders in the Steel Technology Platform

5. Time frame

R & D themes \ Implementation	Short term < 2010	Medium term 2010 - 2020	Long term > 2020
Health and Safety	X	X	X
Demand for highly skilled educated people	X	X	X
How to attract and retain qualified people	X	X	X
Life – long learning	X	X	X
Human Resources Management	X	X	X

Fig. 17: Attracting and securing qualified people to help meeting the steel sector ambition: time frame[6]

6) Small, medium and long term means the term for the achievement of the technological advances in the relevant areas. Several crosses for one R&D theme mean several achievements at different time periods.

E. Implementation of the S.R.A.

This document is the first version of the **Strategic Research Agenda of the Steel Technology Platform**. It offers a global vision of the innovation and R&D initiatives that will lead to the achievement of the objectives identified to retain a sustainable leadership of the steel sector in the coming decades.

Three large and complementary R&D industrial programmes with large societal impacts are proposed. They aim at playing a major role in **boosting competitiveness, economic growth and the related impact on employment in Europe.**

Protecting the environment (greenhouse gas emissions and more particularly CO_2 emissions) and increasing **energy efficiency** both constitute major transversal issues in the universe of the RTD programmes that are proposed. **Security and safety** represent the third very important objective to be addressed, not only in the relevant industries but also in customers' every day lives as users of steel solutions (cars, buildings, energy production and transport, etc.) by developing new intelligent **and safer steel solutions.**

A major transversal theme regarding the **human resources** aspects has also been taken into consideration (attracting and securing qualified **people** to help meeting the steel sector ambition).

Concerning the environment, the European Steel Industry has already measured up to the challenge of lowering CO_2 emissions by creating a consortium of industries and of research organisation that has taken up the mission of developing breakthrough processes, the **ULCOS** (**U**ltra **L**ow **CO$_2$** **S**teelmaking) consortium.

This **large-scale consortium** (48 European participants) which was set up in the spirit of a joint initiative in 2004 plans to develop a breakthrough steelmaking process that has the potential of meeting the target of drastically reducing GHG emissions beyond 2020. The full development of the process, from basic concept to fully-fledged industrial implementation would cover both medium- and long- terms and consist of a number of consecutive projects.

Breakthrough technologies must be developed to achieve the technological advances of the three large industrial programmes of the platform. A **critical mass** (both skills and financial) is necessary to meet the challenges of the long term ambition.

The Steel Technology Platform will further integrate and **broaden the scope of the European RTD partnership** built in the frame of the ECSC Treaty (more than 8,300 researchers). Indeed it will constitute large partnerships involving the whole European steel industry, its suppliers and customers (automotive industry and construction sector and the energy sector in a second stage), SMEs, private and public research, public authorities and representatives of trade unions.

As regards implementation of the SRA, sources of both **private and public funding** will be necessary to meet the ambitious objectives of the European steel sector.

It is envisaged that all necessary resources of the existing instruments will be combined at different levels:

- EU programmes (Framework programmes, RFCS, Eureka, etc.)
- National programmes and even
- Regional programmes.

The Joint Technology Initiatives together with loans from the European investment bank will enable the development of emergent breakthrough technologies and their implementation at large industrial scale, in the coming decades.

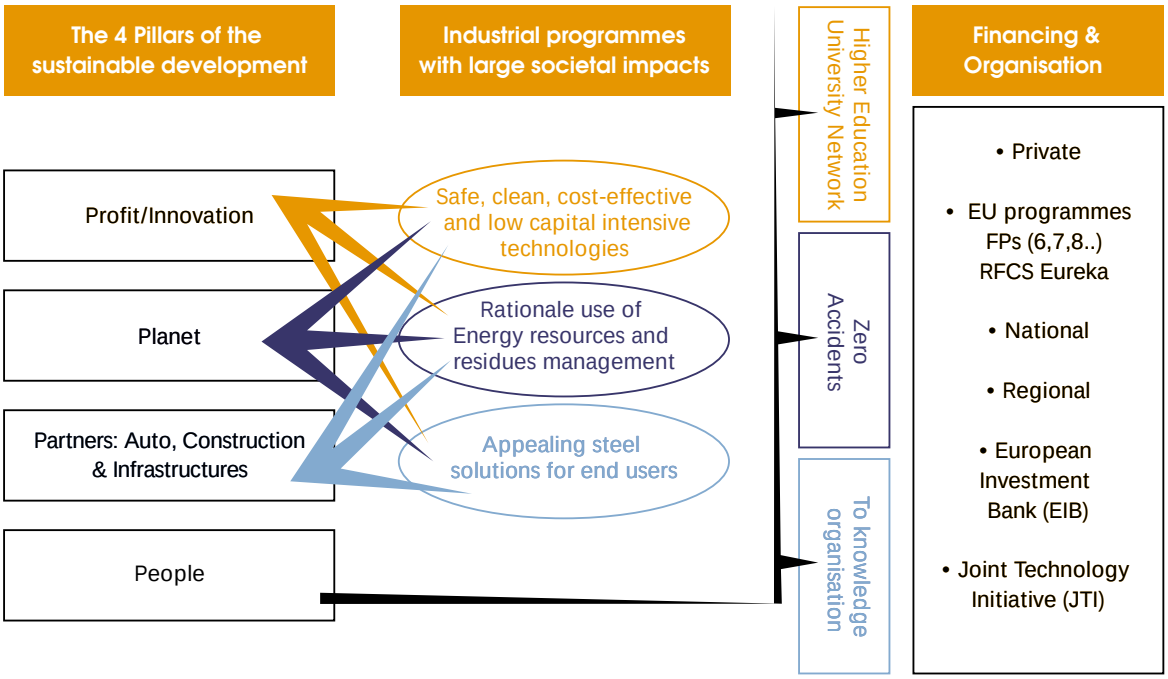


Fig. 18: Implementation of the S.R.A.: need for a critical mass of means

European Commission

The Strategic Research Agenda of the Steel Technology Platform – Executive summary

2005 – 32 pp. – 21.0 x 29.7 cm

ISBN 92-894-8966-9

15

KI-65-05-278-EN-C

This first version of the Strategic Research Agenda of the European steel technology platform (Vision 2030) is the outcome of all stakeholders consensus and expresses the ambition and the long term vision of the whole steel sector. It addresses the main RTD themes and research areas of the sector on short, mid and long term and presents a time frame for the whole sector, including the existing running projects and the forecast actions. It includes a deployment strategy, mechanisms to mobilise private and public funding as well as a communication strategy.

This document has been officially endorsed by the steering committee of the steel technology platform in December 2004.

This is the executive summary, the full text has been published in a separate document.

Printed by OIB

ISBN 92-894-8966-9

9 789289 489669