SENAI – ACTIONS FOR SUSTAINABLE DEVELOPMENT

INDUSTRY MEETING FOR SUSTAINABILITY

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SENAI

National Service for Industrial Trainning
Brazil

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SUMMARY

CNI PRESENTATION

The diversity of the national industry and the significant availability of natural resources reveal excellent opportunities for the sustainable development of Brazil, combining economic growth, social inclusion and environmental conservation. The materialization of concerns related to sustainability in the strategic agenda of enterprises and governments is a reality. Apart from isolated cases of success, the consequences of this attitude are felt in entire sectors of the economy. Further advances are still needed, but the path has already been identified and going back is impossible.

After coordinating an unprecedented critical thinking process on sustainability with 16 industry associations and the Industry System's organizations, the National Industry Confederation (CNI) delivers to the Brazilian society a wide range of information on progress, challenges and opportunities yet to come. The results presented here may not portray the significance of the discussion process experienced by the industry in preparing these documents. Developments on the process will be beyond the Rio +20 Conference, and are definitely incorporated on the daily lives of companies.

The subject of sustainability is inserted differently in each of the industrial sectors. However, some elements are common to all. The continuous pursuit for efficiency in use of resources and the need to increase industrial competitiveness are on the agenda of all the sectors. Encouraging innovation and scientific and technological development is strategic on the transition to more sustainable patterns of production.

Strategies to intensify actions coordinated internally in the industrial sectors and with governments and civil society organizations are no less important. The dissemination of sustainable practices by means of the supply chain and incentives for companies to undertake the role of integrated management of the territories are powerful tools.

The sectorial volumes developed by industry associations and by the Industry System's organizations are valuable contributions to addressing subjects such as sustainability and competitiveness of domestic industry. One of the most representative results of this process will certainly be the strengthening of structured programs of

action with a focus on promoting sustainability in the production. These initiatives will act as raw materials so that the industries involved and the Industry System are able to systematically publish documents presenting the national industry's developments towards the goals of sustainable production.

The documents presented here are intended to be a valuable contribution to enhance the debate on sustainability. Each of the sectorial associations and the organizations that are part of the Industry System is congratulated for their efforts.

Robson Braga de Andrade
National Confederation of Industry – Brazil

SENAI PRESENTATION

The creation of the National Industrial Apprenticeship – SENAI previewed the need for productive social inclusion as one of the pillars for sustainable development of our country. During our 70 years of history, more than 52 million brazilians have benefited from professional courses, promoting decent inclusion in the labor market. SENAI is a force of action in Brazilian society that promotes sustainable development as well as increased competitiveness of the industry.

According to the Competitiveness Report of the World Economic Forum, Brazil is the most innovative country in Latin America. Aligned with this purpose, SENAI over its existence has promoted actions to encourage innovation, technological development and environmental projects, rational use of natural resources as energy and water, training of skilled labor and social inclusion. We understand that these aspects are important for poverty eradication and sustainable development of the country.

SENAI has the opportunity to present at Rio+20 its efforts as well as to strengthen its commitment to sustainable and competitive development of the brazilian industry.

Rafael Esmeraldo Lucchesi Ramacciotti
Executive Director of SENAI – National Department

1 INTRODUCTION

Created on January 22, 1942, by Decree-Law No. 4048, under the presidency of Getúlio Vargas, SENAI has emerged to meet an urgent need: the formation of qualified professionals for the incipient basic industry at that time. On that occasion, it was already clear that without professional education there would be no industrial development for the country.

Euvaldo Lodi, at the time President of the National Confederation of Industry (CNI), and Roberto Simonsen, ahead of the Industries Federation of São Paulo, were inspired by the successful experience of the Rail Center of Teaching and Professional Selection and have devised a similar solution to the Brazilian industrial park. In this way, the business community took not only the costs, but also the responsibility for the organization and direction of a body of its own, subject to CNI and Industries Federations in States.

At the end of the 1950s, when President Juscelino Kubitschek accelerated the industrialization process, SENAI was present in nearly all of the national territory and began to seek abroad, training for its technicians. Soon, it became a reference for innovation and quality in vocational training area, serving as a model for the establishment of similar institutions in Venezuela, Chile, Argentina and Peru.

In the 1960s, SENAI invested in systematic courses of training, intensified the training within firms and sought partnerships with the Ministries of Education and Labor and the National Housing Bank. In the economic crisis of the 1980s, SENAI realized the substantial transformation movement of the economy and decided to invest in technology and the development of its staff. This investment has enabled the expansion of assistance to companies, increased technology, set up educational centers for research and technological development.

With the technical and financial support of institutions from Germany, Canada, Japan, France, Italy and United States, SENAI reached the beginning of the 1990s ready to assist the Brazilian industry in the field of process, products and management technology.

The National Service for Industrial Apprenticeship – SENAI is represented by the National Department and the Regional Departments, located in 27 states and the Federal District, consisting of their respective operating units.

Today, the average of 15000 students of the first years turned into about 2.3 million annual enrollments, totaling approximately 55.04 million enrollments from 1942 until 2011. The first schools gave rise to a network of 797 operational units[1],between fixed and mobile, distributed throughout the country, in which were offered more than 2,900 vocational training courses, in addition to the qualification and improvement programs carried out to meet the specific needs of companies and individuals.

FROM 1942 TO 2011 58,177,577 PEOPLE WERE TRAINED

As a result of all this investment, more than 90% of employers prefer to hire workers trained by SENAI. With courses in tune with the reality of the production system, quality didactic materials, qualified teachers and strong commitment to innovation, SENAI offers a wide range of solutions in professional education for the industry.

SENAI also puts its knowledge, latest equipment and ability to articulate at the disposal of the Brazilian industry in the form of services provided. Between consulting, laboratory services and technological information, the entity offered 127,174 services in 2011.

The commitments established at the United Nations Conference on Sustainable Development (Eco-92) and the United Nations Conference on Environment and Development (Rio+10), held respectively in 1992, in Rio de Janeiro, and in 2002, in Johannesburg, undoubtedly have generated significant impacts on the Brazilian industry, resulting in a paradigm shift in the way of production, which now must be based on the efficient use of natural resources. The social and environmental responsibility today is a reality in which the enterprise must assume its vital role in economic growth and the life improvement of population. Within this perspective, SENAI relies in the generation and dissemination of knowledge the as the strategic tool for the construction of sustainable development, with the mission to promote vocational and technological education, innovation and transfer of industrial technologies, contributing to the sustainability of the Brazilian industry.

In this reality, the objective of this paper is to disclose the actions of SENAI throughout the country, aligned to the principles and guidelines established for sustainable development, highlighting the actions in the areas of education, social responsibility, environment, innovation and technology. The last chapter is dedicated to identifying key trends, challenges and opportunities that will impact the actions of SENAI in the coming years.

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1 Fixed units – operational units based in fixed facilities, in which are offered courses/ programs in different modalities and/or developed technical and technological services.

Mobile units – Units of Professional Education that lead SENAI assistance to regions far from production centers in the country. It consists of trucks, vehicles and boats, all equipped to offer training programs and actions directed to employability and income generation in more distant locations.

2 ECONOMIC AND SOCIO-ENVIRONMENTAL CHARACTERIZATION

Brazil in the last decade, has been growing in the international scenario, assuming a leadership role in Latin America. The current Brazilian economic growth model is associated with the socio-environmental development, with policies aimed at poverty eradication and country's scientific and technological development, while maintaining a policy of environmental conservation.

In the last two decades, Brazil has implemented a large number of structural reforms, such as foreign trade liberalization, privatization, the end of price controls, and a more liberal behavior towards the foreign investment, creating a more stable economic environment, favoring a complex and diversified industrial park.

According to IBGE Census of 2010, is worth noting increase in schooling and the reduction of illiteracy rate, infant mortality and social inequality in Brazil. The income gap between the richest and poorest has fallen in all 27 states of the Federation, with an average reduction of 11.5%.

Between the last two Censuses (2000-2010), the percentage of people who were not attending school in the quota of 15 to 17 years of age went from 22.3% to 16.7% (Table 1). This contributed to the increase of students in professionalizing courses perceived by increased numbers of enrollments in courses offered by SENAI.

TABLE 1. PERCENTAGE OF PEOPLE WHO WERE NOT ATTENDING SCHOOL IN POPULATION OF 15 TO 17 YEARS OF AGE, ACCORDING TO THE MAJOR REGIONS – 2000/2010		
Major regions	Percentage of people who were not attending school in population of 15 to 17 years of age (%)	
	2000	2010
Brazil	**22.3**	**16.7**
North	26.9	18.7
Northeast	23.0	17.2
Southeast	19.8	15.0
South	24.8	18.6
Midwest	22.5	16.9

Source: IBGE, 2010b.

Another important factor for the growth of a country is the promotion of innovation and technological development. According to the Survey of Innovation and Technology 2008 (Pintec), carried out by IBGE, in Brazil there was an increase in the number of innovative industrial enterprises with respect to the year 2005, from 30,377 to 38,299 and innovation rate grew from 33.4% to 38.1%, with a percentage increase of industry revenues invested in Research and Development R&D – (0.57% to 0.62%). Furthermore, the number of companies that have used government instruments to support innovation grew from 5,818 to 8,730, as well as the number of businesses using the Internet (17,249 to 26,349) and institutions of science and technology (3,634 to 9,707) as a source of information. There is a Brazilian public policy for science, technology and innovation that has brought progress with regard to the evolution of levels of investment in science, technology and innovation – S, T & I and the improvement of incentive and support mechanisms for the activities in the area, highlighting the expansion and consolidation of the National System of Science, Technology and Innovation; the promotion of technological innovation in enterprises and of research, development and innovation in strategic areas, including a focus on social development.

TABLE 2. SURVEY DATA OF INNOVATION AND TECHNOLOGY 2008 (PINTEC) ON INNOVATIVE INDUSTRIAL COMPANIES FOR THE YEAR 2005		
	2005	2008
Innovative industrial companies	30,377	38,299
Rate of innovation	33.4%	38.1%
Percent of industry revenues invested in R&D	0.57%	0.62%
Number of companies that used government instruments to support innovation	5,818	8,730
Number of companies using the Internet as a source of information	17,249	26,349
Number of companies using the institutions of science and technology as a source of information	3,634	9.707

Source: IBGE, 2010a.

The last IBGE study about investment in environmental control of industries in Brazil, published in 2007, reflects the concern of the industry to attend environmental legislation. The study contrasted the available data from 1997 and 2002, demonstrating that the share of the total amount invested in environmental control, in relation to the total value of procurement, in-house production and improvements of industrial machinery and equipment, increased from 13.9% in 1997 to 18.7% in 2002, leveraged by the processing industry, which increases by 92.6% the value of investments in environmental control (Table 3).

According to the study in 1997, 3,823 companies made investments in environmental control. This number rose to 6,691 companies in 2002, representing an increase of 75.0%, well above the growing of companies number in the same period (26.4%).

TABLE 3. NUMBER OF INDUSTRIAL COMPANIES AND ACQUISITIONS, OWN PRODUCTION AND IMPROVEMENTS IN MACHINERY AND INDUSTRIAL EQUIPMENT MADE BY THE COMPANIES THAT INVESTED IN ENVIRONMENTAL CONTROL, ACCORDING TO CNAE SECTION – BRAZIL – 1997 AND 2002

CNAE Section*	Number of companies	Acquisitions, own production and improvements in machinery and equipment within the group of companies that invested in environmental control		
		Investment in machinery and industrial equipment (A)	Investment in machinery and equipment for environmental control (B)	% (B/A)
		1,000 R$		
1997				
Total	106,764	10,501,904	1,458.330	13.9
Extractive industry	2,401	374,951	106,259	28.3
Processing industry	104,363	10,126,953	1,352,071	13.3
2002				
Total	135,003	22,106,075	4,128,993	18.7
Extractive industry	2,959	1,105,180	119,461	10.8
Processing industry	132,044	21,000,895	4,009,532	19.1

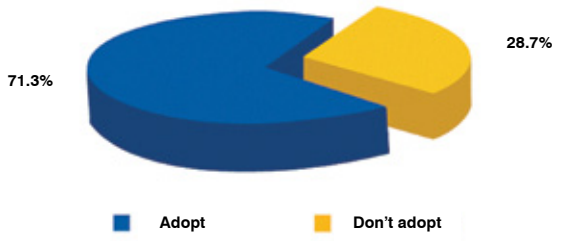
*CNAE: National classification of economic activities. Source: IBGE, 2007.

Regarding the Environmental Management System, in 2011 the number of 5,000 companies acting in Brazil with certification in accordance with ISO 14001[2] was achieved, an important tool for businesses that desire a production process in line with sustainable development.

2 Standard originally designed by the International Organization for Standardization – ISO, which aims to specify the requirements for an environmental management system, allowing an organization to formulate a policy and objectives that take into account the legal requirements and information concerning significant environmental impacts.

In survey conducted by CNI in 2010, about environmental management in industries, among the companies surveyed, 71.3% declared to adopt managerial procedures associated with environmental management (Figure 1). Of the companies that adopt managerial procedures related to environmental management, 87.5% declared to have an environmental management system (EMS). In other words, 62.4% of Brazilian industries have systematic procedures of environmental management.

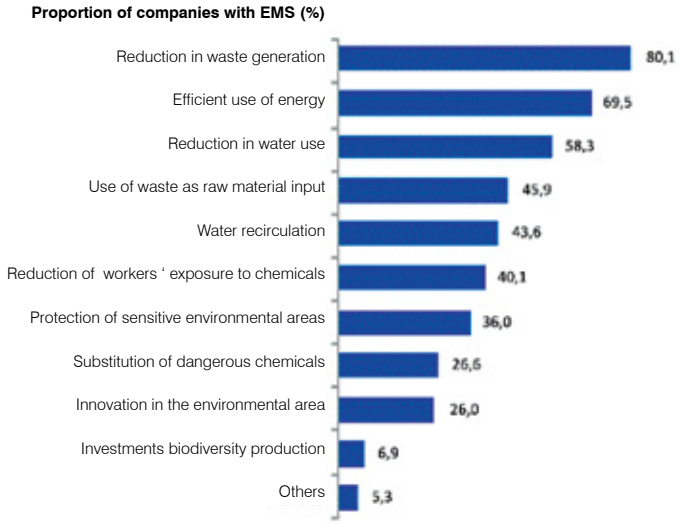
FIGURE 1. ADOPTION OF MANAGERIAL PROCEDURE ASSOCIATED WITH ENVIRONMENTAL MANAGEMENT



Source: CNI, 2010.

The research also demonstrated the concern of companies in improving their efficiency in industrial processes, through the rational use of raw materials and inputs. Among the programs adopted in the Environmental Management System (EMS) it is included the reduction in waste generation (80.1% of companies with EMS), the efficient use of energy (69.5%), the reduction in water use (58.3%), the use of waste as raw material or input (45.9%) and water recirculation (43.6%). Also highlights the programs undertaken to reduce workers' exposure to chemicals (40.1%) and for securing sensitive environmental areas (springs, rivers banks, mangroves etc.) with 36% (Figure 2).

FIGURE 2. MAIN PROGRAMS OF ENVIRONMENTAL MANAGEMENT SYSTEM



Source: CNI, 2010.

2.1 Economic characterization

2.1.1 Job generation/training of labor/ filling vacancies/vocational training

SENAI has as mission to promote vocational and technological education, innovation and the transfer of industrial technologies, helping to raise the competitiveness of Brazilian industry. Interacting with 31 areas[3] of industry, SENAI conducts and supports various programs of development of the productive sector in the different segments.

Two important factors to the socioeconomic development of a nation are the population level of schooling and the absorption capacity of the labor market. These factors are directly connected to each other, i.e. the level of employability increases before the growth of the schooling degree achieved, and, on the other hand, productivity is increased in accordance with the increased knowledge of their employees. One relevant aspect of Brazilian education is the importance of vocational training, one that prepares technically the workforce and specializes the manpower, precisely because one of the major social problems arising is unemployment.

The survey "Generation of industrial employment in the capitals and interior of Brazil", held in 2005 by SENAI, in order to present a general picture on the generation of industrial jobs in the country, showed the importance of vocational training of young workers to their entry on favorable conditions in the labor market, pointing to the potential role of SENAI. In addition, data on education shows that there was a decrease of manufacturing jobs for workers with only the fourth grade complete and, on the other hand, there was job creation to workers with higher levels of schooling, with the increase in the level of education of Brazilian workers in recent years. In this scenario, both in terms of supply and demand, there is a growing number of more educated workers in the labor market.

SENAI follows the socioeconomic transformations that lead to profound changes in the labor market. These challenges relate to technological advances and new expectations of companies, which face highly competitive global markets. With this perspective, SENAI courses seek to meet the needs of industry and society in order to place the student in the labor market, forming people for professional practice in accordance with the required profile.

ONLY IN 2011 ABOUT 2,533,778 ENROLLMENTS WERE HELD IN VOCATIONAL COURSES

3 Communication; informatics; buildings; infrastructure works; specialized services; food and beverages; cellulose and paper; leather and footwear; electronics; medical equipment, hospital; optical and precision; tobacco; graphics and publishing; jewelry and gemology; wood and furniture; metal mechanics; nonmetallic minerals; other transport equipment; oil, gas and fuels; plastics and rubber; miscellaneous products; chemical, petrochemical and pharmaceutical; textiles and clothing; motor vehicles; pipeline transportation; rail transport; extraction of metallic minerals; non-metallic minerals extraction; extracting oil, coal and natural gas; forestry production; water and sewage; electricity and gas.

The main impacts produced by SENAI training can be viewed through the Graduates Follow-up Program, that gathers student information since 1999, in three moments:

1º) at the end of the course

2º) six months after completion of the course; and

3º) in the companies where graduates work, to realize what is the supervisors evaluation.

In the period of 2008/2010, 52.8 thousand of senior students and 22.5 thousand of graduates in learning, technical and qualification modalities were evaluated. This sample was calculated to ensure the representativeness of the whole SENAI students. Even in this period, marked by the slowdown in the economy, especially in industry, the employment rate of SENAI graduates remained high (Table 4).

TABLE 4. EMPLOYABILITY RATE OF GRADUATES FROM SENAI

Modality	Employability rate
Learning	48%
Qualification	48%
Technical	74%

Source: Graduates Follow-up Program. Evaluation of the triennium 2008/2010.

2.1.2 Corporate Social Responsibility

Corporate Social Responsibility is a set of initiatives through which companies seek to voluntarily integrate ethical, social and environmental considerations to their interactions with customers, employees, suppliers, competitors, shareholders, governments and communities, aiming to develop sustainable business from an economic, social and environmental standpoint.

Reinforcing this trend and develop a culture of social responsibility is one of the key initiatives for economic growth and people's lives improvement.

In the period 2002 to 2010, SENAI, through its social responsibility actions benefited directly, in all States, 1,341,963 people through courses, programs and projects geared to the low-income and under social risk population.

Held in conjunction with a broad range of partners, including municipalities, governmental and non-governmental bodies, ministries and industries, these actions mobilized in the period, 6,716 projects carried out jointly with about 5 thousand partners.

SENAI knows the transformative role of education in lives of people under social risk. Whether through partnerships or own programs, SENAI directs part of its efforts to include in the productive society citizens who are jettisoned for various reasons.

2.2 Socio-environmental characterization

2.2.1 Innovation and industrial technology

Technological innovation is the new challenge of SENAI, i.e. insert the institution as a partner of the Brazilian industry in the development of innovative products and processes, forming workers who bring innovation to their daily lives. However, more than 50% of the investment in technological innovation made by Brazilian companies is intended for the purchase of machinery and equipment, essential, but not enough to put the country in a competitive position on the world market.

In this context, SENAI Innovation Program, which aims to encourage partnerships between the operational units of SENAI and industrial companies, seeks to integrate the significant capacity of its professional staff and services network of technology centers to the needs of Brazilian industry, and promote research, development and innovation (R, D & I) in regional departments.

These partnerships have led SENAI units to open up new business, with opportunities to participate in royalties on the products offered by partner companies on the market, allowing for continuous technological upgrading of schools. Added to this, we highlight one of the goals of SENAI, which is the provision of technological and technical services, offering support to the industrial sector.

With a structure that encompasses a network with 200 laboratories accredited by the most important organs, such as the Ministry of Agriculture, Livestock and Food Supply – MAPA, the National Institute of Metrology, Standardization and Industrial Quality – Inmetro and the National Sanitary Surveillance Agency – Anvisa, highly qualified professionals, mobile units and equipment of the first generation, SENAI offers laboratory services, technical and technological assistance, information, technological development, processes certification and products for companies of all sizes.

THE 139,149 TECHNOLOGICAL AND TECHNICAL SERVICES PROVIDED BY SENAI IN 2011 CONSOLIDATE ITS POSITION, CONTRIBUTING TO THE GROWTH OF THE INDUSTRY AND TO THE DEVELOPMENT OF THE COUNTRY

Innovation and technological development are the conditions for a competitive and sustainable economy, with higher productivity, better jobs and salaries. In this scenario, one of the challenges is to make innovation and technological development priority themes for Brazilian companies.

2.2.2 Vocational Education

In several regions of the country, are created, over the years, new industrial development poles, resulting from combined factors, among which stand out municipal incentives, proximity to natural resources, tax exemption, lower manufacturing costs, proximity to the market, proper roads, among others. Similarly, movements of exhaustion or redefinition of traditional industrial agglomerations profile are observed. This is generating significant changes in employment and demand for professional training and technological services.

The survey "Professional Education Reasons: The Demand Standpoint", performed by Getúlio Vargas Foundation (FGV) in partnership with SENAI, released in February 2012, revealed that the number of Brazilians who attended vocational education courses grew 83% between May 2004 and September 2010.

To SENAI, vocational education is the way to empower the individual through work. The education project aims to the formation of citizens able to act autonomously, critically, consciously and participatory in everyday life.

Supporting the industry through training of human resources, SENAI offers professional training programs made possible through the learning, empowerment, qualification, improvement, technical, higher and postgraduate modalities. To illustrate this support, below are the numbers of enrollments and courses held in 2011, according to the modalities.

ENROLLMENTS	682,689 in Professional Initiation courses
	165.557 in Basic Industrial Apprenticeship courses
	423.671 in Basic Vocational Qualification courses
	158.416 in Mid-level Technical courses
	5.004 in Post-graduation courses
	12.181 in Graduation courses
	1.084.108 in Training courses
	2152 in extension courses
	Total enrollment 2.533.778
NUMBER OF COURSES OFFERED	1.623 Industrial Apprenticeship
	1.069 Mid-Level Technicians
	76 Graduates
	119 Post-graduates

SENAI, focused on social responsibility inherent to its activity, provides professional education to all citizens who for some reason, economical or sociocultural, are limited to exercise this right. SENAI's Program of Inclusive Actions aims to include people with special needs (disabled/typical behavior and exceptional ability), expand the service to blacks/natives, allow women's access to courses stigmatized for men and vice versa as well as retrain people above 45 years and older.

2.2.3 Environment

SENAI recognizes generation and dissemination of knowledge as a strategic tool for building sustainable development. In 46 National Centers of Technology, SENAI develops programs and provides laboratory services, production process assistance, as well as applied research and technological information.

Since the early 1980s, SENAI is engaged in an effort to expand the industry's environmental sustainability, through projects of cooperation with international institutions such as the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO), which resulted in initiatives to support the important segments of the supply chain, like leather, textile and food products industries in several Brazilian states.

The experience and knowledge accumulated by the institution over two decades resulted in an ambitious project of national scope: the SENAI Plan of Environmental Quality (PSQA by its Portuguese acronym), which aims to disseminate skills and transfer technological solutions for the productive sector, through the development of training actions and planning and consulting for the implantation of environmental management systems suited to the specific conditions of each industrial branch.

With the maturation and internalization of skills, the PSQA originated the SENAI Environmental Network, composed of experts from the most diverse technological areas counting with a cutting-edge laboratory infrastructure, which, through research and innovations on environmental technology, implements continuous improvement and optimization of the production process for waste reduction, improvement of inputs use, reuse of waste, recycling, conservation and rise of energy efficiency.

For the development of industries with a focus on environmental sustainability, the SENAI Environmental Network has drawn up projects aimed at the minimization of environmental impacts, preservation of natural resources and reuse of inputs.

As a result of this action, SENAI has already assisted more than 4,700 companies throughout the Brazilian territory, performing more than 7,400 environmental consulting services.

3 ECONOMICAL AND SOCIO-ENVIRONMENTAL REGULATIONS

The Rio Declaration on Environment and Development, resulting from the Rio-92, establishes as a principle for sustainable development the enactment of effective environmental legislation by states, mainly on the civil liability and compensation for pollution victims. Brazil, a signatory of Rio Declaration, brings in its legal system a complex and comprehensive environmental regulation, including a section reserved for the environment in its Constitution.

3.1 Environment

Brazilian environmental legislation is very diverse, covering topics such as sustainable use of forest, biodiversity protection, control and standard of environmental quality, among others. Law nº 6.938/1981 established as instruments of the National Environment Policy- PNMA the licensing of potentially polluting activities, the assessment of environmental impacts and the establishment of environmental quality standards. Complementing the PNMA, the Resolutions of the National Council for the Environment - Conama establishes an environmental criteria that influences the industrial activities, may be cited the Resolution nº 237/97, which regulates aspects of environmental licensing, setting the mandatory assessment of impact for activities and projects that could effective or potentially cause significant environmental degradation, and Resolution nº 357/2005, which states the classification of water bodies and provides environmental guidelines, as well as establishes the conditions and standards for effluent discharge.

Another important moment for the sustainable growth of the country was, in 2010, with the publication of a National Policy for Solid Waste, an important milestone in the Brazilian environmental legislation, defining principles and instruments for efficient solid waste management by governments, as well as by private initiative.

SENAI – National Department, through Innovation and Technology Unit – Unitec, is responsible for the general coordination of SENAI Environmental Network, consisting of 24 Regional Departments including Amazonas, Alagoas, Bahia, Ceará, Distrito Federal, Espírito Santo, Goiás, Mato Grosso, Maranhão, Mato Grosso do Sul, Minas Gerais, Pará, Paraíba, Paraná, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Rondônia, Roraima, Santa Catarina, Sergipe and Tocantins, whose goal is to develop strategic actions aimed at the success of networking and leverage the indicators for the provision of technological development in the environmental area in all Brazil.

To do this, it accounts with the partnership of SENAI/BA, in the technical coordination, through the Environmental Division for Industrial Technology Center – Cetind to facilitate the activities included in the project scope and to perform the dissemination and training along with Regional Boards.

The Environmental Division of Cetind Operational Unit is operating for 17 years, providing technical and technological services with the industrial segment of Bahia, aiming at meeting the legal and market environmental requirements, thereby contributing to the sustainable development of the state. It has a multidisciplinary team of highly qualified doctors, teachers and experts as well as laboratories accredited by the National Institute of Metrology, Standardization and Industrial Quality – Inmetro. It is also responsible for coordinating the trilateral cooperation program between Brazil, Peru and Germany and its goal is to assist the process of deploying an excellence environmental center in Lima, the Peruvian capital.

Among the available services in SENAI Environmental Network directed to attend the legislation and voluntary instruments, are cited as examples:

- environment consulting;
- environmental impact study;
- implementation of integrated environmental management system;
- environmental audit;
- georeference data;
- environmental education program;
- solid waste, liquid and atmospheric emissions management plan;
- environmental monitoring;
- environmental licensing;
- plan for reuse of liquid effluents.

Present in 24 Brazilian states, SENAI Environmental Network has a highly qualified team, with ability to meet socio-environmental projects of large impact, specialized laboratories and programs designed to help the Brazilian industry to grow with environmental responsibility.

The Cleaner Production Program (P + L), offered by SENAI, deserves to be highlighted once it assists the transfer of clean technologies, influences the suitability of environmental laws so as to make them compatible with the current reality and expands the industry's competitiveness. The program was developed by the United Nations Industrial Development Organization (UNIDO) in conjunction with the United Nations Environment Programme (UNEP), creating initiatives to prevent pollution activities, with several Centers for Cleaner Production in developing countries, which form an information network on the subject. The Industries Federation of Rio Grande do Sul – FIERGS, along with the SENAI/RS, houses the National Center for Clean Technologies – CNTL since 1995, working primarily on the disseminating information, implementing cleaner production programs in productive sectors, training of professionals and performing in environmental policies.

In 2001 was created in Rio de Janeiro, the SENAI Environmental Technology Center, which provides infrastructure and multidisciplinary technical staff, experienced and with a highly qualified, composed of masters and doctors. The Environmental CTS concentrates its activities in the areas of Audit and Environmental Management, Water and Waste, Research of Environmental Liabilities, Toxicology and Industrial Hygiene, Volumetric Calibration, Cleaner Production – P + L and Atmospheric Emissions.

In 2009, the National Department of SENAI partnered with the Electric Power Research Center (Cepel), body attached to the Ministry of Mines and Energy, to construct four Renewable Energy Demonstration Centers – one of them being the unity of Taguatinga, SENAI/ DF. The Solar House was built in an area of 100m^2 and has a basement, auditorium, bathroom, hall, pantry and balcony. The electric power for its feed is produced by photovoltaic cells and wind generators, besides having a water heating system using solar energy. The house external structure is coated with photovoltaic panels, better able to capture and convert sunlight into electrical current.

In 2010, among many featured actions, SENAI/GO deployed its Environmental and Industrial Hygiene Core. Its goal is to meet the growing demand of enterprises for consulting on environmental issues and assist in increasing productivity without assaulting the environment. Part of SENAI Environmental Network, the core provides monitoring services, licensing and environmental diagnostics, solid waste, liquid effluents and atmospheric emissions management, implementation of cleaner production programs, among others.

SENAI has provided to local industries in Santa Catarina environmental consultancies undertaken from a partnership, signed in 2010, with the Stuttgart University, Germany. The same work at an international level, was made available to the tanneries of Paraguay, who received advice to introduce cleaner production procedures.

Also in 2010, the mechanical workshops from Paraná participated in the Solid Waste Management Program – PGRS in the cities of Curitiba and Ponta Grossa. This program, result of a partnership with the Union of Vehicle Repair Companies – Sindirepa, allowed the workshops to receive the "Green Seal", a recognition to establishments that adopted solutions to minimize the environmental impact generated by waste.

3.2 Vocational Education

Technological and vocational education assumes strategic value to national development, which seeks to consolidate itself as sovereign, sustainable and inclusive, with the important role of meeting the new settings of the labor market and also contributing to the elevation of workers' education, being an important actor of national scientific and technological production.

Vocational education is provided since the 1937 Brazilian Constitution, however, recently, there has been significant progress in legislation on the subject. Law nº 9.394/1996, which establishes the guidelines and bases for national education, provides a specific chapter for vocational education. This law was amended by law nº 11.741/2008, so as to resize, institutionalize and integrate the actions of mid-level technical vocational education, young and adult education, as well as vocational and technological education. The Decree nº 5.154/2004 regulates the articles of the Guidelines and Bases for National Education Law on vocational education, revoking the Decree nº 2208/1997.

SENAI, in conjunction with SESI and CNI, has established actions for the industrial sector to provide education in line with the Industry's Strategic Map 2011 – 2015. These actions were established in a scenario in which the Brazilian industries have increasing levels of demand and complexity at work – due to technological innovations associated with new forms of production organization – to cope with the competitive and increasingly globalized market. Within this perspective, and in line with the principles of the Rio's Declaration on technological development and increase of knowledge, SENAI has courses offered by Regional Departments, forming and enhancing the knowledge of professionals who work in the environmental area. Below are presented examples of courses by training area.

- **Basic industrial learning**
  - ◊ Treatment operator of water, effluents and waste

- Basic vocational qualification
  - ◊ Treatment operator of water, effluents and waste
  - ◊ Nurseryman of plants and flowers

- Technical courses
  - ◊ Environmental control technician
  - ◊ Environmental technician
  - ◊ Landscaping technician
  - ◊ Forest technician
  - ◊ Chemical analysis technician
  - ◊ Chemical technician

3.3 Social inclusion

The Convention nº 159/83, of the International Labour Organization (ILO), which is about enabling and vocational rehabilitation of disabled people, was ratified by Brazil through Legislative Decree nº 51 of August 28, 1989. In accordance with ILO position, its principle is based on securing a suitable job and a possibility of integration or reintegration of disabled persons in the labor market. Due to the practical conditions and the national possibilities, every state that ratifies this Convention should formulate and implement a national policy on vocational rehabilitation and employment of people with disabilities and ensure that measures, effectively, benefit all who are in this condition.

The ILO edited, regulating the above Convention, during the 69th Conference in Geneva in June 1st, 1983, the Recommendation nº 168, which deals with the vocational rehabilitation and employment of disabled persons. In December 13, 2006, the General Assembly of the United Nations (UN) adopted the International Convention on the Rights of the Persons with disabilities, the first human rights document of the twenty-first century and the eighth of the UN. This is a very important tool for improving human rights, not only because it meets the specific needs of this group, which has about 650 million people worldwide, according to the World Health Organization (WHO), but above all because it invigorates human rights to the detriment of social rights before consolidated.

Aligned with ILO position, Brazil promulgated Law nº 7.853/89, establishing the National Policy for the Integration of Persons with Disabilities, instituting judicial protection of the collective or diffuse interests of these people. Added to this, the Law nº 8.213/91, which deals with Social Security Benefit Plans, established the obligation of companies with one hundred (100) or more employees to fill out a portion of their positions with people with disabilities. In 1999, the Decree nº 3.298 was approved, regulating Law nº 7.853, National Policy for the Integration of Persons with Disabilities.

The National Service for Industrial Apprenticeship – SENAI, having the social responsibility as guiding principle of its actions, believes that a society becomes more developed, mature and more humane when it recognizes the diversity of citizens, promoting the inclusion of all in the processes of vocational education.

As already mentioned, SENAI has the SENAI Program of Inclusive Activities – PSAI, coordinated by the National Department and developed in the Regional Departments. As a guideline of PSAI, SENAI units must adapt to receive people with special needs, and have qualified staff to meet Brazilian Sign Language (Libras), Braille and Exceptional ability.

Some actions taken by the SENAI Regional Departments illustrate this important initiative to the development of the country. In 2007, SENAI/PR, in partnership with SENAI/BA, structured a Libras distance course for SENAI teachers in order to develop skills and better serve people with special needs who are looking for the services offered on SENAI.

In 2010, SENAI/MG held through regular courses, the inclusion of 778 people with disabilities, as shown in Table 5.

TABLE 5. NUMBER OF PERSONS WITH DISABILITIES INCLUDED IN REGULAR COURSES OF SENAI/MG IN 2010	
Category of disability	**Number of people**
Mental disability	71
Visual impairment	182
Hearing impairment	143
Physical disability	300
Multiple disabilities	4
Exceptional ability	57
Others	21
Total	**778**

Source: Programa de Acompanhamento de Egressos.

In 2010, the teaching mode in which there was the larger number of inclusion was the Industrial Apprenticeship with 286 people included, followed by Improvement, with 156 people, Basic Vocational Qualification, with 143 people, Professional Initiation, with 106 people, Technical License, with 68 people, Technical Qualification, with 10 people, Post-graduation, with 6 people, and Graduation, with 3 people included.

Also in 2010, 4 employees were trained in Libras, 6 in Braille spelling and mathematical operations, through distance learning courses organized by SENAI National Department, and 32 people were trained in Libras by the Center of Excellence in Technology and Manufacturing – Cetem, unit of Betim, SENAI/MG.

SENAI/RS, in partnership with the Regional Superintendence of Labor and Employment, in the first half of 2010, inaugurated three new courses for persons with disabilities: Administrative Assistant for people with intellectual disabilities; Administrative Assistant for people with hearing impairment; and Maintenance Technician also for people with hearing impairment.

Also stands out in SENAI/RS, the Production Line Assistant course for persons with intellectual disabilities, in partnership with the Association of Parents and Friends of Exceptional and the Stihl company, in the industrial learning mode. SENAI has structured a course taking into consideration that people who fall into this category of disability usually present low schooling, requiring a specific educational proposal that fits your educational needs. The course was structured with load of 800 hours, with two modules, the first being for the development of technical and management skills, taught in SENAI unit, and the second module designed for practical activities, developed in-house under supervision and pedagogical support of SENAI.

SENAI/SP recorded from January to June 2011, more than 3,000 attendances of people with disabilities in various SENAI schools, throughout the state of São Paulo in Brazil. The services offered are aimed at inclusion:

- trainings for people with disabilities (tailored for companies);
- inclusion of people with disabilities in the supply network of SENAI/SP;
- analysis of appropriate jobs to persons with disabilities;
- layout analysis and adaptations of the workplace for people with disabilities;
- awareness-raising lectures and trainings for employees
- vocational telecourses on mechanics with didactic materials transcribed in Braille spelling system (for visually impaired) or subtitled and with Libras (for hearing impaired);
- transcription of didactic materials for the Braille spelling system and expansion of printed materials;
- assistance in the development and adjustment of equipment for inclusion of people with disabilities.

The Technology Center of Chemical and Textile Industry – SENAI CETIQT, main center forming human resources national textile chain, since 2006 offers courses for people with disabilities. The first course offered was the Extension in Clothing Customization, having as target audience people with physical disabilities. This course was conducted in partnership between SENAI/DN and the Brazilian Charity Association of Rehabilitation, ABBR and took place at the Pilot Plant of Clothing Manufacturing and the clothes produced by the students were donated to orphanages in the region surrounding SENAI CETIQT as part of the Education for Citizenship Program.

The apprenticeship course in Industrial Clothing Manufacturing for PNEs deserves to be highlighted for counting with the collaboration of companies like DeMillus, Cyticol and Duloren. It was held in 2008 with the aim to train persons with disabilities to work in jobs of production line of textile and clothing industries. The course graduated 32 students and was attended by 13 teachers of clothing and textile finishing areas, 7 monitors (students of College of Technology on Clothing who received a scholarship funded by DN) and 2 Libra interpreters.

The Regional Department of Paraíba has promoted the inclusion of 527 people with special needs in vocational education programs through the courses developed by educational units, in the following areas: Automotive, Civil construction, Leather and Shoes, Electronics, Energy, Education, Graphics, Metal mechanics, Information technology, Textiles and Clothing.

SENAI in Mato Grosso state has 90% of its schools adapted to receive people with disabilities. In addition to earmark a percentage of their vacancies and promote training courses respecting the specific characteristics that meet this portion of society, also acts in accordance with the demand by companies in the region. SENAI/MT invests in promoting accessibility in assisted technologies, elimination of communication barriers, architectural accessibility and attitudinal barriers extermination to improve ser-

vice to special students. It also develops constantly teachers training and upgrading courses such as Libras, Virtual Vision[4], Written in Braille, and offers to the Federation of Industries professionals of Mato Grosso – FIEMT the opportunity to participate of a Libras course with deaf pedagogical instructor of the staff.

Another action offered by SENAI/MT to the state companies is the guidance on how to proceed to include and integrate people with disabilities. To this end, it promotes awareness-raising lectures and guidance in several segments of industries and businesses, eliminating barriers to inclusion and providing the knowledge so the skills and competences of disabled persons can be recognized.

The social inclusion actions of SENAI made it receive the Freedom Award Camellia 2011 in the Education Institution category. The award is an institutional manifestation of the Center for Articulation of Marginalized Populations (CEAP) and seeks to identify initiatives that promote affirmative actions as a contribution to overcoming racial and social inequalities.

The award is due to the work done by SENAI under the PSAI, especially as regards ethnicity, in black people training in *quilombolas* communities and Indians in indigenous villages.

An example of PSAI's work is given by SENAI/TO, which enables persons with special needs (disabled/typical behaviors and exceptional ability), blacks/natives, penitentiary, rehabilitated (insured persons of INSS) and favors the participation of women in stigmatized men courses and vice versa, in addition to re-qualify people over 45 years.

In addition to courses conducted directly with the community, partnerships signed with the Electric Power Company of Tocantins – Celtins, the State Department of Education, the Ministry of Social Security and the National Institute for Social Insurance have made possible to SENAI/TO train people with disabilities, prison population and INSS insured (rehabilitated) in the municipalities of Palmas, Araguaína and Gurupi. These actions make easier the entry of such persons into the labor market and contribute to the industry in compliance with the goals of the social inclusion process with qualified manpower.

However, the program scope is much greater, and requires not only adaptations of SENAI in its premises as well as the training of teachers. Two teacher training programs show the diversity of PSAI. One of them is the High-Skills course that is being promoted by SENAI/RS in partnership with the National Department. Another project is the Vocational Education for Students with Fragile X Syndrome, videoconferencing theme that marked the beginning of PSAI work in this other strand. A virtual meeting presented the planned actions as well as progress and difficulties encountered in the development of Fragile X Syndrome (FXS) project whose pilot experience is being coordinated by SENAI/SC.

SENAI became reference in the inclusion of blind people in the digital world and has trained, under the PSAI, 11,502 visually impaired, with over 80% of them in computer courses. The entry of visually impaired people in the digital world improves the necessary technical expertise to entry into the Brazilian industry.

4 Software that helps visually impaired in the use of several applications on the computer.

4 BUSINESS PRACTICES FOR SUSTAINABLE DEVELOPMENT

From the Rio-92, the preservation of the environment has become, increasingly, an integrant part of corporate image, since it involves the question of citizenship, the collective heritage and the public good.

Since 1992, SENAI has extended its partnership with industry in the search for improvement of its environmental, social and technological condition, through projects, notices, technological consulting, laboratory services, research and development.

The main transformations incorporated by the Brazilian industry in the areas of technology and innovation, environmental management, social inclusion, training for the labor market, corporate social responsibility with the assistance of SENAI can be seen below.

4.1 Technology and innovation

Unlike a decade ago, today the development of Brazilian industry depends on its ability to service a growing domestic demand and on the challenge of export. To be competitive, the industry must be innovative.

Considered as a priority in the strategic planning of industry, innovation is treated as a priority issue at SENAI. In this thematic, several projects and actions were carried out over these past years, such as:

Educating for innovation

Train workers who bring innovation to their daily lives is the challenge that SENAI is proposed to accomplish.

a) **Program Innovation with Educational Technology (PITE)** was launched in 2010 to develop technologies, methodologies and innovative educational practices within the SENAI system. Most of the inaugural activities of a program of this scope is consumed in creating the basis for future work: group formation, construction of methodologies, disclosure of actions etc.

The PITE encourages a culture of innovation and the use of information technology and communication (TICs) by students and teachers of SENAI throughout Brazil. The program allows the creation of technologies, methodologies and innovative educational practices within the SENAI system.

In its first year, the PITE devoted itself to the establishment of the Interlocutors Network of SENAI for Innovation with Educational Technology (Insite Network), to the development of skills for creating simulator software with the completion of a pilot project in the area of forest harvesting and make the first investments and training actions of ten Regional Departments for providing a platform for production, management and dissemination of content for mobile phones and several portable devices.

The PITE systematizes the attention that SENAI was already giving to mobile technologies for vocational and technological education. One good example is the system of sending text messages to cell phones, which shows excellent results in the SENAI Network of Distance Education.

In 2011, SENAI launched the 2nd notice of innovation with educational technologies based on information and communication technologies. The selected projects will be completed by May 2012. They are:

- SENAI/SC – Authoring system for educational resources for tablets;
- SENAI/SP – Parameters for the development of content for mobile media in SENAI's professional training courses;
- SENAI/RN – Application of the Alice software of programming computer language in technical courses for industrial automation;
- SENAI/PB – The RPG used in vocational education;
- SENAI/AM – Digital interactive TV as a multimedia tool to support the teaching and learning process in SENAI's courses SENAI;
- SENAI/RS – Educational simulator of lighting and signaling systems maintenance in vehicles;
- SENAI/DF – Platform for development of M-learning courses;
- SENAI/MS – Interactive educational terminal;
- SENAI/MG – The network communication technologies in managing the construction of knowledge;
- SENAI/MT – iBox – Creation of a teaching resource of information technology for itinerant vocational training.

b) Inova SENAI, a competition for students and teachers projects that intends to promote solutions to everyday problems, meeting the demands of industry and society in several technology areas.

In 2011, the Inova SENAI was promoted in 21 states of the Federation, with the exposure of more than 350 projects in the categories of Innovative Product, Innovative Process, Business Plan and SENAI Innovative Service.

The event has great potential of raising awareness of visitors and social reach, counting in each edition with the presence of about 250 thousand visitors, mostly students of elementary education. Below are listed the projects awarded for their creativity in society and industry problem solving, as well as the relevant sectors, respectively:

- Computer keyboard for people with disabilities – a product developed by SENAI/MG aiming at digital inclusion for people with limited motor coordination;
- Signaling system for people with hearing and visual disability- signaling system of traffic lights for people with hearing and visual disability, developed by the SENAI/PR staff;
- Reuse of oil – at SENAI/RS, it was developed a mobile unit for processing oil from restaurants to manufacture bio diesel.

In Rio de Janeiro, the state version of the Inova SENAI is the Atitude Inovadora, which received 100 projects and selected 10 for awards. The Regional Office also promotes the (+) Ideias, which encourages the spontaneous generation of ideas from employees, recognizing, rewarding and incorporating those with potential for innovation. In 2011, the (+) Ideias received 427 works and awarded six of them.

The SENAI of Parana has a Hotel of Innovative Projects, a set of pre-incubators in the SENAI units to support the development of projects with focus on industry and prototypes of students and graduates of the vocational educational courses SENAI.

The Hotel currently has 32 (thirty two) underway projects in various stages of pre-incubation, 10 (ten) senior projects, three (3) registered patents and 137 (one hundred thirty-seven) students involved in projects and in the direct formation of entrepreneurial behavior of the Industrial Training, Technical and Post-Graduate Courses.

Practices and ideas that spread

a) SENAI SESI Innovation Notice, one of the tools that drive innovation practice in the S System. This notice is a nationwide initiative, which aims to promote innovation in technology and social areas in partnership with industrial companies. Since its first edition in 2004, 895 proposals were submitted, 79 new technologies developed and other 228 are underway. Below are listed the main innovative products and processes that stand out by economic increase and environmental sustainability:

- Recycled PET pipes – development of a process for the company TECHPLAST of pipe for irrigation and sewage from recycled PET bottles;
- Recyclable polymers in the manufacture of artifacts – in partnership with the company Portoflex, located in the metropolitan area of Porto Alegre – RS, SENAI supported the company to develop products based on recycled polymers;
- Manufacture of ecologic towels – Buettner focused on the development of fluffy towels from organic cotton using a methodology in which the textile substrate released after processing this towel does not need to be treated with synthetic chemicals;
- Eco-Chic Knitwear – innovation project with the company Abbici (Curitiba) that developed flat knitwear fashion products in a sustainable manner, with the prevalence of a contemporary and sophisticated aesthetic, for insertion in the national and international fashion market.

In 2011, the 8th SENAI-SESI Innovation Notice received a record number of entries. Twenty-one Regional Departments involved, totaling 98 projects approved, the Notice of Innovation SENAI-SESI 2011 can be considered a success.

THE SENAI-SESI NOTICE 2011 IN NUMBERS

- 98 projects approved
- 21 Regional departments involved
- 59 technological innovation projects for industry (SENAI)
- 33 social innovation projects (SESI)
- 6 joint projects (SENAI/SESI)
- 58 companies involved

The SENAI SESI Notice of Innovation helps to overcome the idea that innovative capacity is limited to traditional industrial hubs of the country. While states like São Paulo still lead the ranking of projects approved, the number of successful initiatives throughout Brazil is each time higher.

One of the signs of the spreading of innovative culture in SENAI System is the increasing number of patent applications for inventions in the INPI – National Institute of Industrial Property. Only in Bahia there were five. The SENAI/SP, which has 19 innovation projects underway, plus six contracted projects and 47 innovation projects planned for next year, made 10 patent applications to the INPI in 2011. The SENAI/MS created the Center for Intellectual Property which, among other actions, provided service to 10 companies for trademark registrations and two for patent applications.

In Rio de Janeiro, a motion control developed at SENAI Technology Center for Simulation and Automation secured the first software record in the Firjan System at the National Institute of Intellectual Property – INPI. Called "Motion simulator control with six degrees of freedom" (6DoF), the software allows operation of a simulation equipment by reading the signals sent by a remote control. By registering the software, the device can be applied to new technology projects developed by SENAI. In addition, the project can be used in classrooms to build environments more real through the simulation.

The need for instruments for the development of a sustainable economy is reflected in the result of the SENAI-SESI Innovation Notice. Of the 53 projects in which the SENAI is involved, 24 are directly or indirectly related to sustainable production patterns. This is the case, for example, of the packaging of personal care products which degrades within 180 days designed by the SENAI/SC.

The actions of SENAI's Technology Innovation Program stand out, therefore, because they are planned and developed in partnership with industry, which allows to directly meet their demands and needs, allowing the innovative technology to be implemented and transferred to the company simultaneously to its development. Thus, SENAI provides industries resources and tools to improve the life quality of workers, reduce and optimize production costs and reduce environmental impacts while increasing the product portfolio, the number of employees, income and profits, to become more competitive.

The technological improvement is an important aspect for the competitiveness and sustainability of Brazilian industries. One of the instruments used by SENAI for the development of Brazilian industry is the provision of technical and technological services. Divided into five lines of action – Research, Development and Technological Innovation, Technical and Laboratorial Services, Technical and Technological Advice, Information Technology and Certification of Products and Processes – These services benefited more than 15 thousand companies in 2011.

TECHNICAL AND TECHNOLOGICAL SERVICES OFFERED BY SENAI IN NUMBERS

- 139.149 services performed
- 1.990.889 man hours mobilized
- 111.057 technical and laboratorial services
- 11.022 information technology services
- 14.475 technical and technological advisory
- 2.552 development services and technological innovation
- 43 processes and products certification

One of the highlighted technology services is the SENAI Metrology Network, comprised of 200 laboratories that operate in more than 15 technology areas. Ninety-five of them are accredited by the National Institute of Metrology, Standardization and Industrial Quality (Inmetro), National Health Surveillance Agency (Anvisa), Ministry of Agriculture, Livestock and Supply (MAPA) and the Ministry of Labor and Employment (MTE). In total, there are more than 1,314 thousand services and accredited laboratorial parameters, including tests and calibrations.

An important program, which seeks access to specialized services for small and micro enterprises, is the Mobile Units Project – Prumo, which counts with 10 vans equipped with the instruments necessary for rapid analysis and specialized professionals. The PRUMO is helping micro and small enterprises to raise their productivity through projects and consulting about adequacy of environmentally friendly production processes, democratizing access to new technologies, making companies ever more competitive.

The mobile laboratories already serve small and micro enterprises in the areas of leather and footwear of Ceará, wood and furniture of Bahia, Espírito Santo, Pará and Rio Grande do Sul; food of Santa Catarina, Pernambuco, Mato Grosso and Mato Grosso do Sul, and textiles of Parana. They also allow the development of other services, such as customization of production.

Focused on the food and drinks segment, the Food Insurance Program (PAS) was developed to ensure safe food production to consumer health and its principles are used in processes for improving quality in several countries. The PAS covers the training of the company staff in the entire productive chain: field, transport, industry, distribution and food services, develops teaching materials and methodologies, enables professionals to provide advice and consulting to firms, and develop specific actions, taking information to consumers about food safety, contributing to increase the safety and quality of food produced by Brazilian companies, increasing their competitiveness in domestic and international markets and reducing the risk of food borne disease (DTA) to consumers.

The PAS project partners with institutions involved in the dissemination of knowledge and methodology on food, such as the Industry Social Service- SESI, Commerce Social Service – SESC, National Service of Commercial Apprenticeship – SENAC, Support Service for Micro and Small Enterprises – Sebrae, National Service of Rural Learning – SENAR, the Brazilian Agricultural Research Company – Embrapa, the Ministry of Agriculture, Livestock and Food Supply – MAPA, among others, which facilitates the actions at the national level. The PAS began in 1998 and provided for industries awareness workshops, informative lectures, training courses, among other actions. Table 6 shows the numbers obtained by the program from 1998 until 2011.

Table 6 shows the numbers obtained by the program from 1998 until 2011.

TABLE 6. RESULTS OF THE PAS, FROM 1998 TO 2011 (SECTORS: INDUSTRY, BUREAU, DISTRIBUTION, EDUCATION, CONSUMER, TRANSPORTATION, FIELD AND SPECIAL ACTIONS)

Actions taken	Total	Actions taken	Total
Awareness workshops (nº of workshops)	452	Auditor course (nº of courses)	9
Awareness workshops (nº of participants)	19.837	Auditor course (nº of participants)	192
Technical lectures	85	Multiplier course (nº of courses)	24
Participation in events	384	Multiplier course (nº of participants)	463
technological clinics	109	Teachers training (nº of courses)	46
CIO BPF Micro (nº of courses)	357	Teachers training (nº of participants)	883
CIO BPF Micro (nº of companies)	3.606	ISO 22.000 course (nº of courses)	3
CIO BPF Small (nº of courses)	100	ISO 22.000 course (nº of participants)	81
CIO BPF Small (nº of companies)	813	Course of the norm ABNT 15.635 (nº of courses)	1
CIO APPCC (nº of courses)	24	Course of the norm ABNT 15.635 (nº of participants)	21
CIO APPCC (nº of companies)	121	VISAS Fiscal Course (nº of courses)	88
CIO Vendor and Acarajé 10 (nº of courses)	344	VISAS Fiscal Course (nº of participants)	1.498
CIO Vendor and Acarajé 10 (nº of vendors and baianas)	9.010	Hospital table course (nº of courses)	3
CIO BPF kiosks and tents (nº of courses)	38	Hospital table course (nº of participants)	104
CIO BPF kiosks and tents (nº kiosks)	697	Other courses (nº of courses)	89
Company technician course (nº of courses)	617	Other courses (nº of participants)	2.031
Company technician course (nº of participants)	15.491	Support and supervision (company)	415
Consultant course (nº of courses)	135	Technical visits and audit	32
Consultant course (nº of participants)	4.389	Consumer action	15

CIO – Implementation Oriented Course, BPF – Good Manufacturing Practices, APPCC – Hazard Analysis and Critical Control Points, PTI – Integrated Work Plan.
Source: Reports of PAS Agreements and PAS Management System..

In the area of leather and footwear, SENAI/RS has two reference technology centers (CT): Footwear CT and Leather CT. The first aims to meet the industries in the region about the need for human resources trained to the production process. The center offers Mobile Unit Quality Control, taking quality control to the micro and small footwear business and the Design Support Center (NAD), with qualified professionals to support the design area. Also are offered the Center of Information Technology and the Technological Advice Quality Control of Environment Laboratory, promoting the production and dissemination of technological information within the footwear industry.

The Leather CT is located in Estancia Velha/RS, with more than 9,000 square meters of built area. The center's mission is to generate technology for the leather processing area and environment through laboratory technical assistance, technological assistance in leather processing and environment, and education and information technology. Its facilities consist of: tanning-school, workshops, laboratories, industrial wastewater debugger system, information technology core, classrooms, auditorium. The activity in the Leather CT environmental area is fairly representative, supporting industries of the sector with technical expertise in industrial wastewater treatment, management and industrial waste treatment and clean technology, and offers courses for these subjects.

An action that deserves mention for its sectoral transversality is the SENAI Program of Design Management, which operates in 14 states of the Federation, through 40 Design Support Cores (NAD), and 13 industrial sectors: wood and furniture, footwear, leather, printing, garment and textile, electronics, jewelry, pulp and paper, automation and information technology, packaging, plastic, ceramic and chemical industries.

One of the most important actions of the program is the annual publication of the Reference Books, which offer to industry updated information about what happens in Brazil and worldwide. In 2011, the Reference Book of Furniture "Wishes & Breaks" was launched, with the participation of the Regional Departments of AC, BA, DF, ES, MG, PR, SC, RJ, RO e RS.

4.2 Environmental Management

Environmental responsibility is a priority for all companies concerned with the sustainability of their business. Through the Environment Network, SENAI supports the competitiveness of industry offering the best in technical support in meeting environmental demands associated with legal and market requirements.

SENAI's Environment Network stands side by side with the industry at all stages of the production chain, in accordance with regulatory agencies requirements. From assessment to implementation, from planning to international quality certification, industry's productivity and profitability can live in harmony with the environment.

For the development of the industry sectors with focus on environmental sustainability, SENAI's Environment Network developed projects to minimize environmental impacts, conserve natural resources and reuse their inputs. Here are some projects that were successful:

a) **Ecoampla Project** – establishment of a program to exchange recyclable waste for bonuses on energy bills through selective collection network able to meet industrial, commercial and residential clients in its surroundings.

b) **Chemical Leasing Innovative Project –** in cooperation with the United Nations Industrial Development Organization – UNIDO, the SENAI/RJ's Environmental Technology Centre supports the development of another type of contract between suppliers and consumers of chemicals, based on efficiency and benefits of chemical products rather than on the amount of product purchased. On one hand, in this type of contract the consumption of products is reduced, and consequently the environmental impacts associated with their production, distribution and consumption are also reduced. On the other hand, as it incorporates the technology of use of products, there is a greater economic benefit, which is distributed among the parties involved, as well as other players such as technology vendors, recyclers and others.

c) **Cultivar Project –** The objective of this project is to meet the conditions for an environmental permit for project installation (in compliance with the requirements of the Rio de Janeiro Environmental State Institute – INEA) to carry out the planting of native trees for reforestation.

There are ongoing projects for logistics and mining companies aiming at the restoration of over 200 hectares with native species of Atlantic Forest in areas in the cities of Queimados and Campos dos Goytacazes, state of Rio de Janeiro. The project scope includes:

- acquisition of seedlings of Atlantic Forest native essences, commonly found in the region;
- planting of native tree species;
- specialized technical services for the identification of areas to be recomposed;
- planting and application of all appropriate management techniques to the good condition of the seedlings until its complete fixation;
- preparation of detailed monthly report;
- are also added social actions that involve the promotion of environmental awareness for public school students, through campaigns of environmental education in the areas to be recovered, with lessons on climate change and reforestation.

d) **The SENAI National Center for Clean Technology (CNTL)** participates in two projects funded by the international financial corporation of the World:

- Cleaner production in Latin America agro-industrial sector. The focus in Brazil is a data collection on eco-efficiency in the paper and pulp, vegetable oils and dairy and sugar sectors, for projects with the objective of identifying opportunities for improvement in process efficiency, taking into account cleaner production criteria. This action is conducted in partnership with the Colombia National Center for Cleaner Production.

- Cleaner Production in the construction materials sector in Latin America. The focus in Brazil is a data collection on eco-efficiency in the material for construction sector and in the cement, ceramics, foundry and metal fabrication products subsectors. This project is conducted in partnership with the Mexican Center for Cleaner Production.

e) **Project Pilot-Program for the Minimization of Impacts Generated by Hazardous Wastes**, in compliance with the Basel Convention, in which Brazil is a signatory. The project, coordinated and executed by the CNTL, in partnership with the Ministry of Environment – MMA and the Basel Convention Office for Latin America and the Caribbean (Uruguay), provided training for 12 Brazilian states and the elaboration of technical guidelines for management of lubricating automotive oil waste, surface treatment and machining fluid.

Besides of these projects, some actions are an example of the performance of SENAI's Environment Network in the Brazilian states. Among them we can highlight: in Rio de Janeiro, the SENAI Center for Environmental Technology develops, with the support of the metal-mechanics industry and furniture unions, the adequacy of small and micro-companies to the environmental legislation through the use of environmental management tools. In 2011 only, the project served 20 small and micro-companies in Rio de Janeiro state.

The Industrial Technology Center unit – Cetind of SENAI/BA supports the sustainable development of enterprises of the electrical, petrochemical and mining sectors assisting the industries in the activity installation phase through the development and implementation of Basic Environmental Plans that include waste management, monitoring of flora and fauna, monitoring of water quality, environmental education project, among others. In addition, the center conducts environmental impact studies and environmental assessments.

The National Center for Clean Technology – CNTL of SENAI/RS in addition to working in partnership with several productive sectors such as construction, textile, graphic and plastic, performing consulting in the implementation of cleaner production programs, also conducts consulting in the area of energy conservation and management, solid waste treatment, liquid effluents and emissions, solid waste management, environmental assessment, environmental audits and other issues related to the environmental field.

In the environmental area, SENAI feels that the training of professionals contributes to the improvement of the environmental performance of production processes, and offers specific courses on the subject. SENAI/BA, through CETIND, has technological graduation courses in environmental processes, and specialization courses in environmental technology solutions, integrated QSMS (quality, safety, environment and occupational health) management, monitoring of water resources and social and environmental educommunication. A course that deserves to be mentioned is the specialization in Cleaner Production, offered by the CNTL of SENAI/RS, ensuring qualified professional training for usage of this essential tool for eco-efficient management of organizations.

Through the National Program for Training of Refrigeration Mechanics – Proklima, one of the actions that compose the National Plan for Elimination of CFCs, coordinated by the Ministry of the Environment and co-financed by the United Nations Environment Program – PNUMA, SENAI trains conscious professionals for the refrigeration and air conditioning sector. The Plan was developed by the Federal Government aiming to meet the targets proposed by the Montreal Protocol, of which Brazil and other 192 countries are signatories.

The PROKLIMA foresees to supply the Good Refrigeration Practices course in all Brazilian states. The course objective is to disseminate environmentally sound practices regarding the maintenance of refrigeration equipment, avoiding the emission of gases that deplete the ozone layer. The courses are conducted by SENAI schools, through an agreement with the German Agency for Technical Cooperation (GTZ), responsible for the transfer of funds from the Multilateral Fund of the Montreal Protocol[5].

At SENAI, environmental responsibility is a theme present in all programs and actions. Two partnerships with German institutions help to bring to SENAI the most advanced that is produced in the world in environmental technology.

Result of a partnership with the German Development Cooperation (GIZ), the SENAI Project for Capacity Enhancing in Wind Energy will have an impact in the areas of vocational training and technology consulting services. The project will train SENAI staff in the preparation of the educational routes in operation and maintenance of wind farms, and installation and assembly of equipment. Moreover, it will be essential in structuring lines of service of technology consulting in areas such as prospecting wind potential and adequacy for Brazilian standards. The Regional Departments of SENAI of Bahia, Ceará, Paraíba, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Rio de Janeiro, Santa Catarina and São Paulo participate in the project.

Still with the support of GIZ, the training courses for Energy Efficiency Managers have trained about 30 technicians and teachers. Of these, 13 have obtained the certificate of Energy Manager, awarded by the certifying institution TÜV Rheinland, adding value to the services of the units to which they belong.

4.3 Corporate Social Responsibility and Social

Social responsibility has always been part of SENAI's, since it is implicit most of the actions performed in its mission and in the development of its regular activities. In this sense, SENAI works to transform marginalized individuals into effective citizens. Offering what it does best – educate for work – the entity developed during the period 2010-2011, 1,561 projects that assisted 586,264 beneficiaries in professional training programs, creating the opportunity for the low-income youth to join or rejoin the productive life. Among the projects carried out, several were evaluated and awarded by external bodies and institutions.

5 The Montreal Protocol is an agreement established under the United Nations (UN) in 1987, which requires signatory countries to work to eliminate the production and consumption of substances that deplete the ozone layer (SDO). Currently, 193 countries participate in this Protocol.

Developed in partnership with institutions, companies, government agencies and NGOs, its programs benefit young people at social risk, workers excluded from the productive life, indigenous people, prisoners, abandoned children, first-time jobseekers, among other groups regularly attended by SENAI.

SENAI – National Department develops successfully, since 1999, through the Professional Education Unit – Uniep, the National Strategic Project for "Inclusion of People with Special Needs in Vocational Education Programs," which established a broad service to physical, mental, auditory, visual and multiple disabled people as well as gifted (high ability) in the operational units of its 27 Regional Departments. The major focus is to create opportunities to professional education for all citizens who for some sociocultural, economic or prejudice reason are restrained from exercising this right.

Another highlighted action of SENAI is the agreement signed with the Ministry of Labor in 2009. The National Construction Qualification Sector Plan – Planseq Bolsa Família expanded the opportunities for productive inclusion of beneficiaries of the federal program, serving approximately 185 thousand people across the country. The Planseq fitted the professional training courses to local needs encouraging partnerships between sectors of employment and social assistance, to ensure the continuity of the process. The first Regional Departments to start the courses were Parana, where 3,856 people were classified in 26 cities, Rio Grande do Sul, with 5,652 beneficiaries in 13 municipalities, and Sergipe, which trained 721 people in the capital.

Also in 2009, SENAI signed an agreement with the Ministry of Social Security to qualify workers victims of accidents or illness in the workplace. By 2011, the agreement opened about three thousand places in various courses offered.

It also stands out the agreement with the National Council of Justice for qualifying inmates in state prisons, and adolescents in fulfillment of educational measures, such as the Project of Learning in Liberty, in Rio de Janeiro, and dozens of others conducted in the states in partnership with the local departments of justice.

The Distance Education – EAD was one of the methods used successfully in the training of inmates at the Federal Penitentiary in Campo Grande, Mato Grosso do Sul and in Parana. With the mediation of prison officers prepared by SENAI, the program served more than 600 inmates, showing the potential of distance education in its social aspect.

Another wide-range initiative was the partnership with SESI performed for qualification of adolescent victims of sexual exploitation. The Vira Vida Project already works in Ceará, Pernambuco, Bahia, Rio Grande do Norte, and extended from 2010 to the other states.

In another aspect, SENAI has sought in recent years to make social responsibility a specific issue to its managers. One of the initiatives in this direction was the training through the distance learning course for 850 managers, teachers and technicians from SENAI of all states, ensuring an understanding of what is Corporate Social Responsibility (CSR).

The course provided a discussion and stimulated the reflection about possible strategies to change towards sustainable business models and enabled agents for socially responsible management, and increased knowledge about the actors that make up the network of company employees, identifying ways of dialogue between them.

The strong social impact of the professional education also makes SENAI preferred partner of companies who wish to carry out social projects with solid results. This is the case, for example, of the Future in Our Hands program, promoted in Brazil by SENAI and Votorantim Cimentos since 2009. The project in Acre accounts with the partnerships of the Union of Construction Industry – Sinduscon/AC and of non-governmental organizations.

In the first year of operation in Acre, the program offered 24 classes in 13 cities, with priority for young people from 18 to 29 years. The course has practical sessions held in communities, and allows for immediate hiring of staff in one of the 10,000 jobs that the construction industry opens on a monthly basis in the state.

Fiat also accounts with SENAI to develop projects in which professional education is the key to citizenship. Tree of Life is the name of the company's relationship policy with the community. The program focuses on three areas: training, volunteering and institutional partnerships. The partnership with SENAI – that develops the program in the Federal District, Recife, Curitiba and São Paulo – has trained 1,125 young people, of whom 800 are employed.

4.4 Training for the labor market

SENAI's brand has a strong connection with the needs of industry and society. In educational terms, this means that the production of courses is concerned with both the student's placement in the labor market and with their training as citizens.

Several modalities prepare people for the labor world: industrial learning, mid-level professional empowerment and vocational qualification are some of them. Others, such as professional development, serve to update or supplement the knowledge that workers already have. It's different from specialization, which deepens the skills acquired and may even become a new profession.

The performance of professional education corresponds to direct action – action that is developed in the exclusive SENAI operational units – plus the terms of cooperation – action developed by the companies under the supervision of SENAI – reached 2,362,312 enrollments, a total of 55,043,799 skilled workers over its 68 years of existence.

SENAI offers free distance courses on cross-cutting themes that develop capacities for initiation into the world of labor or in the case of those already working, to upgrade professional skills. The topics currently available are: Environmental Education, Entrepreneurship, Labor Legislation, Safety at Work, Information Technology and Communication and Intellectual Property. Over a million enrollments in distance cross-cutting skills courses have already been recorded.

All actions of the SENAI Inclusive Actions Program (PSAI) are related to the labor market. The data collection made from 2004 shows a picture of around 80 thousand qualified people with special educational needs, and in 2011, from January to September there were 13,040 people with disabilities. Since 2004, there were created thirty-three guiding documents for the training of people with disabilities, for orientation to work with blacks and Indians, and the elderly and issues related to gender, only under the National PSAI,

not including documents produced by the Regional departments. In addition, courses have been developed according to specific business industrial demand for inclusion in the labor market and achievement of the hiring quota for people with disabilities – PwDs.

To ensure access to qualified professional training to hundreds of underserved communities, in the most remote parts of the country and abroad, SENAI has developed the Mobile Action Program. It transforms social exclusion and unemployment into citizenship and entrepreneurship. Through rapid and effective courses, the program enables professionals to work alone or in combination, organized in cooperatives or microenterprises. More than just teaching an occupation, the Mobile Action Program prepares people to have productive activities autonomously. Besides the courses, it offers all the necessary technical support for setting up microenterprises. In 2010, there were over 52,878 registrations made by "mobile actions," showing that this is an important instrument for the democratization of education.

5 CHALLENGES AND OPPORTUNITIES FOR SENAI IN THE PATH OF SUSTAINABILITY

5.1 Challenges

The Technological Innovation Survey (Pintec) 2008, developed by the IBGE, which presents a general overview of innovation in the period 2006-2008 in Brazil, points out that of the total of 110,5 thousand companies that participated in the survey, only 38.1% were innovative. Moreover, the survey showed the main problems and obstacles to the industrial sector that discourage firms to innovate. First appear the high costs of innovation (73.2%), followed by excessive economic risks (65.9%), lack of qualified personnel (57.8%) and shortage of funding sources (51.6 %). If such data is compared to the trend observed in this sector in the Pintec 2005, there is change due to the relative increase on the significance of the lack of qualified personnel as opposed to the decrease on the relevance of the scarcity of financing sources and barriers to innovation.

The survey, released in 2010 by the CNI, about environmental management in industry (Table 7) showed that among the companies surveyed, 71.3% were adopting, in 2009, management procedures associated with environmental management, citing as main factors image and reputation (mentioned by 78.6% of them), environmental permits requirements (77.7%), environmental regulations (66.6%) and internal policy of the companies (65.8%). Moreover, the percentage of companies which forecasted a larger share of investment in environmental management for the year 2010, was 84.3% being: the percentage of companies that invested 4% to 10% in environment management in 2010 was 15.3%, with a raise of 4.3 percentage points compared to those who invested in 2009, and in the range from 10% to 20% it was of 5.6%, an increase of 1.9 percentage points in the percentage of companies compared to the year 2009. It is important to mention that among the programs adopted in the Environmental Management System of companies are the reduction in waste generation (80.1% of companies that have SGA), the efficient use of energy (69.5%), reduction in the use of water (58.3%), the use of waste as a feedstock or input (45.9%) and the recirculation of water (43.6%).

TABLE 7. RESEARCH DATA RELEASED BY THE CNI IN 2010 ON INDUSTRIES ENVIRONMENTAL MANAGEMENT		
Companies that adopt management procedures associated with environmental management		**71,3%**
Main factors	Image and reputation	78,6%
	Environmental permits requirements	77,7%
	Environmental regulations	66,6%
	Internal policy of the companies	65,8%
Companies which forecasted a larger share of investment in environmental management for the year 2010		**84,3%**
Companies that invested 4% to 10% in environment management		15,3%
Companies that invested 10% to 20% in environment management		5,6%
Programs adopted in the Environmental Management System of companies		
Reduction in waste generation		80,1%
Efficient use of energy		69,5%
Reduction in the use of water		58,3%
Use of waste as a feedstock or input		45,9%
recirculation of water		43,6%

Source: CNI, 2010.

In a population of nearly 190 million people, there are 14.2 million illiterates that are more than 15 years old. In industry, the numbers are also concerning. Of the 9.8 million workers, 5.3 million lack basic education. In another survey released by the CNI, in April 2011, it was found that the lack of skilled workers is a problem that affects 69% of the industrial companies and harms especially the smaller ones. The problem affects businesses of all manufacturing and extractive industry sectors. The research also reveals that almost all firms that face labor shortages have difficulty finding qualified technicians (94% of these companies) and operators (82%).

The in-house training is the major action taken by industry to deal with the lack of skilled workers. This alternative was chosen by 78% of companies, considering those who have mechanisms to deal with the problem. The action is especially important for larger companies, the percentage of answer reaches 86% for them. Then the main mechanisms adopted by companies to deal with the problem are the empowerment of the worker retention policy, through salaries and benefits (noted by 40% of companies) and training outside the company through external courses (33%). In large companies, the percentage reached 48% and 45% respectively.

The above scenarios point to challenges in the areas of technology and innovation, professional education and environment in which SENAI should always improve to meet the industrial sector in the face of sustainable development. Given this and the observed trends, the main challenges to be overcome are listed:

- increase the number of industries that use innovation in its processes and services, stimulating innovative culture and enhancing the competitiveness of Brazilian industry;
- increase the scope of technological services in the area of environment offered to industry in order to meet the needs of the sector investments in the environmental area; and
- increase the number of skilled workers in the industrial sector.

5.2 Key trends

One of the central topics of discussion at the Rio+20 is the green economy in the context of sustainable development and the eradication of poverty. The green economy is a concept of development that is not based only on low carbon emission and efficiency in the use of natural resources, it also provides for social inclusion, with the eradication of poverty, especially through investments in so-called green sectors, including agriculture, fisheries, water and forests.

Principle 9 of the Rio Declaration on Environment and Development guides the cooperation between states in order to strengthen the endogenous capacity-building for sustainable development, increasing knowledge through the exchange of scientific and technological knowledge, enhancing the development, adaptation, diffusion and transfer of technologies, especially the new and innovative technologies.

The Industry's Strategic Map 2007-2015 places education as one of the pillars of sustainable development, in which the elevation of educational quality is related to the increase of competitiveness and innovation capacity. Access to technology is also a decisive factor for increasing the productivity of companies. SENAI, through its mission to promote vocational and technological education, as well as innovation and the transfer of industrial technologies, plays an important role in transforming the industrial sector, providing green and technological solutions and training professionals to serve this market.

Accelerated changes in the productive system shall require a permanent update of existing skills and professional qualifications and the identification of new professional profiles and new itineraries of professionalization. The impacts of new technologies revealed the need for more versatile professionals, able to interact in new constantly changing situations. The key challenges of vocational education are related to the needs of workers with increasingly higher levels of qualification and skills, as well as higher degrees of intellectual and decision-making autonomy, able to monitor their own performance and to adapt to the new conditions of occupation which requires continuous enhancements and updates. The trend is the provision of a set of vocational education activities that will attend the entire occupational structure, from the basic level to the top level, articulating, as envisaged in the recent amendment of the Guidelines and Bases of Education Law – LDB, the several dimensions of education, labor, science and technology.

With respect to trends in the area of innovation, the report Science, Technology and Industry Outlook 2010, published in December 2010, by the Organization for Economic Cooperation and Development (OECD), examines the transformations of scientific, technological and innovation policies facing the increasing globalization of research and development activities – R & D.

The report identifies that emerging economies see innovation as means to modernize their economic structures and achieve sustainable development. To overcome the distance that separates them from developed countries, some of these countries have strived to develop and/or improve national systems for the research, development and innovation, integrating their strategies for science, technology and innovation – S, T & I on their national development strategies, as are the cases of Brazil, China, Russia, South Africa and India. Over the past two years, several trends of governmental policies of S T & I have emerged or strengthened. Among the broad set of trends are included:

- in many OECD countries, there is a tendency to "greening" of national research and innovation strategies;
- resurgence of basic science as high-priority policy, given that basic research is essential for future innovation, particularly with regard to technologies necessary to achieve environmental sustainability;
- countries are prioritizing areas of research and technologies such as nanotechnology, biotechnology, information and communications, new materials and advanced industries;
- with the redirection of global growth to areas outside the OECD, the emerging economies such as China, Brazil, Russia and South Africa, increasingly depend on innovation to advance in the value chain;
- the governance of actions to promote S, T & I remains a key issue in national agendas as well as in international collaboration to address global challenges;
- reform of funding mechanisms for public institutions of research, seeking to link budget allocation to performance, aiming to enhance the research excellence;
- in most countries, the direct and indirect government support for the business activities of R & D and innovation continues to increase;
- innovation demand policies such as government orders and innovation-friendly regulations, are receiving growing attention both in OECD countries and in emerging economies;
- many OECD countries are adopting a variety of policies to promote and disseminate knowledge, networks of cooperation and internationalization of the activities of R & D and innovation, as well as international mobility of human resources specialized in the areas of science and technology.

For the environmental area, the trends are driven by low-carbon economy, in which Brazil has been assuming, before the international community, voluntary targets for greenhouse gas emissions, consolidated by the adoption of a National Policy on Climate Change – PNMC, in the year 2009. PNMC's article 12 establishes that, to achieve its goals, the country will adopt, as voluntary national commitment, actions of mitigation of greenhouse gas emissions, to reduce between 36.1% and 38.9% its projected emissions up to 2020.

The PNMC's regulation, by Decree nº 7.390/2010 states that sector plans should be drawn up to mitigate and adapt to climate change, in order to consolidate a low-carbon economy in the processing industry, consumer durables, fine and basic chemical industries, pulp and paper industry, construction industry among other sectors of the economy.

The plans are opportunities for the development and consolidation of trajectories of low-carbon industrial development. In the workshop "Fostering Low- Carbon Economy and Green Growth of Domestic Industry", organized by the National Confederation of Industries – CNI, with support of the British Embassy in Brazil, opportunities and challenges were identified for the implementation of sector plans for reducing greenhouse gas emissions – GHG in the industry. In the table below are illustrated the opportunities and challenges of management, research and development – training and R&D.

	OPPORTUNITIES	CHALLENGES
Management/Measures	• Use of solar thermal energy for pre-heating of equipments evaluating also the large-scale use of cogeneration. • Energy efficiency = competitiveness • More productive use of all resources – productive efficiency/ industrial symbiosis/cleaner production/labeling (seals) for low carbon products. • Incorporate what has already been done, for example, since 1990 by industry in sector plans. In next 10 years there is governance to define what we want to include as reduction. • Incentives to products and processes (ecodesign). • Assess the provisions of Resolution n° 4, 12/15/2010, by the National Institute of Metrology, Standardization and Industrial Quality, which deals with the conformity evaluation. • The best contribution that the Brazilian industrial sector can make to reducing GHG emissions in the short term is energy efficiency and fuel switching.	• Measures have to be technically and economically feasible. • Need for basic information to diagnose where emissions occur (inventories). • Tropicalize measurement, registration and verification methodologies. • Creation of the Public Registry of Inventories and of Project Registration. • What is the production chain of each sector? • Issues with technology transfer and absorption by sectors. There is no fluidity in the incorporation of technological advances.

	OPPORTUNITIES	CHALLENGES
R&D	• Industrial Policy aimed at increasing exposure of Brazil abroad through sector funds (MCTI). • Deployment, in the Amazon and the Brazilian Cerrado, of technological parks for the valuation of local biodiversity and to the manufacture of products with higher added value. Incentives to the local economy.	• Approximation between academy and industry for science and technology – S&T. The business sector should take the demands and lead the process. • Creation of an Academy & Emission Factor Database. • Identification of existing technologies in the country – database. • There is no international technological benchmark (BACT – Best Available Control Technologies). • Technological update of old industrial parks (technological imbalance between regions). • S&T and R&D policies on clean technologies will be crucial and must be considered in an integrated manner, with goals and use of strong incentives of low transaction costs. • S&T policy should combine tribute (increase effect price) and the allowance to R&D (mitigate market size effect).
Training •	• Use of sector funds of training S&T – provided in sector plans. • Promotion of meetings to discuss the issue, not only in the capitals but also in medium-size cities, with structures of local productive arrangements. • Professional certification on measurement and verification, according to the International Performance Measurement and Verification Protocol, in a structured program, encouraging the feeding of an emissions record.	• There is technical deficiency in the public sector and lack of manpower in the private one to perform inventories and measurements, checks and records, mainly in non-energy-intensive industries.

5.3 Opportunities

Attentive to the demands of the industry, SENAI prepares for a new challenge: to strongly support the technological innovation in the productive industrial sector to increase its competitiveness.

Today's scenario involves an explosion of demand for innovation in industry, which depends on applied research actions with strong appeal in environmental sustainability. Such projects are focused on: economy of natural resources (raw materials), reduction and reuse of industrial solid waste, eco-efficiency of production processes, energy efficiency and renewable energy, reuse/recycle of water in industries, reduction of emis-

sions and carbon sequestration. Accordingly, green chemistry also emerged, which can be set as the design, development and implementation of chemical products and processes to reduce or eliminate the use or generation of hazardous substances to the human health and the environment. This concept of green chemistry can also be attributed to cleaner technologies.

To do this, a Network of Innovation Institutes is being implemented within the project Embrapii – Brazilian Cooperation of Research and Industrial Innovation, headed by the Ministry of Science, Technology and Innovation, which will act in a complementary and synergistic way along the different industrial sectors.

SENAI Network of Innovation will act on the frontier of knowledge, in a complementary manner and in close liaison with the knowledge generator sector, exerting the role of connector with the productive sector, contributing decisively to the development of innovative products and processes by Brazilian industry.

SENAI's Institutes of Innovation will offer technological and technical services and advanced vocational education, including postgraduate courses stricto sensu, whose research topics are industry-specific problems. They operate in the network, so that each unit has expertise in a defined area of knowledge, and are responsible for the dissemination of knowledge to all other operating units of the SENAI.

In the area of assistance to industry in technological and technical services related to the environment, the trends are geared to the reduction of impacts at the generating source, contributing to the productive sector move toward a preventive environmental management, with focus on pollution prevention principles. The following key opportunities are highlighted:

- cleaner production;
- atmospheric emissions inventory;
- clean development mechanism – CDM
- sustainable consumption;
- sustainable consumption;
- sustainable events;
- water efficiency;
- energy efficiency;
- waste reutilization (reuse or recycling);
- minimization of losses;
- carbon management;
- cogeneration;
- reduction of carbon footprint;
- water footprint reduction;
- chemical leasing; and
- reverse logistics.

To enhance the availability of these solutions, SENAI is structuring the deployment of Technology Institutes, which will be geared to the provision of technical and technological services and technical and technological education that will meet local and regional needs within the areas of knowledge in which they will be reference.

By having the largest capillarity than Innovation Institutes, the Technology Institutes will be critical to ensure the success of the thematic networks – shared knowledge networks whose goal is to ensure connectivity and complementarity of efforts on specific issues between companies, research centers, SENAI, Ministry of Science and Technology, reference universities and institutions abroad. In addition, the Technology Institutes have the role of observing the industries of its regional and local arrangement, identifying demands for innovation projects to be carried out by Institutes of Innovation.

Thus, the trend is the strengthening and expansion of applied research actions of SENAI units in order to cope with the demand for research, innovation and technology transfer to industry, thereby enhancing the competitiveness of it.

With this expansion of practice scope, the Environmental Network will leverage the supply of technological and innovative solutions to businesses, developing technologies for "tomorrow" in Brazilian industry.

In the area of assistance to industry in vocational education, related to the environment, the opportunities differ for the two target audiences: community and industry.

Community

Since the Decree nº 6.635, November 2008, SENAI started to expand, gradually, the provision of free vacancies in technical courses and in initial and continued training. These vacancies are intended mainly for low-income people, and until 2014, they will correspond to 2/3 of SENAI's revenue.

Over the next four years, with the goal of training youth and adults in vocational courses, through the National Program of Access to Technical Education – Pronatec, SENAI will offer thousands of free vacancies. This program envisages to implement modalities of Professional License Course and Professional Qualification Course, both distance and face-to-face.

The demand of college degree education and post-graduation will rise in the face of increasing competition in a globalized world in pursuit of environmental sustainability. Additionally, SENAI has a strong name and recognition in society, which supports and attracts students to their colleges.

Industry

The opportunities are geared towards the execution of professional learning courses and professional qualification courses, which have lower hourly load, but are applied to specific expertise. This expertise will be aimed at the new environmental thematic in vogue, with focus on pollution prevention, which requires new knowledge from professionals and positioning vis-à-vis the corporate environmental management.

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