

Ministry of Science and Technology
Center of Mineral Technology

Master Plan 2006-2010

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Presentation

The Center of Mineral Technology – CETEM - is a national research institute linked to the Ministry of Science and Technology - MCT. Since its creation, in 1978, it has been involved with technological development in mineral technology. Since implementation, its activities are based on the Triennial Research Programs that have been improved with time, culminating with the First Master Plan (2006-2010), which resulted from the Strategic Planning sponsored by MCT. The methodology employed was developed specifically for the organization's Research Units.

During its 28 years of existence, CETEM accumulated an outstanding track record for services provided, including over 750 technological projects assisting companies that operate in the mining-metallurgical, chemical and materials industries. The scope of its activities characterizes CETEM as a National Institute focused on a well-defined theme: performance in research and development of mineral and environmental technologies. Currently, research activities are conducted in almost all of the Federation states, above all the states of Pará, Bahia, Piauí, Ceará, Santa Catarina, Minas Gerais, Rio de Janeiro and São Paulo.

CETEM occupies an area of 20.000 m², which includes 24 laboratories, 3 pilot plants and a specialized library. Its excellent lab infrastructure, oriented exclusively to the development of mineral technologies, unique in the Country, in addition to the highly qualified technical staff, grant CETEM credibility to face the challenges of the mining and metallurgical industries.

CETEM is mostly funded by public resources. Therefore, it must create programs to develop more projects of interest to society and, preferably, having visibility to society. It plays a significant role in the development of Mineral Technology in the country and in the dissemination of knowledge, a fact evidenced by its scientific and technological production, in addition to the many inquiries made to the Center by the public sector and by private initiative, seeking solutions for technological problems. An expressive portion of its technical capacity is focused on the rendering of services to small and medium sized companies, through mineral-based local productive arrangements.

Rocks and industrial minerals constitute a very significant field in CETEM's operations, for several reasons. This is an area characteristic of micro, small and medium sized

enterprises, presents a vast field to be explored for aggregation of value to products, and the investments are smaller, adequate to micro, small and medium sized enterprises.

In the segments of metallurgy and environment, it is expected that CETEM operates in hydrometallurgical and bio-hydrometallurgical processes, having as references the best available technologies, with attention to minimizing environmental impacts, processing costs, materials waste, waste generation and the maximization of water reuse and/or materials recycling.

It is expected that CETEM will remain as a research center in mineral technology and environment, and that it will excel in research activities, acting nationwide in a decentralized and comprehensive way, strongly focused in its mission, which is **to develop technology for the sustainable use of Brazilian mineral resources**.

CETEM will probably concentrate its efforts in going beyond the development of processes, in order to reach the development of products and prototypes (reactors, processing equipment, etc).

This Master Plan includes Mission, Vision, Values and Principles, Strategic Objectives, Guidelines for Action, and Goals.

During the preparation of this Master Plan, seven major strategic themes were identified.

Human Resources - to perform a group of actions in order to meet the Center's HR demands, according to the research schedule.

Financial Resources for P.D&I - to diversify the funding sources in order to assure the performance of projects considered strategic to the Center.

Advances in Mineral Technology - to develop processes and products in the area of functional minerals/ materials, aligned with the principles of sustainability.

Technological Support with Clean Technologies for Micro, Small and Medium Sized Enterprises and Mineral-Based APLs - to strengthen operations in relationship networks between CETEM and MCT's organs as well as other public and private agencies.

Strengthening of Strategic Management - to adopt management practices focused on improvement of the decision-making process and promotion of CETEM's external image.

Technology Transfer - to implement a Nucleus of Technological Innovation in CETEM for protection of intellectual property.

Decentralized CETEM operations - to consolidate the capacity for decentralized operations in the mining, metallurgical and environmental areas, through partnerships with public and private organizations, both locally and regionally.

Brazil is a country where mining plays a significant role in the economy. In this context, the work performed by the Center is extremely relevant for the technological development of the nation.

This Master Plan was submitted to the appreciation of CETEM'S Technical-Scientific Council, in a meeting held on 01/11/2006, and approved unanimously by all those present.

Adão Benvindo da Luz
Director

Introduction

The construction of a promising future depends, above all, on secure and conscious planning. During the year of 2005, the Center of Mineral Technology started a strategic planning process for the period 2006-2010. The objective is to improve CETEM's management process, so that the institution can successfully accomplish its mission and contribute to the interests of the country.

The initiative is part of a wider project, managed by the Undersecretariat for Coordination of Research Units (SCUP) of the Ministry of Science and Technology, aligned to the implementation of MCT's Strategic planning, of Research Units (UPS), and Social Organizations (OSs) linked to it.

The strategic planning process in the UPs began in late 2004, when a group of MCT consultants started periodic visits to UPs with the objective of providing support during the strategic planning process. In March of 2005, in order to facilitate and organize the work, CETEM created a Group of Strategic Management (GGE) and nine Workgroups (GTs). Internal events were held, while representatives of GGE participated in external events, with the purpose of developing the Center's work.

CETEM's process of strategic planning followed the methodology established by MCT and enabled, in a participative and systematized way, a wider scope reflection, concerning the destinies of the Unit, its mission and goals as a public institution dedicated to scientific and technological research. Therefore, it was possible to understand and to adequately respond to the changes that are happening in the external environment, thus identifying and overcoming the difficulties brought by those changes or taking advantage of opportunities offered by them.

The result of the Strategic Planning process undertaken by CETEM is contained in this Master Plan, which gathers the key elements to guide the actions of the Center for the next five years. There we find, among other items, the mission, the vision of the future, values, guidelines and strategic objectives to be pursued from now on.

The Center of Mineral Technology intends that this Master Plan will aid in the preparation of the next Terms of Management Commitment executed with the Ministry of Science and Technology and that the whole process undertaken during the year of 2005 supplements

MCT's Strategic Planning and the Federal Government's Pluriannual Plan. .

In addition to marking the closing of the Strategic Planning, the publication of this Master Plan launches a new process of strategic management currently being implemented in CETEM. Based on this work, the Ministry can follow up on compliance with the guidelines proposed in the master plans and effect the necessary adjustments, always with the objective of optimizing the management process in the areas of science, technology and innovation.

The work performed was made possible by the unrestricted support of CETEM's High Management, represented by director Adão Benvindo da Luz, as well as coordinators and service heads, with the useful participation of the Center's researchers, and the aid of the Undersecretariat for Coordination of MCT's Research Units, through undersecretary Avílio Antonio Franco and the Ups coordinator-general, Carlos Oití Berbert. Also, the support received from the coordinator of Strategic Planning of the Center for Management and Strategic Studies (CGEE), Antonio Carlos Guedes, was essential, as well as MCT's consultant Gileno Fernandes Marcelino and Professor Joaquim Rubens Fontes Filho, from Fundação Getúlio Vargas (FGV-RJ), who provided direct advice to CETEM.

1. Mission

The Mission of the Center of Mineral Technology is:

“To develop technology for the sustainable use of Brazilian mineral resources.”

2. Vision of the Future

“To be recognized as one of the world’s PD&I leaders in mineral technology.”

3. Values and Principles

Ethics and transparency

To have an administration committed to an ethical and transparent conduct, which values its collaborators and respects diversity and/or work methods.

Organizational growth

To develop an administration that stimulates creativity, innovation and the sharing of knowledge in order to increase institutional qualification.

Technological Excellence

To perform all PD&I acts, in all the areas of operation, using methods and procedures oriented towards quality, and allowing for an interdisciplinary approach and a global vision of the themes in question.

Valorization of Knowledge

To invest in the professionals' continuous qualification and training, thus motivating and valuing competences.

Social responsibility

To act in consonance with the paradigms of sustainability, considering the social, economical, cultural, technological and environmental influences and consequences

4. Scenarios

For the preparation of scenarios, a Morphologic Analysis Matrix - MAM was built, based on the main threats and opportunities identified in the analyses of the external environment. In this way, for each critical variable three possible future states were defined, Scenario 1 being considered as the most probable (moderate), followed by Scenarios 2 and 3, considered less probable and with future projection characteristics that are more optimistic and more pessimistic, respectively. For this Master Plan, it was decided to formulate the major strategies of the institution based on Scenario 1 without, however, dismissing the possibilities presented in other scenarios.

4.1 Scenario 1 - moderate

Availability of Public Funding for PD&I in the mineral area

There will be no significant additional investment in the segment. The sectorial financial resources of the mineral segment will not receive significant increments.

Application of biotechnological processes in the mineral area

Accelerated growth of the use of biotechnology in the processing, extraction and treatment of waste products and effluents.

Network Cooperation

Moderate expansion of the networks due to a change in the work requirements of the industry organizations.

Use of Information Technology (IT) associated to mineral processing (including models for simulation, automation, and control)

Widespread use in large companies, but with moderate growth in PMEs mostly as a result of implementation, training and maintenance costs.

Requirements in metrological practices and certification in contracts /partnerships

Increased demand for laboratories accredited in certification and test runs.

Characterization and use of nano-structured materials

Increase of research activities showing a significant production of innovations and applications.

Technological alternatives for recycling materials

High implementation costs for recycling projects, associated to inefficient inspections, will reduce the application width of the techniques, limiting their adoption to large companies and restricting their adoption by small sized and medium ones - PMEs.

Protection of Intellectual Property

There will not be significant changes, maintaining a context of fragility of the institutional environment, particularly governmental organizations responsible for such protection.

4.2 Scenario 2-optimistic

Availability of Public Funding for PD&I in the mineral area

Increase of investments due to contribution of resources from sectorial funding and other resources from increased collection.

Application of biotechnological processes in the mineral area

Increasing adoption of biosafety regulations, requiring adaptation of the laboratory infrastructure.

Network Cooperation

Strong expansion of this type of work, through strategic alliances, for conduction of large-sized impacting projects, reinforced by the need for application of large sums of financial resources in order to conduct projects.

Use of Information Technology (IT) associated to mineral processing (including models for simulation, automation, and control)

Widespread use of TI in all segments of the mining-metallurgical industry.

Requirements in metrological practices and certification in contracts /partnerships

Certification requirements will restrict noticeably the market performance of organizations

that do not meet such requirements.

Characterization and use of nano-structured materials

Significant increase in the demand for nano-structured materials and, as consequence, of the added value of such materials. Increase in the preparation and characterization of industrial consumption materials for manufacturing of nano-structured materials.

Technological alternatives for recycling materials

Increased demand for more efficient technologies due to the need of reducing environmental liability; at the same time, increase of market share for use of recycled materials, seeking alternative destination for residues. This movement is impelled by society pressure, and demands from companies a higher level of social and environmental responsibility.

Protection of intellectual property

Restrictions imposed by the companies, as a strategy to maintain secret their technological innovations, may inhibit the improvement of intellectual property protection policies.

4.3 Scenario 3-pessimistic

Availability of Public Funding for PD&I in the mineral area

Decrease of sectorial funding with negative impact on the flow of public resources for PD&I, mineral area included. Reduction of budgetary resources under P&D.

Application of biotechnological processes in the mineral area

Loss of competitiveness of biotechnological processes in relation to other processes (chemical, for instance).

Network Cooperation

Fragile and punctual alliances committed to studies or projects with reduced scope.

Requirements in metrological practices and certification in contracts /partnerships

Accelerated growth of demand may inhibit the certification requirement.

Characterization and use of nano-structured materials

Discouragement with the results obtained in the area and migration of research to other areas.

Protection of intellectual property

A reversal in the industry, due to heavy government investing arising from business sector pressures to reinforce intellectual property rights.

5. Strategic objectives

In order for CETEM to accomplish its Mission of **developing technology for the sustainable use of Brazilian mineral resources** and be in total consonance with the macro-guidelines defined by the Federal Government, priority was given to objectives and goals compatible with MCT's Main Axes of Strategic Planning. Such conditions assure to the institution its institutional sustainability as a public organization that seeks the social valuation of goods and products produced by it.

Therefore, the Strategic Objectives mentioned in this chapter are in alignment with those of Strategic Planning - PE of MCT, called Axes that, on their turn, unfold into Sub-axes. In each Sub-axis, the Specific Objectives of CETEM are identified. Thus, the public manager and the society may see how the institution associates and offers its contribution to the MCT's Axes of Strategic Planning.

5.1 Strategic Objective I: Industrial, Technological and Foreign Trade Policies

Sub-axis: Support to Industrial Policies

5.1.1 Specific objective 1: To follow up on the advancements of conventional processing, extraction and recycling of mineral goods and materials.

Goal 1

To prepare, until December 2007, a study on alternative minerals for agriculture.

Goal 2

To develop, until December 2008, three technologies for the recovery of mined areas and environmental control.

Goal 3

To develop, until December 2008, two technologies for ore leaching.

Goal 4

To develop, until December 2008, three technologies for the recovery of metals using the process of extraction by solvents.

Goal 5

To develop, until December 2008, two technologies for treatment of mercury-containing residues.

Goal 6

To develop, until December 2008, a technology for extraction of aluminum, based on bauxites.

Goal 7

To develop, until December 2008, a process for treatment of anodic slimes from metal electrorefining processes.

Goal 8

To develop, until December 2008, two processes for pyrometallurgical treatment of residues.

Goal 9

To develop, until December 2007, five computer systems for characterization, modeling, simulation, optimization and automation of crushing, grinding, gravity concentration, flotation, and solid-liquid separation processes.

Goal 10

To prepare, until December 2007, a study for technological characterization and processing of nickel lateritic ores.

Goal 11

To develop, until October 2006, an advanced technology for characterization and processing of iron ores.

5.1.2 Specific Objective 2: To identify opportunities in emerging technologies (i.e., nanotechnology, biotechnology, modification of mineral properties, etc.)

Goal 1

To develop, until December 2006, a technology for using clay in hydrocarbon retention in oil extraction waters.

Goal 2

To develop, until January 2007, multidisciplinary strategies to evaluate bio-geochemical processes in rock-reservoir sediments.

Goal 3

To develop, until September 2006, analytical methods for determination of mercury and its specimens in oil and in oil fractions.

Goal 4

To develop, until November 2008, an analytical method for determination of silicon traces in diesel.

Goal 5

To develop, until December 2007, a pyrochlore synthesis for use in the immobilization of bioaccumulative and radioactive metals.

Goal 6

To develop, until December 2007, a chemical and technological characterization of an atmospheric particulate.

Goal 7

To develop, until December of 2008, two processes of ore bioleaching (flotation concentrates, etc.).

Goal 8

To develop, until December 2008, five biotechnological processes for treatment of residues (solids and/or liquids).

Goal 9

To develop and to apply, until December of 2008, the electrokinetic technique in the treatment of at least one type of residue.

Goal 10

To implement, until December 2008, ecological effectiveness practices in two industrial units.

Goal 11

To develop, until December 2007, processes for modification of the physical properties in materials and mineral inputs for the paper manufacturing industry.

5.1.3 Specific Objective 3: To produce certified reference materials of mineral samples

Goal 1

To produce, until December 2010, ten certified reference materials of mineral samples.

Goal 2

To promote, until December 2008, three proficiency test programs for laboratories of mineral analyses.

5.2 Strategic Objective II: National Strategic Objectives

Sub-axis: Amazonian

5.2.1 Specific Objective 1: To develop technological research projects focused on Amazonian mineral resources

Goal 1

To develop, until December 2007, a technology for use of marginal bauxites from the Amazonian region.

Goal 2

To prepare, until December 2007, a fluids drainage study on minerals pulps from the Amazonian region.

Goal 3

To prepare, until December 2007, a study to evaluate environmental impacts due to small-sized gold prospecting in the Amazonian region.

5.3 Strategic Objective III: Science, Technology and Innovation for Social Inclusion and Development

Sub-axis: Technological Vocational centers

5.3.1 Specific Objective 1: To promote the implementation of vocational centers directed to local mining activities.

Goal 1

Create and support, no later than 2010, four vocational centers located, respectively, in the North, Northeast, Southeast and Center-west regions.

Sub-axis: Northeast and Semi-Arid

5.3.2 Specific Objective 2: To develop technological research projects directed to the mineral resources of the Northeast and the Semi-arid regions.

Goal 1

To develop, until December 2007, two technologies seeking the integral use of the northeastern pegmatites.

Goal 2

To develop, until December 2007, a study on the sustainable administration of aquifers in the semi-arid region.

Sub-axis: Appropriate technologies / Social Technologies

5.3.3 Specific Objective 3: To develop appropriate technologies to foster the level of competitiveness and to reduce the environmental impact of the productive segment of ornamental rocks in the country

Goal 1

To develop, until December 2010, two technologies for treatment and use of the residues from ornamental rock sawmills.

Goal 2

To offer a master's degree course *lato senso* in ornamental rocks with 30 students every two years, beginning in 2007.

Goal 3

To collaborate with the Federal Center for Technological Education - CEFET-ES in the creation of at least one class for the mining technical course, beginning in 2007.

5.3.4 Specific Objective 4: To increase CETEM's participation in projects for the development of technologies connected to micro, small and medium enterprises and to APLs.

Goal 1

To support, until December 2007, the technological development of the Local Productive Arrangement (APL) for utilization of opals from Pedro's II -PI.

Goal 2

To support, until December 2007, the technological development of the Local Productive Arrangement (APL) for utilization of limestone from the Cariri-CE area.

Goal 3

To support, until December 2007, the technological development of the Local Productive Arrangement (APL) for utilization in flooring and lining of the rocks from Padua-RJ.

Goal 4

To prepare, until December 2010, studies for the development of fast methods for semi-quantitative determination of bioaccumulative metals (Hg, Pb, Zn, Cd, As).

Goal 5

To develop, until December 2008, products and equipments directed to collectors of recyclable materials.

Goal 6

To disseminate, until December 2007, an alternative method for mercury determination in environmental samples, with a view to the diagnosis of pollution, follow up of processes and prevention of mercury intoxication.

Goal 7

To implement, until December 2007, eco-toxicological tests for the mining/ metallurgical industry.

Goal 8

To implement, until December 2007, eco-toxicological tests in environmental samples.

Goal 9

To develop, until December 2007, technologies and methodologies for environmental monitoring of the quality of the waters in the carboniferous basin in southern Santa Catarina.

Goal 10

To develop and to implement, until December 2008, appropriate technologies for the improvement in the quality of life, health and environment in the recycling of residues of

construction and demolition (RDC) and in soapstone art.

5.4 Strategic Objective IV: Consolidation, Expansion and Integration of the Science, Technology and Innovation National System

Sub-axis: Support to the institutional infrastructure of research

5.4.1 Specific Objective 1: To develop prospective studies of the mineral segment

Goal 1

To organize, until December 2007, the event “Trends in the Mineral Segment - Brazil 2015.” Technological panels (Crushing, Improvement, Extractive Metallurgy, Mining and Industrial Minerals).

Goal 2

To organize, until December 2007, the event “Trends in the Mineral Segment - Brazil 2015.” Systemic panels (Environment and Economic and Social Issues in Mining).

Goal 3

To prepare, until December 2007, a study of Scenarios on the Mineral Segment in Brazil - 2015: Vision of the Future.

Goal 4

To prepare, until December 2007, a study on the recycling of materials originated by mineral and metal works.

Goal 5

To prepare, until December 2007, a study on the importance of mining for the economical and social welfare of the population.

Goal 6

To develop, until December 2007, a computer system for consultation of historical series in the Brazilian mineral segment.

Goal 7

To prepare, until December 2007, a diagnosis of the environmental problems in the segment of ornamental rocks.

6. Guidelines for Action

6.1 Operational guidelines and Goals: Research and development

Guideline 1: To disseminate the scientific and technological knowledge developed by CETEM.

Goal 1

To maintain, until December 2010, the General Index of Publications - IGPIB of TCG of CETEM, at a value equal to or higher than 2.

Guideline 2: To develop research projects involving national and international cooperation.

Goal 1

To maintain, until December 2010, the Index of Projects, Researches and International Cooperation Actions - PPACI of TCG of CETEM at the value of 17.

Goal 2

To maintain, until December 2010, the Index of Projects, Researches and National Cooperation Actions - PPACN of TCG of CETEM at the value of 27.

Guideline 3: To develop processes and techniques to assist companies operating in the mineral-metallurgical segment.

Goal 1

To maintain, until December 2010, the Index of Developed Processes and Techniques - PcTD of TCG of CETEM at a value equal to or higher than 0.8.

Guideline 4: To seek customer satisfaction by complying with deadlines and contracts.

Goal 1

To maintain, until December 2010, the Deadlines and Contracts Compliance Index - CPC of TCG of CETEM at a value equal to or higher than 90%.

Guideline 5: To assist the productive segment.

Goal 1

To maintain, until December 2010, the Financial Index of Service and Technology Transfers - IFATT of TCG of CETEM at R\$ 20.000 by technician.

Guideline 6: To conduct studies, diagnoses and consulting of interest to the mineral segment and related segments.

Goal 1

To maintain, until December 2010, the Index of Studies Performed - IER of TCG of CETEM at 0.15.

Guideline 7: To provide technological support to micro, small and medium domestic companies.

Goal 1

To maintain, until December 2010, the Index of Support to Micro, Small and Medium Companies - APME of TCG of CETEM at 35%.

Guideline 8: To increase the number of invention privilege filings, as well as processes, products and prototypes

Goal 1

To maintain, until December 2010, the Index of Intellectual Property - IPIIn of TCG of CETEM at a value equal to or higher than 0.07.

Guideline 9: To promote social inclusion.

Goal 1

To maintain, until December 2010, the Index of Technological Dissemination of Social Interest -IDTIS of TCG of CETEM at a value equal to or higher than 40.

Goal 2

To increase, by at least 10% a year, the budget that supports the activities of the National Week for C&T.

6.2 Administrative and Financial Guidelines and Goals

6.2.1 Human Resources

Guideline 1: To perform joint actions with the government and to form alliances with companies and universities in order to meet CETEM's RH demands.

Goal 1

To staff, until December 2010, the 27 job positions now existing and to increase the current staff of 117 public servants (90 jobs filled + 27 vacant) by 30% (152 servants).

Goal 2

To increase by 10% per year the PCI quota.

Goal 3

To increase by 10% per year, in relation to the number of employed researchers and technologists, the number of researchers involved with projects.

Guideline 2: To qualify and to train CETEM's human resources.

Goal 1

To maintain, until December 2010, the Index of Qualification and Training - ICT of TCG of CETEM at 5%.

Guideline 3: To adapt the number of CETEM's collaborators according to need.

Goal 1

To maintain, until December 2010, the Index of Relative Participation of Scholarship Holders - PRB of TCG of CETEM at 40%.

Goal 2

To maintain, until December 2010, the Index of Relative Participation of Outsourced Personnel - PRPT of TCG of CETEM at 50%.

6.2.2 Financial Resources

Guideline 1: To diversify funding sources for the performance of CETEM's strategic projects.

Goal 1

To maintain, until December 2010, the Income /OCC Ratio - RRP of TCG of CETEM at a value equal to or higher than 50%.

Guideline 2: To enhance CETEM's budget planning.

Goal 1

Before the beginning of each new financial year, to prepare and implement a plan for application of treasury department resources in research.

Goal 2

To increase, in 2006, the funding budget by 35% (recovery of historical losses) and to grow 10% as of 2007.

Goal 3

To maintain, until December 2010, the Index of Application in Research and Development - APD of TCG of CETEM at a value equal to or higher than 20%.

Goal 4

To maintain, until December 2010, the Index of Budgetary Fulfillment - IEO of TCG of CETEM at 100%.

6.2.3 Organizational Administration

Guideline 1: To implement management practices in accordance with PNQ's criteria.

Goal 1

To meet at least one requirement from each criterion established by PNQ every year.

Goal 2

To implement and make operational until June of 2007 the System of Managerial and Technological Information – SIGTEC, with the support of CenPRA and SCUP.

Guideline 2: To promote the external image of CETEM.

Goal 1

To prepare until February of each year the plan of institutional promotion.

6.2.4 Infrastructure

Guideline 1: To enlarge and upgrade the physical computer infrastructure of CETEM.

Goal 1

To replace, until December 2006, the cabling infrastructure of the Center's administrative sector.

Goal 2

To implement, until July 2007, a videoconferencing project.

Goal 3

To implement, until December 2007, a Voice IP communication project.

Goal 4

To modernize, until December 2008, the consulting and loan services offered by the Center library.

Guideline 2: To modernize the Center air-conditioning systems.

Goal 1

To replace, until December 2006, the central air-conditioning system for the laboratories and researchers' rooms.

Guideline 3: To enlarge and modernize the physical and instrumental infrastructure of CETEM's laboratories of chemical analyses, mineral processing and extractive metallurgy.

Goal 1

To adapt, until December 2007, the physical and instrumental infrastructure for implementation of two biotechnology laboratories, installed according to biosafety norms.

Goal 2

To adapt, until December of 2007, the physical and instrumental infrastructure for implementation of a hydrometallurgical test laboratory with high-pressure processes and reduction by hydrogen, according to the safety regulations in effect.

Goal 3

To adapt, until December 2006, the physical and instrumental infrastructure for implementation of a laboratory of aggregates.

Goal 4

To adapt, until December 2006, the physical and instrumental infrastructure for implementation of an instrumented Flotation Pilot Unit.

Goal 5

To adapt, until July 2006, the infrastructure for a laboratory of chemical ultra-traces analyses for reception of the equipment of CG-ICP-MS.

Goal 6

To implement, until December 2007, the laboratory of applied eco-toxicology to the mineral-metallurgical industry.

Goal 7

To update, until December 2007, the lab infrastructure for chemical and mineralogical analyses related to the mineral-metallurgical industry.

Goal 8

To adapt and modernize, until December 2008, the current lab infrastructure regarding hydro-metallurgical processes, in compliance with the safety norms in effect.

7. Structuring Projects

- Institutional Structuring Projects

Structuring Project 1: To promote CETEM's operations in technological outreaching in the mineral-metallurgical and environmental areas (technological outreaching).

Goal 1

To implement, until 2010, the advanced campus of Cachoeiro de Itapemirim – ES and the creation of another advanced campus.

Goal 2

To establish, until 2010, at least three “associated” laboratories (development of projects through durable partnerships), preferably in the areas North, Northeast and South.

Structuring Project 2: To obtain the accreditation /certification for test labs and processes.

Goal 1

To implement, until 2010, management systems for accreditation /certification of three laboratories.

- Inter-Institutional Structuring Projects

Structuring Project 3: Creation of a Nucleus of Technological Innovation in CETEM, or associated to similar institutes, to disseminate and encourage intellectual protection of innovations (Innovation Act).

Goal 1

To negotiate, until 2010, the transfer of at least two technologies per year generated at CETEM.

Goal 2

To file two requests for the registration of privilege of invention per year.

Other institutions involved: INT and IEN.

Structuring Project 4: Brazilian Aquatic Eco-regions: Delimitation of the Xingu-Tapajós - CT-Hidro subunit.

Goal 1

To form, until December 2006, a network of multidisciplinary and multi-institutional technological research.

Goal 2

To generate, until December 2007, primary data, seeking conservation and sustained use of natural resources in the eco-region Xingu-Tapajós.

Other participant institutions: : Companhia de Pesquisa de Recursos Minerais - CPRM, Fundação Oswaldo Cruz - FIOCRUZ, Centro de Excelência em Engenharia de Transportes - CENTRAN/Exército, Universidade Federal do Amazonas - UFAM, Universidade Federal Rural da Amazônia - UFRA, Ministério da Saúde - MS, Ministério de Minas e Energia - MME.

CONCLUSION

The preparation of this Master Plan enabled us to reach certain conclusions, summarized in the following comments:

- The Center's Technical Staff, realizing that Strategic Planning is a Project of institutional Interest, took intense part in its activities and contributed to identify the research lines considered strategic to CETEM;
- The commitment of each researcher from the Center in the preparation of this Master Plan will certainly help management to implement the actions required to attain the expected goals;
- Strategic Planning was found to be a tool of great importance to the Center, for the definition of strategic and action guidelines;
- It should be noted that the strategic objectives identified by the Strategic Planning are aligned with governmental Programs and Policies;
- Fulfilling the Center's human resources requirements is a key factor for the success of this Master Plan and for attainment of the goals agreed with TCG;
- CETEM must also widen its decentralized performance, creating Advanced Campuses in strategic areas of the country, for the mining and metallurgical industries or establishing associated laboratories (developing projects in a durable way);
- CETEM must also concentrate efforts in the development of technologies that are appropriate to the regional and local context, increasing its participation in projects directed to micro, small and medium enterprises and Local Productive Arrangements (APLs); and
- It would be advisable that, after being implemented, the Master Plan were periodically reviewed to adapt its actions to the expected goals.

Acronyms and Abbreviations

APD - Index of Application in Research and development – Índice de Aplicação em Pesquisa e Desenvolvimento

APL – Local Productive Arrangement – Arranjo Produtivo Local

APME - Support to Micro, Small and Medium Enterprises – Apoio à Micro, Pequena e Média Empresa

CENTRAN/ Military - Center of Excellency in Engineering of Transports – Centro de Excelência em Engenharia de Transportes

CETEM - Center of Mineral Technology - Centro de Tecnologia Mineral

CGEE - Management and Strategic Studies Center – Centro de Gestão e Estudos Estratégicos

CG-ICP-MS – Gas Chromatograph coupled to a mass spectrometer – Cromatógrafo a gás acoplado a um espectrômetro de massa

CPRM - Company for Research of Mineral Resources (Companhia de Pesquisa de Recursos Minerais) – Companhia de Pesquisa de Recursos Minerais

CT&I - Science, Technology and Innovation – Ciência, Tecnologia e Inovação

FIOCRUZ - Fundação Oswaldo Cruz

– Fundação Oswaldo Cruz

FGV-RJ - Fundação Getúlio Vargas

– Fundação Getúlio Vargas

GGE - Strategic Management Group

– Grupo de Gestão Estratégica

GTs - Workgroups

– Grupos de Trabalho

ICPC - Deadlines and Contracts Compliance Index – Índice de Cumprimento de Prazos e Contratos

ICT - Qualification and Training Index – Índice de Capacitação e Treinamento

IDTIS - Index of Social Interest Technological Diffusion – Índice de Difusão Tecnológica de Interesse Social

IEN - Institute of Nuclear Engineering – Instituto de Engenharia Nuclear

IEO - Index of Budgetary Fulfillment – Índice de Execução Orçamentária

IER - Index of Studies Performed – Índice de Estudos Realizados

IFATT - Financial Index for Services and Technology Transfer – Índice Financeiro de Atendimento e Transferência de Tecnologia

IGPUB - General Publication Index – Índice Geral de Publicações

INT - National Institute of Technology – Instituto Nacional de Tecnologia

IP - Internet Protocol – Internet Protocol

IPIn - Index of Intellectual property – Índice de Propriedade Intelectual

MAM - Morphologic Analysis Matrix – Matriz de Análise Morfológica

MCT - Ministry of Science and Technology – Ministério da Ciência e Tecnologia

MME -Ministry of Mining and Energy – Ministério das Minas e Energia

MS -Ministry of Health – Ministério da Saúde

OSs - Social Organizations – Organizações Sociais

OCC - Other Funding and Capital – Outros Custeios e Capital

PcTD - Index of Processes and Techniques Developed – Índice de Processos e Técnica Desenvolvidos

PD&I - Research, Development and Innovation – Pesquisa, Desenvolvimento e Inovação

PMEs - Small and Medium Enterprises

– Pequenas e Médias Empresas

PNQ - National Quality Award – Prêmio Nacional da Qualidade

PPACI - Index of Projects, Researches and Actions in the area of International Cooperation – Índice de Projetos, Pesquisas e Ações de Cooperação Internacional

PPACN - Index of Projects, Researches and Actions in the area of National Cooperation - Índice de Projetos, Pesquisas e Ações de Cooperação Nacional

PRB - Rate of Relative Participation of Scholarship Holders

– Índice de Participação Relativa de Bolsistas

PRPT - Rate of Relative Participation of Outsourced Personnel – Índice de Participação Relativa de Pessoal Terceirizado

RH - Human resources – Recursos Humanos

RRP - Income /OCC Ratio – Índice Relação entre Receita Própria e OCC

SCUP - Undersecretariat for Coordination of the Research Units – Subsecretaria de Coordenação das Unidades de Pesquisa

TCG - Management Commitment Term – Termo de Compromisso de Gestão

TI - Information Technology – Tecnologia da Informação

UFAM - Federal University of Amazon

– Universidade Federal do Amazonas

UFRA - Federal Rural University of Amazon – Universidade Federal Rural da Amazônia

UPs - Units of Research – Unidades de Pesquisa

Glossary

Threats - External environment variables, of key future and negative importance for the activities and performance of organizations.

Follow-up (or monitoring) - Management process simultaneous to performance, to compare steps taken with planning. Activity oriented to a search for efficiency and correction of direction (offering means to turn plans into reality). Same as with planning, it can be performed in three levels: strategic, tactical and operational.

Strategic alliances - Agreements entered among organizations with common objectives, to share resources that are scarce and to obtain synergies of resources and results. For instance, research projects done in networks.

External environment (of an organization) - the whole group of organizations, social groups and events located outside the limits of an organization, but which have the power to influence it (or to suffer its influence).

Internal environment - People (with their capacities, aspirations and beliefs), norms (or internal laws), physical structures and management processes and systems, inside an organization.

Morphologic analysis - Study of the possible future status of variables that influence a certain system, and association of those status to macro-variables (called themes), seeking to define future scenarios for that system. Performed with the Matrix of Morphologic Analysis.

Processing (or ore treatment) – Operations with mineral goods, seeking to modify the granulometry, the relative concentration of the mineral species or its form without, however, modifying the chemical or physical identity of the mineral.

Bio-hydrometallurgy - A branch of biotechnology that deals with the study and application of economic potential in the interactions between the microbial world and the mineral kingdom.

Biosafety - Generic designation for safety in the control and minimization of risks resulting from the use of different technologies biologically based, whether in a laboratory or applied to the environment. Biosafety is regulated in several countries by a group of laws, procedures or specific guidelines.

Biotechnology – A large group of enabling technologies that imply the use, controlled alteration and optimization of live organisms or their parts, cells and molecules for the

generation of products, processes and services. The biotechnological processes are applied and used by several segments, such as health, agribusiness and environment, and relate to different areas of knowledge, such as molecular biology, genetics, physiology, microbiology, chemistry etc.

Scenarios - Group of characteristics and conditions from the external environment, expected or feared in the future, which condition the functionality, operations, strategy and success of an organization or system.

Customers (of a CT&I organization) - People or organizations that use knowledge, technologies and services of an organization, paying for them directly.

Context - the whole set of organizations, social groups and events located outside the limits of an organization, which may influence it (the same as external environment).

Relevant context - Organizations, social groups (or groups of interest, or stakeholders) and events that have influence or interest in the priorities and products of an organization.

Requirements (for CT&I organizations) - Need for knowledge and technologies capable of altering the performance of a productive and/or of knowledge system.

Eco-regions - Group of natural communities, geographically different, that share most of their species, dynamics, ecological processes and environmental conditions. They have been proposed as instruments for research, inventory, monitoring and environmental management, and may be considered geographical planning units for biodiversity conservation.

Strategy (organizational) - Planning of an organizational change in order to adapt (in reaction or anticipation) to the changes and challenges of the external environment. Strategies articulate players, factors and actions to reach its objectives, taking into consideration the context of the organization.

Sectorial Fund - Fund created by the Brazilian government to motivate the scientific and technological development in strategic areas and to build a new form of financing in Science, Technology and Innovation.

Future - The result of historical tendencies and hypothetical events.

Management - (a) Act of managing; administrating; (b) planning, organization, leadership and control of the people that make up a company and of the tasks and activities performed by them.

Strategic Planning Management - Consists of planning the several stages of the process of Strategic Planning; to assign roles to teams and workgroups; to provide the means and to assure capacities for accomplishment of all the stages; to mobilize the different organizational groups; to follow up and evaluate, using internal or external appraisers, the progresses and results of the process; and to make pertinent decisions from those evaluations.

Strategic Management - Administration of an organization, based on its strategic plan, oriented so that tactical and operational planning, as well as management systems, are aligned with the organizational strategy; and also oriented to the continuous monitoring of the external environment, with the purpose of performing the necessary adjustments in strategy required by changes in the environment.

Hydrometallurgy - Consists in the treatment of ores, concentrates and other materials containing metals, such as residues, metallic leagues etc., by specific leaching processes (liquid medium), providing the consequent recovery of such metals, whether by solvent extraction process followed by electro-recovery or by selective precipitation processes of the respective metallic hydroxides.

Indexes (or strategic indicators) - Quantifiable variables, linked to the implementation of the strategy, established *a priori* to be used in the monitoring of the strategy implementation.

Infrastructure (for research support) - Group of physical resources, indispensable to the development of the researches and/or technical services provided by the Unit. Includes laboratories, experimental fields, facilities, machines and equipments, vehicles etc.

Innovation - Introduction in the market of products, processes, methods or systems that did not exist previously, or with some new or different characteristic from what existed until then, with strong socioeconomic repercussions.

Biosafety Act - Law that establishes safety standards and inspection mechanisms for the use of biotechnology.

Innovation Act - Law # 10.973, dated December 2, 2004. Establishes measures for incentive to innovation and scientific and technological research in productive environments, aiming at technological autonomy and the industrial development of the country.

Morphologic Analysis Matrix – Double entry matrix, where are listed, on one side, the variables that influence a system and, on the other, the possible future status of those variables, for the preparation of future scenarios. Enables morphologic analysis.

Goals (strategic) - Quantified strategic objectives, with definition of attainment deadlines.

Methodology (of Strategic Planning) - Description of a systematized process, with its stages and examples of instruments to guide the fulfillment of the Strategic Planning.

Metrology – Deals with measures and weights, whose units systems are based in three basic quantities: length, mass and time.

Mission - Declaration of the purposes, scope and principles of an organization, that distinguish it from others.

Nano-structured - Structured according to the principles of nano-technology, understood as the technology or art of manipulating materials in the atomic or molecular scale, particularly to build microscopic devices.

Specific objectives – Long term institutional direction, contained in the organizational strategies, defined by the Strategic Planning. In the present document, refers to CETEM's specific strategic objectives, which are aligned with MCT's strategic objectives.

Strategic objectives - Long term institutional direction, contained in the organizational strategies, defined by the Strategic Planning. In the present document, refers to CETEM's specific strategic objectives defined in MCT's strategic objectives.

Opportunities - Variables of the external environment, of key future and positive importance for the activities and performance of an organization.

Participation - Process by which groups of interest influence and share control over the establishment of priorities, policies, allocation of resources and/or implementation of programs.

Patent - Temporary title or deed of an invention, utilization model or industrial drawing, granted by the State to the inventor, author, natural or juridical person holder of rights over creation. The patent gives its title-holder a legal status, by which the patented invention can be explored (manufactured, imported, sold and used), upon the titleholder's authorization.

Strategic Planning – A form of planning that allows an organization to understand and to respond appropriately to changes that are either happening or are expected to happen in the external environment. Guided by long-term objectives and formalized by a strategic plan or Master Plan.

Master Plan (of an organization) - Document that synthesizes the main results of an organization's Strategic Planning.

Strategic Plan - The same as Master Plan.

Process - A continuous sequence of operations that have a certain unity, or that occur with certain regularity, in which an operation of processing, extractive metallurgy, chemistry, etc. can be performed.

Products (of CT&I) - Scientific knowledge, technologies, services or, in some cases, physical products generated by a CT&I organization. They can be in the form of publications (technical articles, bulletins, books...), patents, licenses, softwares, methodologies, etc, and in the form of different services (training, consulting, advising, analyses etc).

Structuring Project (or strategic project) - Projects related to strategy, with a management aligned to the strategic plan of the organization and oriented to intervention and change of elements in the internal environment that were recognized as weaknesses in the organization. Examples of structuring projects are: review and improvement of the Managerial Information System of the Unit; preparation of a System of Evaluation and Awarding; preparation of a last-generation research model; development of a Fund Raising System.

Intellectual Property – Any type of property that originates from conception or is a product of the intelligence expressing a group of rights held by the intellectual (writer, artist or inventor) as author of the work imagined, prepared or invented. In a broad sense, the

author or creator unrestricted power over an immaterial asset. It becomes restricted when conditioned to prerogatives of time and space. The title to the intellectual property can be granted in the artistic, technical and scientific categories.

Reactor - processing unit for substances that produce molecular transformation reactions (i.e., cracking reactor, polymerization reactor etc.).

Reuse - There are two main types of recycling: internal and external. Internal recycling, in an industrial processing of materials, and also called reuse of the material, consists of reusing the material that would be discarded as effluent. That is, the material returns to the same process that generated it. External recycling utilizes effluents that were discarded in the process, not necessarily the same process that generated them. A typical example is the recycling of old newspapers for re-pulping and production of new paper.

Management Systems - Forms of internal structuring of an organization employed to manage the performance of activities by the members. Examples of management systems for CT&I organizations are the Project Follow up and Evaluation Planning Systems, Strategic Programs and Plans; Managerial Information System; Awarding and Rewarding System, etc.

Sustainability - Sustainable development harmonizes the imperative of economic growth with the fostering of social equality and the preservation of natural resources, thus guaranteeing that the needs of the current generations are met without compromising the needs of future generations.

Institutional Sustainability - Continuous organizational capacity for: a) understanding the needs and aspirations of interest groups, in their external environment, or of the operation conditions originating from those groups or from events occurring in the environment; b) self-organizing its capacities, processes and results in order to meet those demands under the established conditions.

Technology - (a) Method to transform *inputs* into *outputs*; (b) the application of the results of scientific research to the production of goods and services; (c) specific type of knowledge, process or technique demanded for practical ends; (d) the knowledge that a society has about sciences and industrial arts, including social and physical phenomena, and its application to the production of goods and services. There are two major

technology categories: product technology (tangible and easily identifiable components) and process technology (techniques, methods and procedures).

Validation of Master plan - Process of evaluation of the Master Plan of an organization, performed with internal and external stakeholders, to verify its adequacy to changes in the external environment, and to identify adjustments that must be made to enhance adaptation.

Values - Beliefs that guide the organizational action.

Critical variables (or critical factors) - Variables with higher impact (either positive or negative) on the performance of a system (in this case, of an organization). In Strategic Planning processes, such variables may be classified as impellers, restrictors, opportunities or threats.

Vision - Declaration of what a given organization intends to become in the future.

The definitions for the concepts used in strategic planning were taken, with a few adaptations, from the publication *Metodologia de Planejamento Estratégico para as Unidades do Ministério da Ciência e Tecnologia (Methodology of Strategic Planning for Units of the Ministry of Science and Technology)*.

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