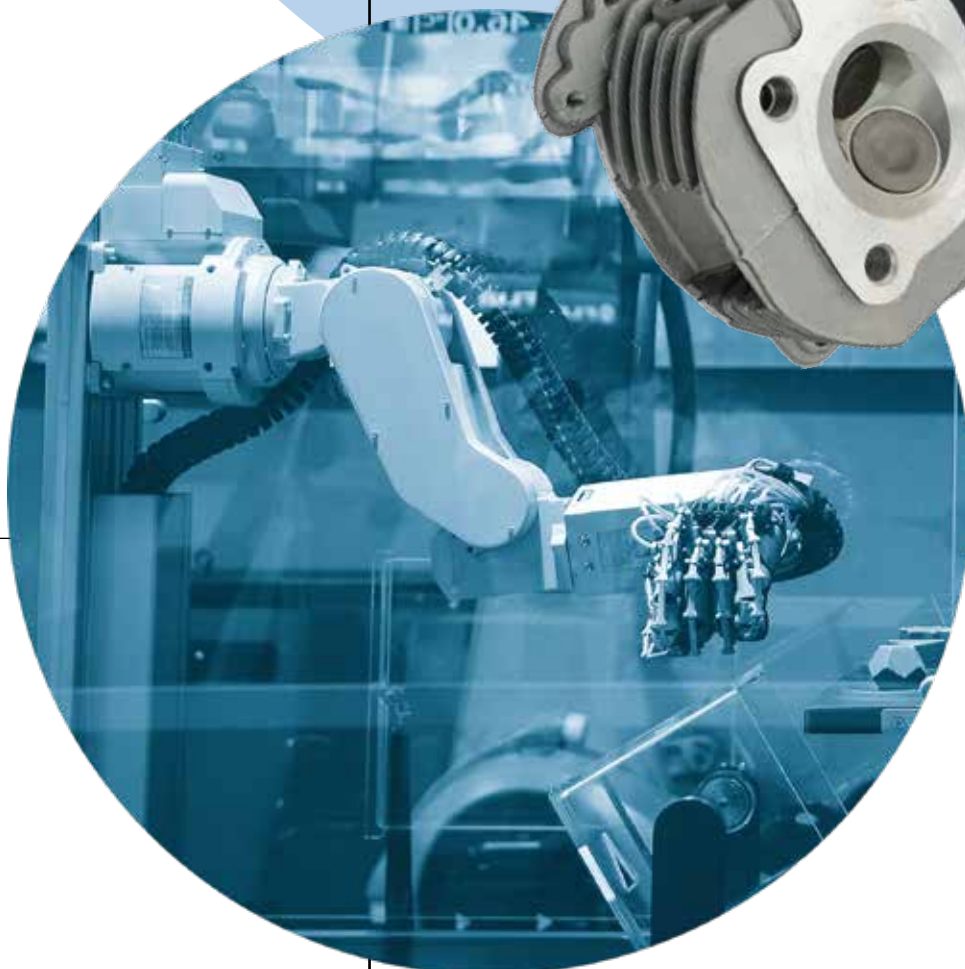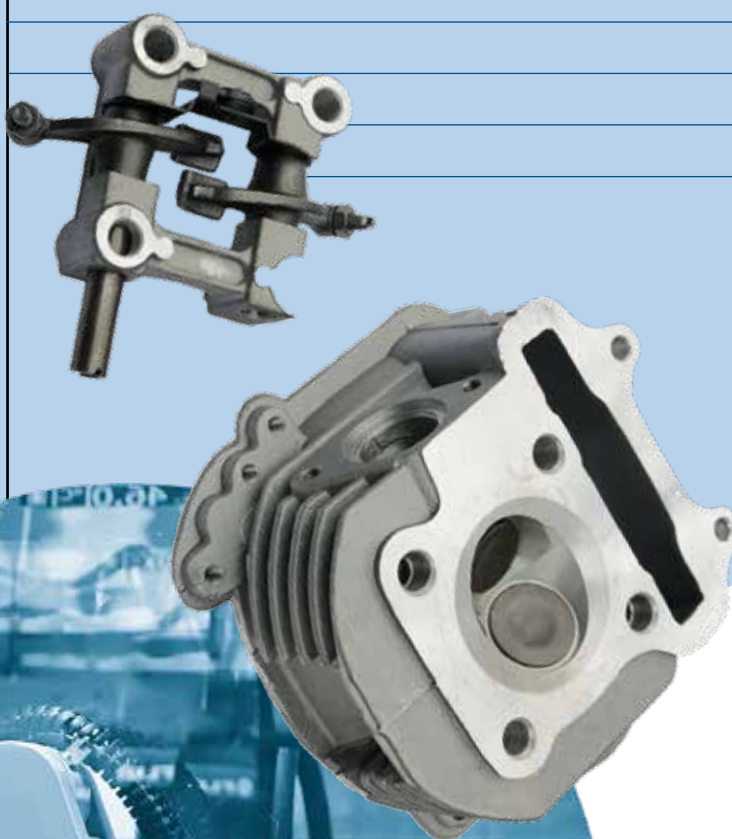# PROFESSIONS OF THE FUTURE

TECHNOLOGICAL CONVERGENCE: THE NEW TECHNOLOGICAL EVOLUTION
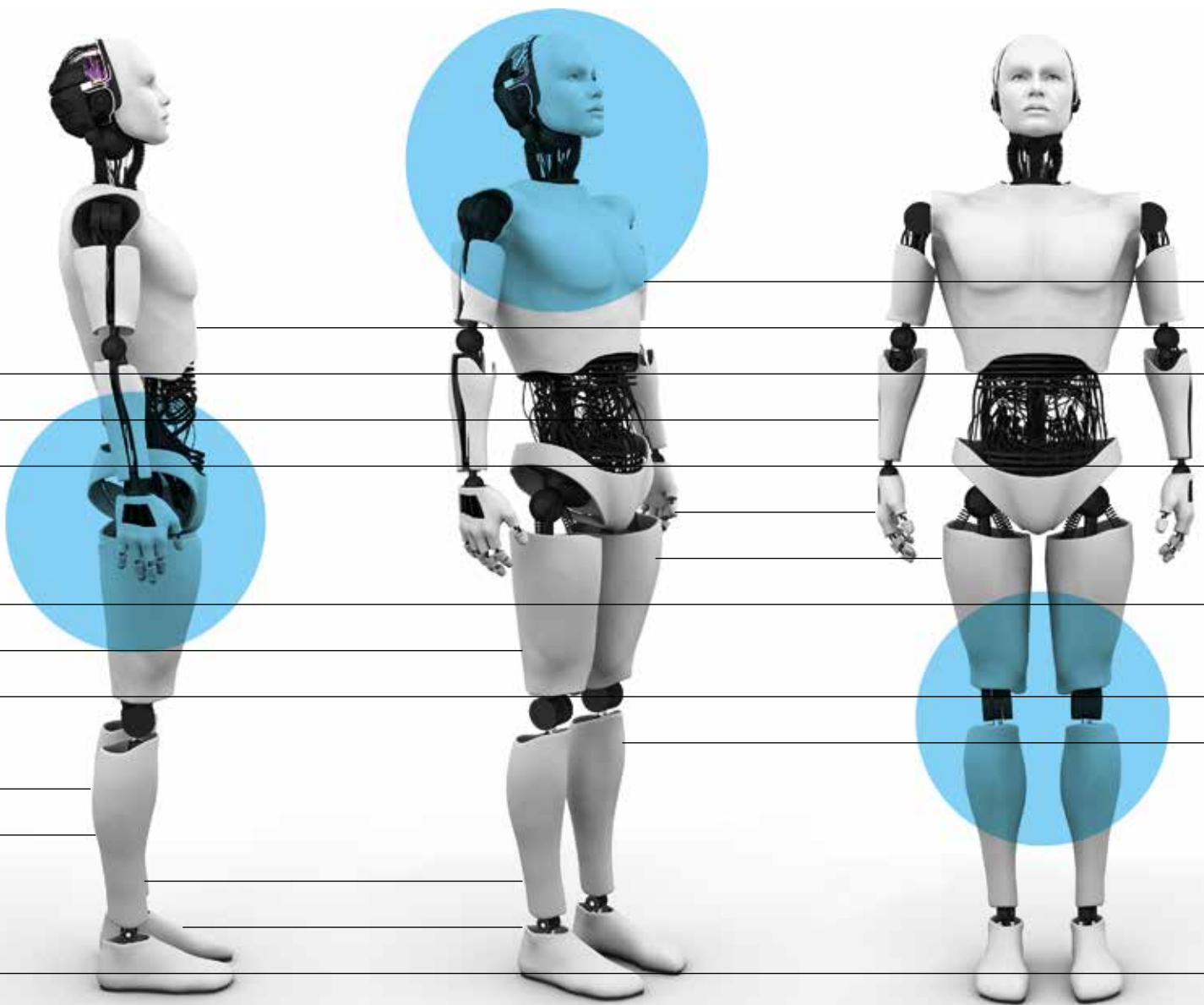
APPLICATION OF THE SENAI AND SESI FORESIGHT MODEL

APPLICATION OF THE SENAI AND SESI FORESIGHT MODEL – RESULTS

SENAI
PELO FUTURO DO TRABALHO

Estudos
e Prospectiva
UNIEPRO

PROFESSIONS OF THE FUTURE

SUMMARY

SENAI

PELO FUTURO DO TRABALHO

Estudos eProspectiva UNIEPRO

BRASIL, BRASÍLIA, DF
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1 | INTRODUCTION

Over the last decades, structural, technological, productive and organizational changes have affected the labor world and led to a significant restructuring of productive flows. This phenomenon has as background the accelerated technological development aiming at increasing productivity and competitiveness and the constitution of an ever more competitive and selective market and work environment.

It is worth remembering that significant shifts in the needs of new abilities can generate structural imbalances between supply and demand for skilled labor. This disproportion affects the productivity and competitiveness of the economic sectors of countries and regions, as companies do not find in the labor market the necessary amount of skilled workers they need.
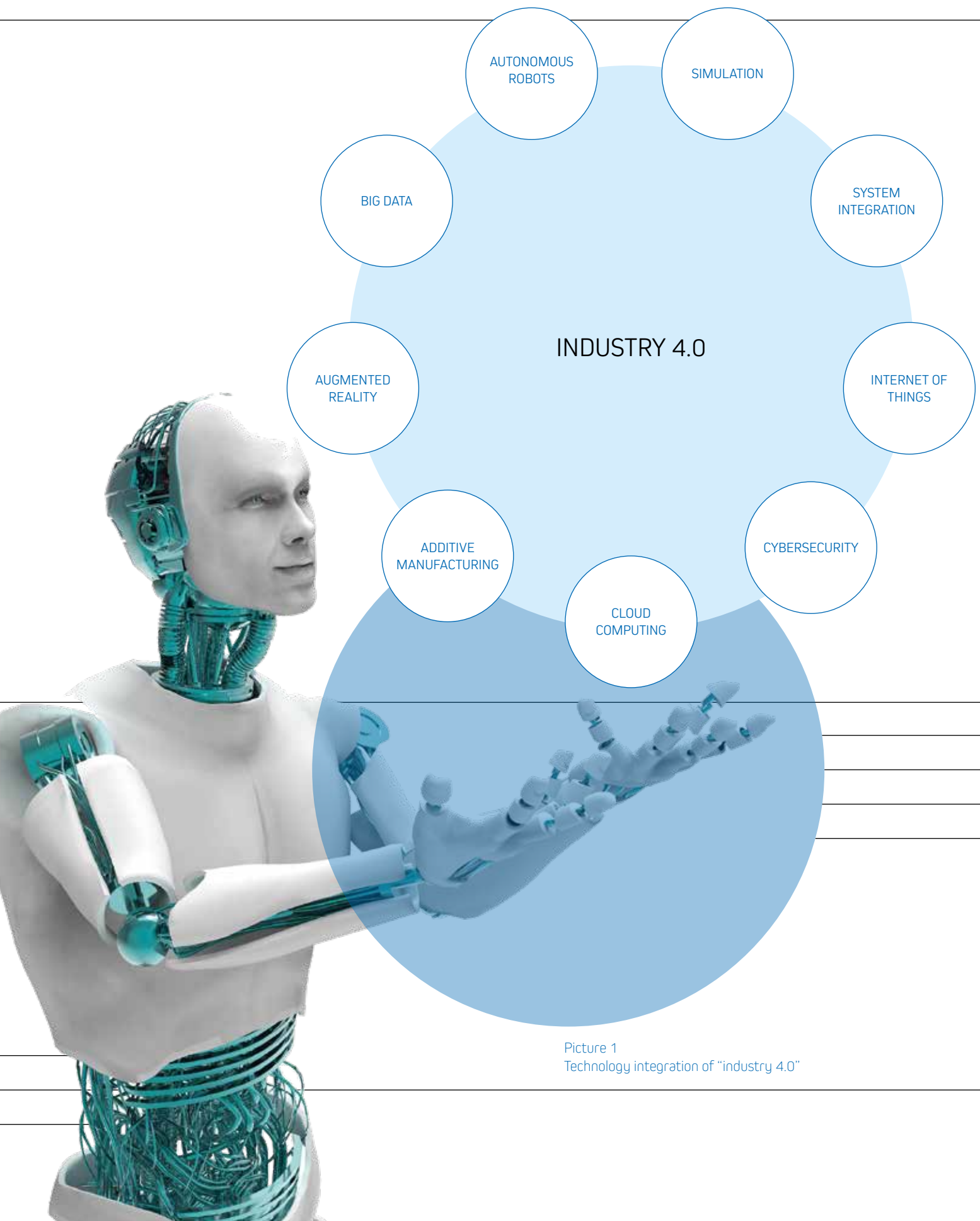
In order to address issues related to possible changes in the labor market in its main dimensions (technological and organizational innovations, variations in professional and educational profiles, and new occupations), the Studies and foresight Unit (UNIEPRO) developed the SENAI and SESI foresighting Model.

To obtain such forward-looking information, the Prospecting Models use the foresight tool of the Panel of Experts. The panels of experts are structured meetings and seek the interaction between experts to reach a certain degree of consensus. Its structuring is through the application of surveys or previously conceived questions, besides the establishment of specific working rules. The specialists involved come from the industrial sectors, as well as authorities from the academic sector and experts from SENAI and SESI.

The information generated by the Model allows SENAI and SESI to adapt their respective course offerings by updating professional and educational profiles, curricular designs and identification of new courses for the training of new professionals.

This document is divided into 5 topics including this introduction. In topic 2, there is a summary about the concepts of technological convergence, with emphasis on "industry 4.0", which, according to experts, will significantly modify production and labor relations. Topic 3 presents the application methodology of the SENAI and SESI foresight Model to obtain the information about the professions of the future. Section 4 describes the results for each sector studied. The final remarks of this study are presented in topic 5.

The results of the SENAI and SESI foresight Model allow a better preparation of the institutions in the provision of educational services that prepare the industrial workforce, according to the technological and organizational evolution of the Brazilian industrial sector.

AUTONOMOUS ROBOTS

SIMULATION

BIG DATA

SYSTEM INTEGRATION

INDUSTRY 4.0

AUGMENTED REALITY

INTERNET OF THINGS

ADDITIVE MANUFACTURING

CYBERSECURITY

CLOUD COMPUTING

Picture 1
Technology integration of "industry 4.0"

2 | TECHNOLOGICAL CONVERGENCE: THE NEW TECHNOLOGICAL EVOLUTION

Currently, the evolution of new technologies has been directed to the process of convergence (technological convergence), that is, the combination of different scientific and technological fields in the development of products, processes and services. The most notorious technological convergence structures are the NBIC (nano-bio-info-cogno) and the so-called "Industry 4.0" or Advanced Manufacturing.

The NBIC convergence which is characterized by the synergistic action of the four scientific technological advances that have shown a rapid evolution in the last decades - nanotechnology, biotechnology, communication and information technologies and cognitive sciences (neuroscience).

By its full concept, "Industry 4.0" can be characterized as an intelligent factory, with elements of high technological complexity, high level of collaborative automation, interconnected by the Internet of Things (IoT). In this factory, vertically integrated manufacturing systems are networked with business processes within factories and companies, as well as connected horizontally to the various value networks that can be managed in real time. They are factories that can understand context and help people and machines in performing their respective tasks. Picture 1 shows, schematically, the technologies associated with the concept of "industry 4.0".
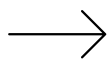
## 2.1| IMPACTS OF INDUSTRY 4.0 ON THE LABOR MARKET

The diffusion of technologies associated with "Industry 4.0" will bring about considerable changes in the workforce. Although one does not have an exact notion on the impact on the reduction of the work force, it must be taken into account that this reduction can be compensated by the demand of professionals with new knowledge, skills and capacities. There is a relative consensus among experts, that professions characterized by a high degree of creativity and social interaction skills, which are not yet part of the collaborative robots, will be able to "armor" themselves in this highly complex technological scenario, which will have as protagonists the STEM professionals.

In general, "Industry 4.0" will require from professionals of all levels of performance, knowledge on Analytical and Simulation Models, Critical Analysis of Products and Processes, Databases, Information Systems and Programming Languages. In addition, the skills that will gain prominence will be those of Programming, Technology Design, Problem Solving and Decision Making and Arbitrating.

The impacts of "Industry 4.0" on the job market can also be identified by the demand for new professionals, such as IoT Analysts and Programmers, Robotic Neural Network Design and Artificial Intelligence, and Cybersecurity Engineer.

However, these impacts must be considered strongly conditioned by the rates of diffusion (acquisition and use) of "Industry 4.0" technologies in the Brazilian market. In terms of diffusion rate, experts consulted by UNIEPRO predicted that most of these technologies will present a diffusion rate of at most 30% of the potential user market over the next 10 years.

The perception of the low diffusion rates are associated to the factors that negatively impact the process of acquisition of these technologies by the Brazilian industrial companies, such as: the lack of skilled labor to operate the technology, a long time of return on the investment made, high level of technology complexity, long term payback time on the investment made and the need for the company's adequate infrastructure.
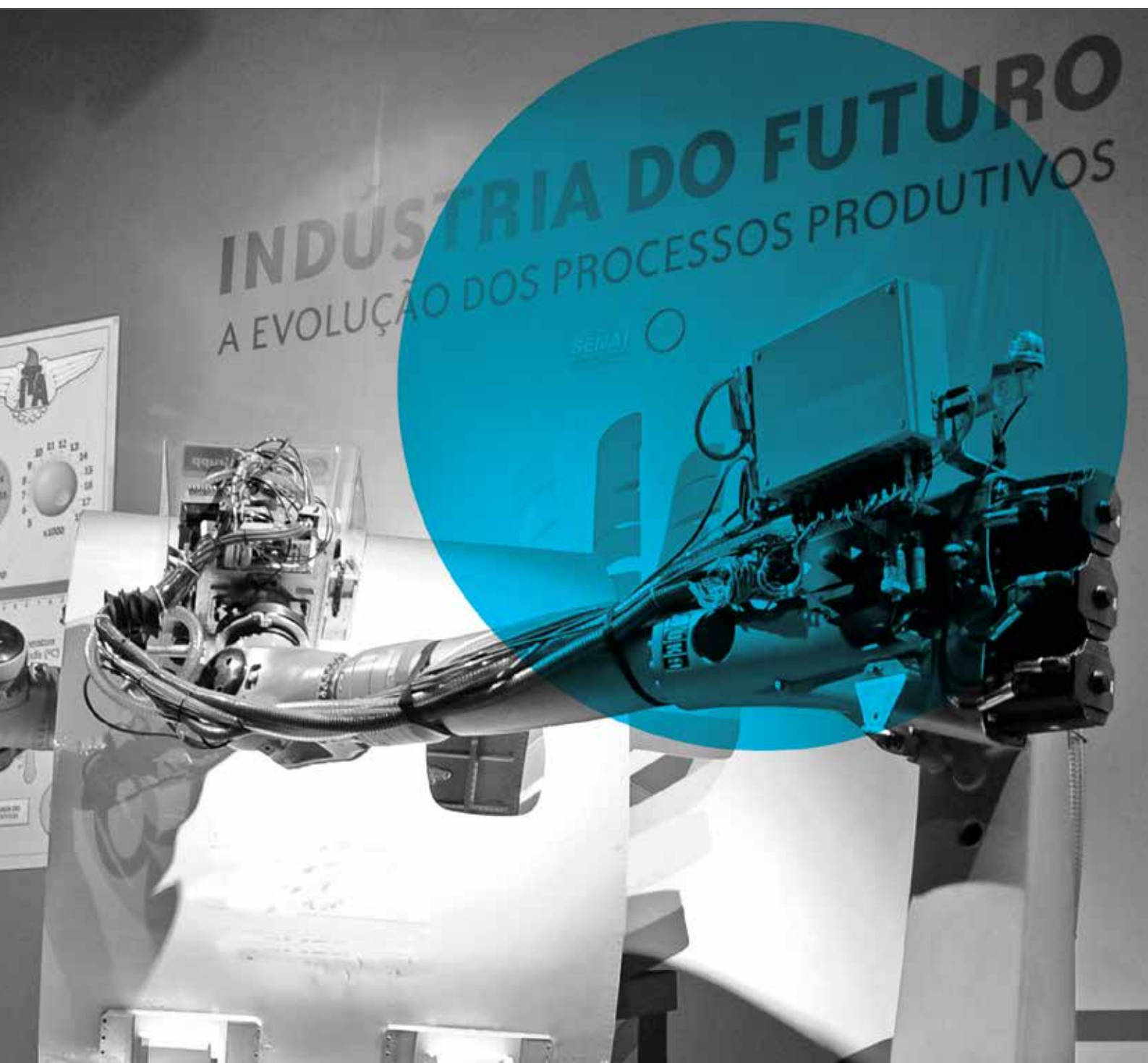
3 | APPLICATION OF THE SENAI AND SESI FORESIGHT MODEL

3.1| SELECTED SECTORS

The choice of sectors for this study was based on two aspects. One is related to the potential of the sectors in the use of "industry 4.0" technologies. For this purpose, there were used data from the results of the Industry Project 2027, carried out by the National Confederation of Industry (CNI) and the Euvaldo Lodi Institute (IEL), in partnership with the Federal University of Rio de Janeiro (UFRJ) and University of Campinas (Unicamp). The second aspect involved is related to sectors whose diffusion of the new technologies will strongly affect their occupations and will demand new professionals.

The generation of the foresight information and its subsequent analyzes had the following logical structure:
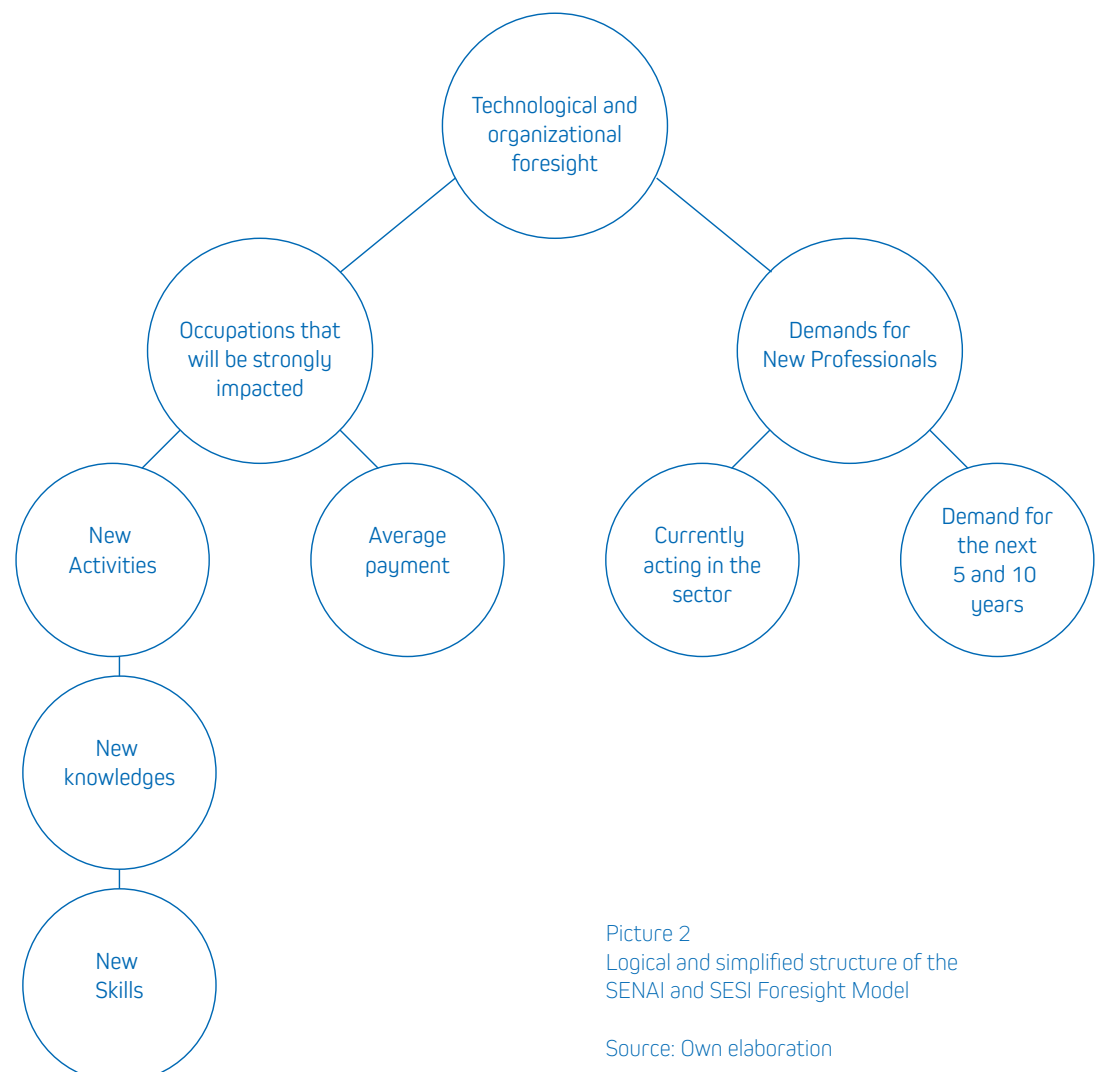
Picture 2
Logical and simplified structure of the SENAI and SESI Foresight Model

Source: Own elaboration

Initially it is identified, by technological and organizational foresight, the main technologies to be disseminated in the Brazilian market in the next 15 years, as well as the organizational changes that the productive chain of the studied sector may experience in the same time horizon. This foresight information compiles the base context for the identification of new professionals and their future demand, and the changes in working profiles of existing occupations.

Regarding the influence of possible technological and organizational changes in occupations, initially there is an analysis to identify the occupations that will be most affected by the diffusion of new technologies, changes in the structure of the productive chain of the sector and the new business models of the companies that make up the sector.

The next step, after identification of the occupations that may be most affected, is finding out the changes in the competency elements (which make up the professional profile) of these work-profiles, that is, what will be the new activities, knowledge and skills of these occupations, in the next 5 and 10 years. In addition to the identification of these changes, the remuneration of these workers is sought in the following levels: average remuneration of occupations up to 1 year of work and age under 24 years (initial), average remuneration of occupations with more than 10 years of work, regardless of age (with experience), and average remuneration of occupations independent of years of work and age (average). The figures are taken from the Annual Social Information Report (RAIS) for the year 2016.
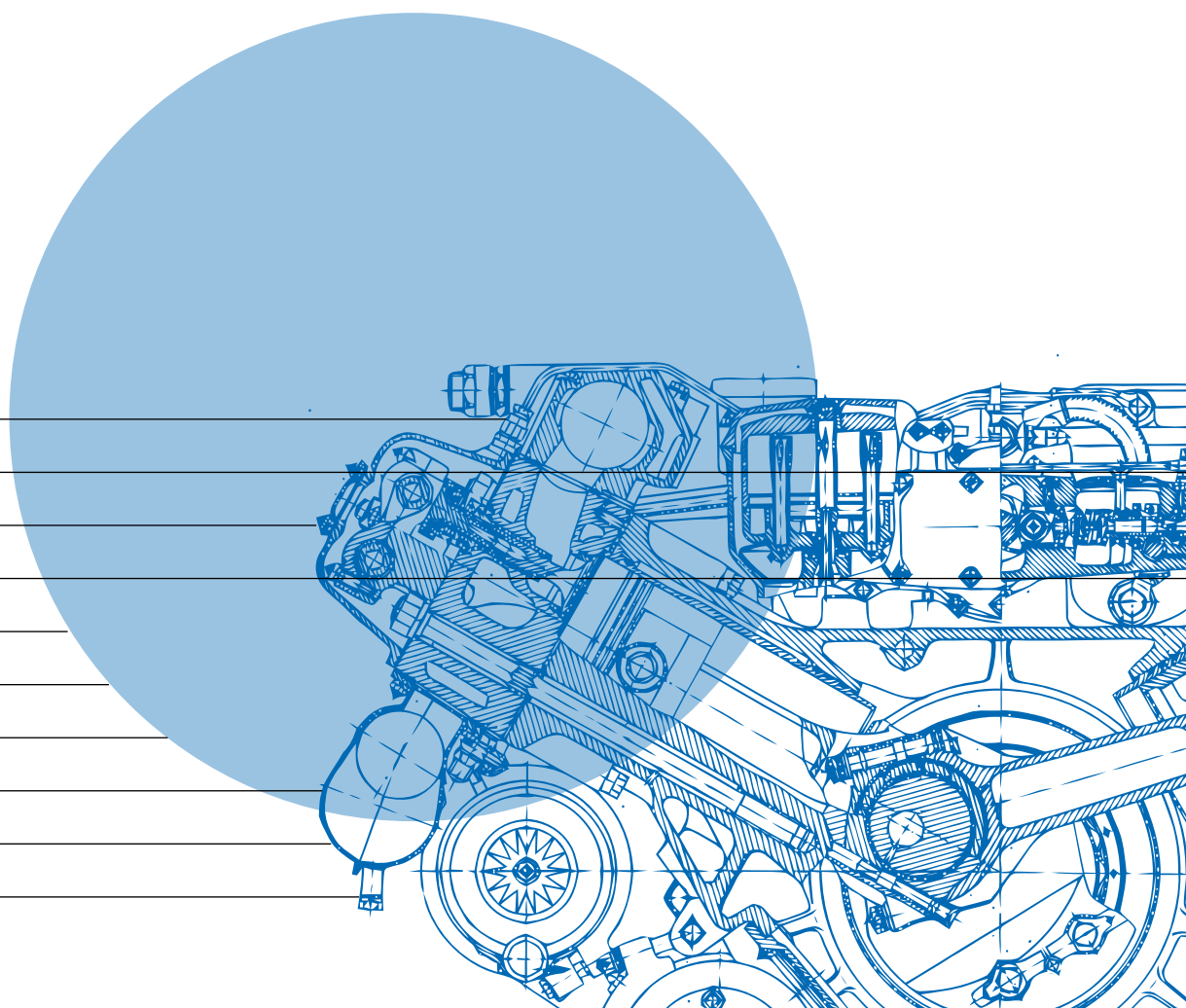
4 | APPLICATION OF THE SENAI AND SESI FORESIGHT MODEL – RESULTS
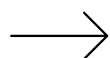
4.1| AUTOMOTIVE SECTOR

4.1.1| Sector Importance

The automotive sector is one of the most important national sectors, since its productive and value chain has great importance in the generation of innovations and generation of employment. This sector accounts for 4% of the Brazilian GDP and one fifth of industrial production.

By the end of 2017, this sector directly employed 126,700 people in 65 factories in 10 states and produced 2.7 million vehicles, of which more than 80% were passenger cars. Anfavea estimates that, including indirect employment, the sector generates about 1.3 million jobs. Still according to the Association, a new cycle of investments is under way. Despite the excess capacity (installed capacity is estimated at more than 5m), investments are required to develop new product lines.

4.1.2| Technological Trends

The main trends observed for the Brazilian auto industry are the growth in the use of technologies associated with "industry 4.0", notably those related to the collaborative robotization of production lines, the communication of machines through the Internet of Things (IoT), and 3D printing and process simulators. Such technologies will strongly impact the design and production process stages of the automotive industry.

4.1.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Automotive electro mechanic

- Activities - Perform maintenance and installation of multimedia system and connectivity; Calibrate security system sensors; Calibrate gearbox and clutch mechanism for automated transmissions.
- Knowledge - Computer Systems Architecture; Databases; Information systems; Electronic circuits; Electric circuits; Magnetic and Electronic; Hardware; Software applications.
- Skills - Operations analysis; Systems analysis; Programming; Technology design; Problems solution; Judgment and decision-making.

- Remuneration: Average – US$ 815,40; Initial R$ US$ 385,23; Experienced – US$ 1.784,14.
  1US$ = R$ 3,8

Light vehicles mechanic

- Activities - Inspect and repair hybrid vehicles; inspect and repair electric vehicles; inspect and repair electrical steering.
- Knowledge - Machine Elements; Machinery, Engines and Equipment; Tools; Control of Mechanical Systems; Maintenance and Machine Elements; Lubrication; Environmental Chemistry; Waste Management; Treatment of Waste and Effluents.
- Skills - Service orientation; Equipment maintenance; Selection of equipment; Complex problem solving; Service Orientation.
- Remuneration: Average - US$ 1364,11; Initial - US$ 517,06; Experienced - US$ 1820,08.

Automotive Maintenance Mechanic

- Activities - Inspect and repair systems for energy reuse through braking. (Regeneration of braking energy.); inspect and repair telemetry systems applied to automotive mobility; diagnose and repair cars using more complex information technologies.
- Knowledge - Electronic Circuits; People management; Electrical Circuits Electronic Instrumentation; Mathematics focused on metrology, negotiation techniques.
- Skills - Quality control analysis; Service orientation; Equipment maintenance; Selection of equipment; Complex problem solving; Service orientation.
- Remuneration - Average - US$ 788,55; Initial - US$ 382,29; Experienced - US$ 1779,99.

Automotive Maintenance Technician

- Activities - Central programming (keys, alarm, multimedia navigation, electronic injection, via scanner and or computer); perform diagnostics and analysis of test data for automotive systems, subsystems or components.
- Knowledge - Operation and configuration / programming of automotive systems. Communication protocols, norms of electronic interfaces. Physics (Electro electronics, Electro mechanics, Electro pneumatics and Electro Hydraulics), Logic, Combustion Analysis, Programming, Data Communication Protocol and Operating Systems.
- Skills - Quality control analysis; Service orientation; Equipment maintenance; Selection of equipment; Complex problem solving; Service orientation.
- Remuneration - Average - US$ 1328,73; Initial - US$ 532,94; Experienced - US$ 1680,57.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Hybrid Vehicle Mechanic - Performs internal and / or electric combustion engine diagnostics, as well as all predictive and preventive maintenance activities of hybrid vehicles.
- Mechanic Specialist in Telemetry - Computers Program and performs diagnosis and Repair in Electronic Networks.
- Programmer of electronic control units - Access and reprogram electronic control units through communication protocols via scanner or interfaces. Diagnose and analyze test data for automotive systems, subsystems, or components.
- Vehicle Information Technician (TIV) - Inspect or test parts to determine the nature or cause of defects or malfunctions, install equipment, such as test equipment, engines or accessories, customize the vehicle's functionalities and correct, by remote or on-site access , problems of vehicular systems.

4.2| INFORMATION AND COMMUNICATION TECHNOLOGY

4.2.1| Sector Importance

According to the Brazilian Association of Information and Communication Technology Companies (Brasscom), the Brazilian ICT companies market (which encompasses hardware, software, services, cloud, state-owned BPO and exports) produced R$ 195.7 billion in 2017, growth of 12.7% compared to 2016.

In addition to this promising initial position, Brazil already presents a set of successful cases of ICT application, such as the Brazilian Payment System, the Open University of Brazil, the electronic proof of purchase and electronic voting. There is also a set of business hubs in the ICT area that have already achieved important economic results, such as the "Digital Port" in Recife.

4.2.2| Technological Trends

The main trends observed for the ICT sector in Brazil are the integration of these to the processes of industry automation 4.0. It is possible to highlight the processes of digitalization of the productive processes stages and the use of the Internet of Things (IoT) and of the wireless networks in the productive lines and the communication between robots.

4.2.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Technical Digital Game Programmer

- Activities - Test and correct errors in computer game programs, documenting code modifications; modify the computer game code to enhance its functionality; perform maintenance on computer game codes, to correct minor errors or to enable their execution on new types of hardware or operating systems.
- Knowledge - Computer Systems Architecture; Databases; Programming languages; Logic and Semantics of Programs; Information systems; Analysis of Algorithms and Computational Complexity; Software applications; Principles of software engineering; Color Analysis; Product Design; Drawing Techniques; Visual communication; Graphic Publishing; Mechanical design.
- Skills - Communication; Mathematics; Sciences; Critical reasoning; Coordination; Negotiation; Orientation to the provision of services; Complex problem solving; Operations Analysis; Technology Project; Programming; Judgment and decision-making; Analysis and evaluation of systems; Management of material resources.
- Remuneration - Average - US$ 1130,08; Initial - US$ 587,61; Experienced - US$ 2047,01.

Multimedia Developer

- Activities - Develop or validate routines and test execution schedule to ensure that test cases cover external interfaces and are compatible with all types of Internet browsers and hardware devices; design

and implement measures for the security of websites, such as firewalls or message encryption; suggest programming languages, design tools, or software development applications.

- Knowledge - Computer Systems Architecture; Databases; Programming languages; Logic and Semantics of Programs; Information systems; Computer Theory; Analysis of Algorithms; Software applications; Software Engineering; Marketing; Public Relations and Propaganda; Sales planning; Sales and after-sales techniques.
- Skills - Communication; Sciences; Performance Monitoring; Social perception; Persuasion; Negotiation; Complex problem solving; Analysis of operations; Technology design; Selection of equipment; Programming; Equipment maintenance; Judgment and decision-making
- Remuneration - Average - US$ 1.130,08; Initial - US$ 587,61; Experienced - US$ 2047,01.

Systems Development Technician

- Activities - Consult software engineering teams to evaluate interfaces between hardware and software, develop specifications and performance requirements or solve problems; specify requirements for the configuration of systems and database; evaluate and recommend software development tools.
- Knowledge - Computer Systems Architecture; Databases; Programming languages; Logic and Semantics of Programs; Information systems; Electronic circuits; Electric circuits; Magnetic and Electronic; Electronic Instrumentation; Analytical and Simulation Models; Computer Theory; Analysis of Algorithms and Computational Complexity; Software development processes; Software architecture; Prototyping

and programming for sensors and embedded devices; Computer network; IT Governance; Information security.

- Skills - Reading Comprehension; Active Listening; Communication; Sciences; Active learning; Strategic learning; Installations; Programming; Operation and Control; Problems solution; Repairs; Evaluation of systems.
- Remuneration - Average - US$ 1130,08; Initial - US$ 587,61; Experienced - US$ 2047,01.

Computer Network Technician

- Activities - Search for new technologies, attending seminars and courses or reading commercial articles and implement or recommend the implementation of these technologies; diagnose and troubleshoot hardware, software, or other network and system problems, and replace defective components when necessary; plan, coordinate, and implement network security measures to protect data, software, and hardware.
- Knowledge - Computer Systems Architecture; Databases; Programming languages; Logic and Semantics of Programs; Electric circuits; Magnetic and Electronic; Hardware; Analytical and Simulation Models; Basic Software; Analysis of Algorithms and Computational Complexity; Telecommunications Systems; Analog Signals; Digital Signals; Digital signal processing; Network switching; Electromagnetic Theory; Microwave; Propagation of Waves and Antennas.
- Skills - Active Listening; Essay; Communication; Mathematics; Sciences; Analytical reasoning; Active learning; Strategic learning; Analysis of operations; Management of material resources.
- Remuneration - Average - US$ 821,12; Initial - US$ 455,67; Experienced - US$ 1638,25.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Technician in Information and Automation - Professional that seeks to create systems of collection, storage, information analysis, besides making decisions, using the concepts of Big Data, Internet of Things and Automation.
- IoT Analysts and programmers - Professionals with analytical, programming and logic knowledge. They will be trained in computer engineering, but also engineers from other areas with extensive programming knowledge, IoT and Big Data.
- Robotic neural network design and artificial intelligence - Professional looking for new applications, with logical-mathematical knowledge, programming and, if possible, philosophy.

- Cybersecurity Engineer - Uses experience in invasion testing and other cybersecurity tools, using them to keep the enterprise safe from both internal and external threats. In addition to computer science training, security expertise and practical experience in the field are required.
- Data Scientist - Professionals with analytical, programming and logical knowledge. They are trained in mathematics or statistics, specialized in applying their disciplines to new technologies
- Specialist in big data - A professional with a scientific base who is able to analyze the economic movements of the sector and the context in which the company is, helping to identify opportunities for insertion into new market niches.

4.3| FOOD AND BEVERAGES

4.3.1| Importance of the sector

According to the Brazilian Food Association (ABIA), the food and beverage sector had a nominal growth of 4.6% in 2017, reaching R$ 642 billion. This means a slice of 9.8% of the Brazilian GDP. Still according to ABIA, the largest share of this sector is the food segment, which corresponds to 81%; while the beverage segment occupies 19%.

Production in the food sector grew by 1.25% in 2017, while food consumption also reacted in 2017, growing by 4.6%. According to the ABIA Report, food retailing increased 3.8% and sales of food service out of the home, 6.2%.

4.3.2| Technological Trends

The main trends observed for the food and beverage industry in Brazil are: the use of advanced software for process control, as well as the use of big data systems and software for forecasting industrial budgeting (global and sectorial).

Added to these are the consolidation of product development based on the concepts: natural, organic, functional, alternative proteins, ingredients to reduce sugar and sodium, exotic flavors and aromas.

4.3.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Sugar and alcohol technician

- Activities - Analyze new equipment and instruments: NIR's, CG, HPLC; Identify the need for adjustment and / or repair of mechanical, electronic and automated equipment or devices for testing; raise and analyze historical, market, quality, production and loss data for production planning.
- Knowledge - Microbiology; Electronic Instrumentation; Automation and Process Control; software applications; Logical reasoning; Machine elements; Machine elements; Waste Management; Environmental Chemistry; Treatment of Waste and Effluents; Information Retrieval Techniques; Biochemistry; Physiology; Microbiology; Ecology.
- Skills - Critical thinking; Mathematics; Sciences; Service orientation; Equipment maintenance; Operation and control; Operations monitoring; Analysis of operations; Quality control analysis; Technology design; Problems solution; Management of material resources.
- Remuneration - Average - US$ 586,85; Initial - US$ 386,79; Experienced - US$ 887,44.

Brewery Technician

- Activities - Operate and monitor automated production equipment; Support food engineers or technologists in research and development, production technologies and quality control; Examine

chemical or biological samples to identify cell structures or locate bacteria or foreign material using analytical equipment.
- Knowledge - Biochemistry; microbiology; biotechnology; environmental law; mechatronics; Manufacturing processes; Planning, design and control of production systems; software applications; Service management; Waste Management; Probability and statistics; Visual communication; Production management; People management; Quality Management and Processes.
- Skills - Negotiation; Operations Analysis; Operations Monitoring; Operation and Control; Systems Analysis; Evaluation of Systems; Orientation to the Provision of Services; Complex Problem Solving; Selection of Equipment; Human resource Management.
- Remuneration - Average - US$ 586,85; US$ 386,79; Experienced - US$ 887,45

Grain Processing Operator

- Activities - Operate and monitor automated equipment for drying, grinding or roasting food items such as cocoa and coffee beans, cereals, nuts and raw materials used in baking; monitor and schedule the flow of materials and detect machine malfunctions, such as locks, implementing corrective actions.
- Knowledge - Food quality assessment and control; Food Technology; Food storage; Standards; food storage; food Technology; GMP (Good Manufacturing Practices); Electronic Instrumentation; Automation and Process Control; software applications; General and mechanical physics; Electronics.
- Skills - Quality control analysis; Active learning; Reading Comprehension; Communication; Coordination; Active Listening; Time management; Operations Monitoring; Performance Monitoring.

- Remuneration - Average - US$ 369,65; Initial - US$ 335,13; Experienced - US$ 416,73.

Beverage Processing Operator

- Activities - Monitor, operate and control automated equipment such as boilers, vats, dryers, silos, distillers, filters, mills, cutters and mills for cooking or preparing beverages; interpreting work orders, recipes or formulas to determine cooking times and temperatures and ingredient specifications; collect and analyze product samples during production to test the quality, color, content, consistency, viscosity and acidity, among other parameters.
- Knowledge - General biology; Microbiology; Machine elements; Machinery, motors and equipment; Lubrication; control of mechanical systems; maintenance; Electronic Instrumentation; Automation and Process Control; software applications; General and mechanical physics; electronic products; thermal processes.
- Skills - Quality control analysis; Active learning; Reading Comprehension; Communication; Equipment maintenance; Monitoring Operations and performance; Operation and Control.
- Remuneration - Average - US$ 399,55; Initial - US$ 343,20; Experienced - US$ 508,01.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- ICT Applications Specialist for Food Traceability - The ICT Application Specialist for Food Traceability collaborates with food companies in the design, implementation and maintenance of traceability systems for raw materials, ingredients and containers as well as food processed and marketed.

- Specialist in food packaging applications - He is the professional leader in the research of new material applications, packaging techniques, new packaging and packaging, protection atmospheres and improvements, within a strategy to launch new products, improvement of current packaging and / or adaptation to new packaging technologies.
- Food Printing Technicians - Food printing technicians will be responsible for maintaining the machines responsible for printing food. In a very similar way to how 3D printers work today, but with the proviso that there will be basic ingredients in the warehouses.

4.4| MACHINERY AND EQUIPMENT

4.4.1| Importance of the Sector

The capital goods sector responds by producing a complex set of machines and equipment used in the production of other goods, maintaining a direct relationship with the production of the other sectors, besides playing an important role in the diffusion and generation of new technologies. The sector ended 2017 with a total net revenue of about R$ 67 million and employing around 291 thousand people.

4.4.2| Technological Trends

The main trends observed for the machinery and equipment sector in Brazil are the growth in the use of virtual reality technologies, additive manufacturing, as well as machine tools with greater speed and greater accuracy. Use of new materials notably those of polymer base, ceramic and nano-carbon tubes. Production robotization in the stages of welding and assembly.

4.4.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Electromechanical technician

- Activities - Interpret plans, diagrams, diagrams and operational procedures to determine assembly and maintenance methods and sequences; Check dimensions of parts to ensure compliance with technical specifications, using measuring instruments.
- Knowledge - Electrical, mechanical and production engineering; Product Design; Drawing Techniques; Mechanical Design; Machinery Projects; Machine elements; Mechanics of the materials; Industrial Facilities Planning; Production Management; Operational Research.
- Skills - Mathematics; Sciences; Critical reasoning; Active learning; Strategic learning; Orientation to the provision of services; Complex problem solving; Analysis of operations; Technology design; Selection of equipment.

- Remuneration - Average - US$ 922,16; Initial - US$ 393,50; Experienced - US$ 1952,20.

Maintenance of industrial machines technician

- Activities - Interpret plants, drawings and manuals of manufacturers to determine the correct installation or operation of industrial machines; programming computer-controlled machines; analyze test results, error messages or information obtained from operators to diagnose problems and perform the interventions.
- Knowledge - Electrical, mechanical and production engineering; Product Design; Drawing Techniques; Mechanical Design; Machinery Projects; Machine elements; Mechanics of the materials; Industrial Facilities Planning; Manufacturing Processes.

- Skills - Operations analysis; Technology design; Selection of equipment; Installations; Programming; Operations Monitoring; Operation and Control; Equipment maintenance; Problems solution; Analysis and Evaluation of systems.
- Remuneration - Average - US$ 766,21; Initial - US$ 281,95; Experienced - US$ 1078,74.

Mechanical Designer

- Activities - Develop detailed drawings and specifications for mechanical equipment, matrices, tools and controls, using computer systems; programming in CAD/ CAM/ CAE/ CAI systems; developing industrial projects; review and analyze specifications, sketches, drawings, ideas, and data to evaluate the factors that cause impacts on component designs and the manufacturing procedures and instructions to be followed.
- Knowledge - CAD/ CAE/ CAM and CAI tools; Drawing Techniques; Technical Mechanical Design; Machinery Projects; Machine elements; Machinery, Engines and Equipment; Matrices and Tools; Control of Mechanical Systems; Mechanics of Solids, Transport Phenomena; Maintenance and Machine Elements.
- Skills - Problem Solving; Quality control analysis; Judgment and decision-making; Analysis and evaluation of systems; Time management; Management of material resources; Programming; Technology design; Sciences; Mathematics.
- Remuneration - Average - US$ 980,82; Initial - US$ 413,94; Experienced - US$ 1523,16.

Mechanical technician

- Activities - Apply theory and principles of mechanics to modify, develop, test or calibrate machines and equipment under the supervision of engineers; suggest changes in projects, manufacturing and assembly methods and drafting techniques and procedures with work teams and coordinates corrections; evaluate the functionality of tools and devices, measuring and comparing with original project specifications.
- Knowledge - Surface treatments; New materials (metallic, polymers, ceramics); New thermal treatments; Machinery and equipment, including design, use, repair and maintenance; Softwares focused on design and production (CAD and CAM); Drawing techniques, tools and principles of production of technical drawings, plans and models.
- Skills - Mathematics; Sciences; Negotiation; Orientation to the provision of services; Complex problem solving; Analysis of operations; Technology design; Selection of equipment; Programming; Operations Monitoring; Quality control analysis; Judgment and decision-making; Analysis and evaluation of systems; Human resource Management; Management of material resources.
- Remuneration - Average - US$ 1193,57; Initial - US$ 428,67; Experienced - US$ 2115,09.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Operator of High Speed Machine - Will act in the optimization of Productive Processes through CNC programming software; Programming of CNC machines over three axes.
- CAD/ CAM/ CAE/ CAI tools developer - Will act as a substitute for the Mechanical Designer; Elaboration of programming in CAD / CAM / CAE and CAI

- Maintenance Technician in Automation - Will act in the substitution of Electrical and Electronic Components, using different industrial networks; Execution of retrofiting in machine and equipment and optimization of Productive Processes.
- Designer for 3D technologies - Will act in the modeling in CAD software and / or specific for 3D printing; Preparation of programs for 3D printing.

4.5| OIL AND GAS

4.5.1| Importance of the Sector

The importance of this sector can be verified by the continuous growth of the national production, which grew for the fourth consecutive year, reaching 2.6 million barrels per day in 2017, which represented an increase of 4.2% in relation to 2016. This increase was led by the pre-salt oil supply, which reached an average of 1.3 million barrels a day in the year, about 50% of the national production. Natural gas increased by 5.9% and gas extracted from the pre-salt increased the share in the national total and corresponded to 45.3% of the total produced.

4.5.2| Technological Trends

The pre-salt exploration is one of the main challenges. The use of deep-water technologies, such as new technologies for drilling and development of technologies and materials for deep water, production and storage vessels and relief; ultra-short beam anchorage. Add to that the greater diffusion (acquisition) digital technologies for Control, telemetry (wireless), remote operation, monitoring and automatic analysis (computational algorithms) of data.

4.5.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Probe Operator

- Activities - Control of probe data by telemetry; monitor probe data; Analyze (computational algorithms) the probe data; perform their activities based on the concepts of lean production; assemble safety equipment, well control and completion; test the assembly of safety equipment and well control; operate the probe equipment systems (elevation, circulation, power generation and rotation).
- Knowledge - Machine Elements; Machinery, Engines and Equipment; Matrices and Tools; Control of Mechanical Systems; Maintenance and Machine Elements; Lubrication; Mechanics of the materials; Technical English; Mathematical Methods of Physics; Mechanics; Elasticity and Rheology; Electricity; Optics; Acoustics; Waste Management; Geotechnical; Environmental Chemistry; Treatment of Waste and Effluents.
- Skills - Active Listening; Sciences; Reading Comprehension; Service orientation; Operation and control; Operations monitoring; Time management; Management of material resources; Problems solution; Repairs.
- Remuneration - Average - US$ 1102,84; Initial - US$ 449,60; Experienced - US$ 1771,42.

Oil & Gas Technician

- Activities - Operate and control machines and equipment in the production of oil and natural gas; assist and act in the planning, planning and execution of maintenance of machinery and

equipment; determine the dimensional properties and magnitudes of rocks, fluids and materials for the oil and natural gas industry; assist in controlling the environmental effects of the operations carried out.

- Knowledge - Electronic Instrumentation; Basic Software; Software applications; Machinery, Engines and Equipment; Control of Mechanical Systems; Mechanics of Solids, Transport Phenomena; Maintenance and Machine Elements; Lubrication; Mechanics of the materials; Information Representation; Files Organization; Classification of Documents; Process of Procurement of Materials; Information Dissemination Processes; Organization and Methods; production systems; operations and unit processes, analytical chemistry.
- Skills - Operations monitoring; Management of material resources; Service orientation; Complex Problem Solving; Selection of equipment; Equipment maintenance; mathematics.
- Remuneration - Average - US$ 1778,45; Initial - US$ 570,71; Experienced - US$ 2466,68.

Oil engineer

- Activities - Plan and coordinate the execution of activities related to the research of new deposits and the production of oil and natural gas; operating in exploration, production, transportation, refining, marketing, distribution and logistics; conduct geological studies and evaluate the technical and economic viability of fossil fuel extraction.
- Knowledge - Programming Languages; Information systems; Electronic circuits; Hardware; Electronic Instrumentation; Basic Software; Software applications; Machinery, Engines and Equipment; Control of Mechanical Systems; Mechanics

of Solids, Transport Phenomena; Maintenance and Machine Elements; Lubrication; Mechanics of the materials; Information Representation; Tools for measuring productivity; project management; Unit operations and unit processes

- Skills - Adaptability / Flexibility; analysis and control of systems; Quality control analysis; Strategic learning; technology projects; solving complex problems; judgment and decision making.
- Remuneration - Average - US$ 4.850,66; Initial - US$ 1519,69; Experienced - US$ 6.717,47

Petrochemical Technician

- Activities - Operate and control petrochemical processes by computerized systems (eg ERP and SAP) and pilot plant operations; monitor performance and intervene in automated systems (critical process analysis devices and meters); participate in teams to develop new petrochemical products; coordinate productive processes in a petrochemical plant.
- Knowledge - Programming Languages; Information systems; Electronic circuits; Electric circuits; Magnetic and Electronic; Hardware; Electronic Instrumentation; Basic Software; Software applications; Machinery, Engines and Equipment; Control of Mechanical Systems; Solid Mechanics; Transport Phenomena; Maintenance and Machine Elements; Lubrication; Mechanics of the materials.
- Skills - Adaptability / Flexibility; Quality control analysis; Strategic learning; Attention to detail; Sciences; Conservation of equipment; Coordination; Management of material resources; Mathematics; Critical thinking; Problems solution.
- Remuneration - Average - US$ 1475,73; Initial - US$ 1279,11; Experienced - US$ 2281,25.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Specialist in drilling techniques - Will work on the development and implementation of new drilling techniques.
- Specialists in seismology and well geophysics - Will work on the development and implementation of technologies to increase the reliability of prediction of the occurrence of new reservoirs and reduce the costs of discovering oil and natural gas reservoirs in onshore and offshore basins.
- Specialists for advanced oil recovery - Will act in the development and implementation of new technologies to improve Water Injection Efficiency; recovery of heavy oil and control of the water produced.

4.6| CONSTRUCTION

4.6.1| Importance of the Sector

The construction industry in Brazil is considered a "thermometer" of the evolution of economic activity. Due to its large construction chain, involving a large number of companies in both the beginning and the end, the sector employs about 13 million people, considering formal, informal and indirect jobs. Investments in works boost areas important for urban development.

4.6.2| Technological Trends

The main trends observed for the machinery and equipment sector in Brazil are the growth of domotics (building automation) and Internet of Things (IoT), for example, to gather detailed information about what is happening at the construction site of real-time works and automate processes such as orders for new materials and tools and intelligent materials. In addition, there is a growth in the use of new materials such as translucent and self-repairing concrete, as well as new technologies for thermal and acoustic comfort.

4.6.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Residential Electrician

- Activities - Install electrical components for residential automation; install photovoltaic systems; maintenance of electrical systems incorporated in automation systems.
- Knowledge - Building electrical installations; electric materials; Electric circuits; planning; Production management; Costs management; strategic management; Color analysis; visual communication; Technical drawing; Electricity and magnetism; electric shocks; Current Technical Standards (NBR 5410; NR10; NR35); Reading and text interpretation.
- Skills - Mathematics; Reading Comprehension; Judgment and decision-making; Selection of equipment; Installation; Maintenance of equipment Troubleshooting; Time management; Sciences.

- Remuneration - Average - US$ 725,57; Initial - US$ 461,23; Experienced - US$ 1530,59.

Building technician

- Activities - Interpretation of plans, drawings and specifications to evaluate dimensions of structures and determine quantities of materials; identify new materials, equipment, construction techniques and suppliers; conduct field surveys to identify building construction sites, determine suitability for occupancy and available area; customer service.
- Knowledge - Environmental Sanitation; Waste Management; Transport Infrastructure; Geotechnical; Architecture and urbanism; Maintenance and Machine Elements; Engines and Equipment; Matrices and Tools; Information Dissemination Processes; Materials

Engineering; Quality and Service Management; Urban Geography; CAD and BIM; Commercial techniques (for customer service).

- Skills - Mathematics; Sciences; Critical reasoning; Active learning; Strategic learning; Performance Monitoring; Orientation to the provision of services; Problems solution; Quality control analysis; Human resource Management; Management of material resources; Management of personnel resources.
- Remuneration - Average - US$ 1015,23; Initial - US$ 509,54; Experienced - US$ 1813,06.

Contractors' supervisor

- Activities - Locating, measuring and marking construction sites or positioning of structures or equipment, using measuring and marking equipment; evaluate problems and recommend solutions, such as improving construction methods; inspect the execution of work, equipment or construction sites to verify safety or to ensure that specifications are met.
- Knowledge - Principles, techniques, procedures and equipment for the design and production of goods and services (Civil Engineering); Drawing Techniques; Waste Management; Transport Infrastructure; Architecture and urbanism; Applied Meteorology; Construction software applications.
- Skills - Active Listening; Communication; Mathematics; Sciences; Critical reasoning; Active learning; Strategic learning; Social perception; Coordination; Selection of equipment; Analysis of operations; Orientation to the provision of services; Instruction; Negotiation; Judgment and decision-making.
- Remuneration - Average - US$ 889,00; Initial - US$ 524,50; Experienced - US$ 1064,06.

Laborator of construction materials

- Activities - To supervise the execution of the work; manage quality control processes; monitor the quality of Materials.
- Knowledge - Basic concepts of civil engineering; materials engineering and electrical engineering; Administrative routines; Organization and Methods; Building materials and components; Construction Processes; Soil mechanics; Mechanics of the materials.
- Skills - Quality control analysis; Active learning; Communication; Active Listening; Time management; Operation and control; Service orientation; Selection of equipment; Problems solution.
- Remuneration - Average - US$ 955,64; Initial - US$ 490,89; Experienced - US$ 1635,42.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Construction Site Logistics Manager - This professional has as main activities: Plan activities of storage, distribution, transportation and communications; manage teams; manage material resources of the area; control operational process; promote conditions of safety, health, environment and quality; dispose of materials in accordance with environmental
- Building automation system integrator - This professional will seek to make compatible and integrate the needs related to building automation
- Building automation system installer - This professional will work in the installation of building automation systems (electrical, electronic and IT).
- Dry construction technician - This professional will analyze projects, as well as execute and assemble dry-type systems (drywall, steelframe, woodframe).

- Building automation technician - This professional will work in the development of projects and execution of building automation.

4.7| CHEMISTRY

4.7.1| Importance of the Sector

The chemical sector is of great importance in the Brazilian and world economic context. It is a producer of raw materials for various economic sectors. The Brazilian chemical sector closed 2017 with a net turnover of about US $ 119.6 billion, which puts it in the eighth position in the sector's global ranking. The leadership is from China, with projected revenues of $ 1.907 trillion in 2017, followed by the United States, at $ 768 billion.

4.7.2| Technological trends

Technological developments present a major challenge for most companies, which require continuous research, development and innovation activities as a way of maintaining competitiveness and growth. The main challenges for the sector in Brazil are related to the automation of continuous processes and the robotization of discrete processes, as well as the more intensive use of IoT in the communication between stages of production processes and the collection of market information that affect production, and the development of new products, applying the concepts of nano and biotechnology, as well as new polymer compositions for paints, varnishes and synthetic fibers.

4.7.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Chemistry Technician

- Activities - Operate and control processes by computerized systems (eg ERP and SAP) and pilot plant operations; monitor performance and intervene in automated systems (critical process analysis devices and meters); participate in teams for the development of new products and new technologies (eg biotechnology, allergens, transgenics, nanotechnology and crystallography).
- Knowledge - Distributed control digital systems, communication networks, fieldbus, man and machine interfaces, automated systems and online interpretation and analysis; Process simulators and pilot plant operations; Conservation of energy and reduction of emissions. Basic knowledge of nanotechnology and biopolymers.
- Skills - Adaptability / Flexibility; Quality control analysis; Strategic learning; Attention to detail; Sciences; Conservation of equipment; Coordination; Management of material resources; Mathematics; Critical thinking; Problems solution.
- Remuneration - Average - US$ 1085,66; Initial - US$ 579,78; Experienced - US$ 1631,93.

Process Operator (qualification)

- Activities - Operate and control processes by computerized systems (eg ERP and SAP) and pilot plant operations; monitor performance and intervene in automated systems (critical

process analysis devices and meters); integrate project teams and discussions on sustainability (eg energy reduction, raw materials and recycling processes).

- Knowledge - Knowledge about automation, computer systems; Knowledge of automated systems and online interpretation and analysis; Process simulations and pilot plant operations; Basic knowledge of nanotechnology and crystallography; Basic knowledge of biotechnology, allergens, transgenics.
- Skills - Mathematics; Reading Comprehension; Sciences; Communication; Instruction; Operation and control; Operations monitoring; Quality control analysis; Conservation of equipment; Problems solution; Initiative; Programming; Adaptability / Flexibility.
- Remuneration - Average - US$ 791,31; Initial - US$ 470,35; Experienced - US$ 1136,03.

Plastics technician

- Activities - Develop formulations (raw materials + additives) appropriate to processes and products; perform technical support from the sales department; train the work team; seek new technologies and solutions (machinery, equipment, raw materials and others); implement production and quality management systems.
- Knowledge - Analytical and Simulation Models; Software applications; Color Analysis; Product Design; Mechanical Design; Marketing Services; Quality in Services; Negotiation; Service management; Feasibility Study of Projects; Machinery Projects; Machine elements; Mechanics of the materials; Nanocomposites, biopolymers and new polymeric materials (engineering plastics and composites).
- Skills - Strategic learning; Communication; Coordination; Complex Problem Solving;

Selection of Equipment; Operation and Control; Operations Monitoring; Operations Analysis; Quality Control Analysis; Problems solution; Judgment and decision-making; Systems Evaluation.

- Remuneration - Average - US$ 726,84; Initial - US$ 381,76; Experienced - US$ 894,15.

Chemical analysis technician

- Activities - Operate integrated instrumental analysis systems; apply industrial computing resources (hardware and software) in the operation of automated instrumental analysis systems; to operate instruments of chemical and physico-chemical nanometrology; benchmarking of analytical instruments for analysis of solid, liquid or gaseous substances; standardize chemical solutions (acquired) to carry out analyzes following established procedures.
- Knowledge - Industrial Informatics (hardware and specific software - industrial networks - sensors and transmitters); Automation of analytical instruments (controllers - PLCs - HMI - supervisory systems); Statistics applied to the reliability of online measuring instruments (analytical instrumentation); Metrology (nanometrology - chemometrics - models and mathematical tools applied to analytical techniques); Biopolymers; Nanocomposites.
- Skills - Critical thinking; Strategic learning; Mathematics; Sciences; Service orientation; Operation and control; Quality control analysis; Conservation of equipment; Management of material resources; Adaptability / Flexibility; equipment maintenance; Selection of equipment; Programming; Analysis of systems.
- Remuneration - Average - US$ 1085,66; Initial - US$ 579,78; Experienced - US$ 1631,93.

Production supervisor

- Activities - Plan and manage automated continuous processes of chemical, petrochemical and related production using large amounts of data; to lead, develop and evaluate multidisciplinary work teams; apply and ensure the procedures according to technical norms and procedures and quality, safety, hygiene, health and environmental preservation.
- Knowledge - Basic knowledge in digital distributed control systems, communication networks, fieldbus, man and machine interfaces, automated systems and online interpretation and analysis (critical process analysis devices and meters); Process simulators and pilot plant operations; Basic knowledge of nanotechnology, biopolymers, and new polymeric materials (engineering plastics and composites); Knowledge of international safety and health standards at work.
- Skills - Adaptability / Flexibility; Quality control analysis; control and evaluation of systems; Strategic learning; Attention to detail; Sciences; Conservation of equipment; Coordination; instruction;

Management of material resources; Critical thinking; Complex problem solving
- Remuneration - Average - US$ 1695,5; Initial - US$ 635,57; Experienced - US$ 2161,71.

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Chemical analysis technician with specialization in automated instrumental analysis - This professional will perform instrumental analysis using automated equipment (eg UV / Visible Spectrophotometer, Infrared, Atomic Absorption)
- Technician specialized in the development of polymer products - This professional will analyze and develop new products based on nanotechnology, natural sources (bioplastics) and biodegradability. In addition, they will interface with universities, research institutes and innovation centers.
- Technician specialized in recycling of polymer products - This professional will manage the process of separation and decontamination of the materials to be recycled, besides developing formulations and adding plastics.

4.8| TEXTILES AND CLOTHING

4.8.1| Importance of the Sector

The textile and clothing sector can be considered as a reference in design of beachwear, jeanswear and homewear, having also grown the segments of fitness and lingerie. The Brazilian textile industry is the second largest employer in the manufacturing industry, second only to food and beverages (together). The sector directly employs about 1 million jobs and about 7 million indirectly. There are approximately 30,000 companies in the country today.

4.8.2| Technological Trends

The tendencies for the textile and clothing sector are based on the incorporation of digital technologies (Modeling and simulation), mainly in the stages of creation, conception and prototyping of products in the search for the maximum customization of products, the use of Smart Clothes, that allow diverse types of information from the interaction of yarn, fabric or clothing with the body and the environment. In addition, there is an increase in intelligent automation in various parts of the seam (3D measurements and machine vision).

4.8.3| Occupational Impacts

The following are the current professions that will be most affected by the technological changes, besides the activities, knowledge and skills that will gain relevance in the next 15 years.

Clothing Technician

- Activities - Develop methodologies to increase productivity; select new materials and production techniques to be used in customized products; establish waste management procedures for production waste; develop and apply new techniques and quality control tools.
- Knowledge - Technical standards; people management; project management; Costs management; 3D technologies; machine vision; modeling and manufacturing simulation technologies; virtual reality tools; concept of cloud platform; technical characteristics of textile fibers; technical English; Product Design; Waste Management; Sales planning.
- Skills - novation; Negotiation; Programming; Analytical reasoning; Digital fluency; Results Orientation; Adaptability / Flexibility; Analytical reasoning; Critical thinking; Negotiation; Complex problem solving; maintenance and selection of equipment; Technology design
- Remuneration - Average - US$ 643,93; Initial - US$ 312,80; Experienced - US$ 837,05.

Textile technician

- Activities - Identify new productive technologies to increase productivity levels and reduce effluent generation; identify new material technologies and adapt them to the productive processes; adapt production processes and raw materials to new automated systems.
- Knowledge - Cost Management; Quality and Processes and Projects; Computer Systems Architecture; Databases;

Programming languages; Color measurement in automated systems; Thermal and thermodynamic processes; Machine elements; Planning, Design and Control of Production Systems; Marketing Services; Quality in Services; Negotiation; Service management.

- Skills - Strategic learning; Mathematics; Sciences; Negotiation; Complex problem solving; Selection of equipment; Operation and control; Analysis of operations; Programming; Quality control analysis; Technology design; Analysis and evaluation of systems; digital fluency; Analytical reasoning.
- Remuneration - Average - US$ 945,38; Initial - US$ 438,22; Experienced - R$ US$ 1195,81.

Fashion designer

- Activities - Develops, in computerized design / creation systems, sketches and detailed drawings of garments and accessories, write specifications such as color schemes, assembly and types of fabrics; research and identify new fibers, yarns and fabrics and designs of models to develop projects for publics with more complex and specific needs.
- Knowledge – Design; cost management; project management; art theory; painting; visual communication; constructive processes; color analysis; product design; drawing techniques; urban anthropology; ethics; art history; technical standard; planning; interpersonal relations; management and services.
- Skills - Adaptability/ Flexibility; Attention to detail; digital fluency; Analytical reasoning; Programming; Communication; Technology projects; Orientation to results.
- Remuneration - Average - US$ 830,00; Initial - US$470,73; Experienced - US$1.389,88.

Fashion Production Technician

- Activities - Apply new media and new technologies for the development of a fashion catalog; select materials and production techniques to be used in product disclosure; identify target markets for projects, considering factors such as age, sex and socioeconomic status.
- Knowledge - Photography; Drawing; Quality and Process Management; Costs management; Interpersonal Relationships; Visual arts; Production Management; Marketing; Sales planning; Public Relations and Propaganda; Simulation Models; Information Dissemination Processes; Communication Processes; Visual communication; Negotiation; Psychology of human development; Interpersonal relationships.
- Skills - Critical thinking; Communication; Digital fluency; Innovation; Programming; Stress tolerance; Initiative; Technology design; Judgment and decision-making; Management of material resources.
- Remuneration - Average - US$ 643,93; Initial - US$ 312,80; Experienced - US$ 837,05

The new professionals that will be demanded by the Brazilian sector in the next 15 years are:

- Technician of projects of fashion products - This professional will work in the development of systems of productive process for increase of productivity and reduction of costs, besides restructuring the areas creation, production, development and expedition and to develop products and technologies to increase the customization "
- Engineer in textile fibers - This professional aims to develop new chemical fibers for the production process, adapted to

the demands of the value chain and the consequent adaptation of the spinning, weaving and textile processing processes to the new fibers.
- Advanced Fabric Designer - Expert involved in designing new fabrics and synthetic materials with predefined properties (eg LED or shape memory screens).
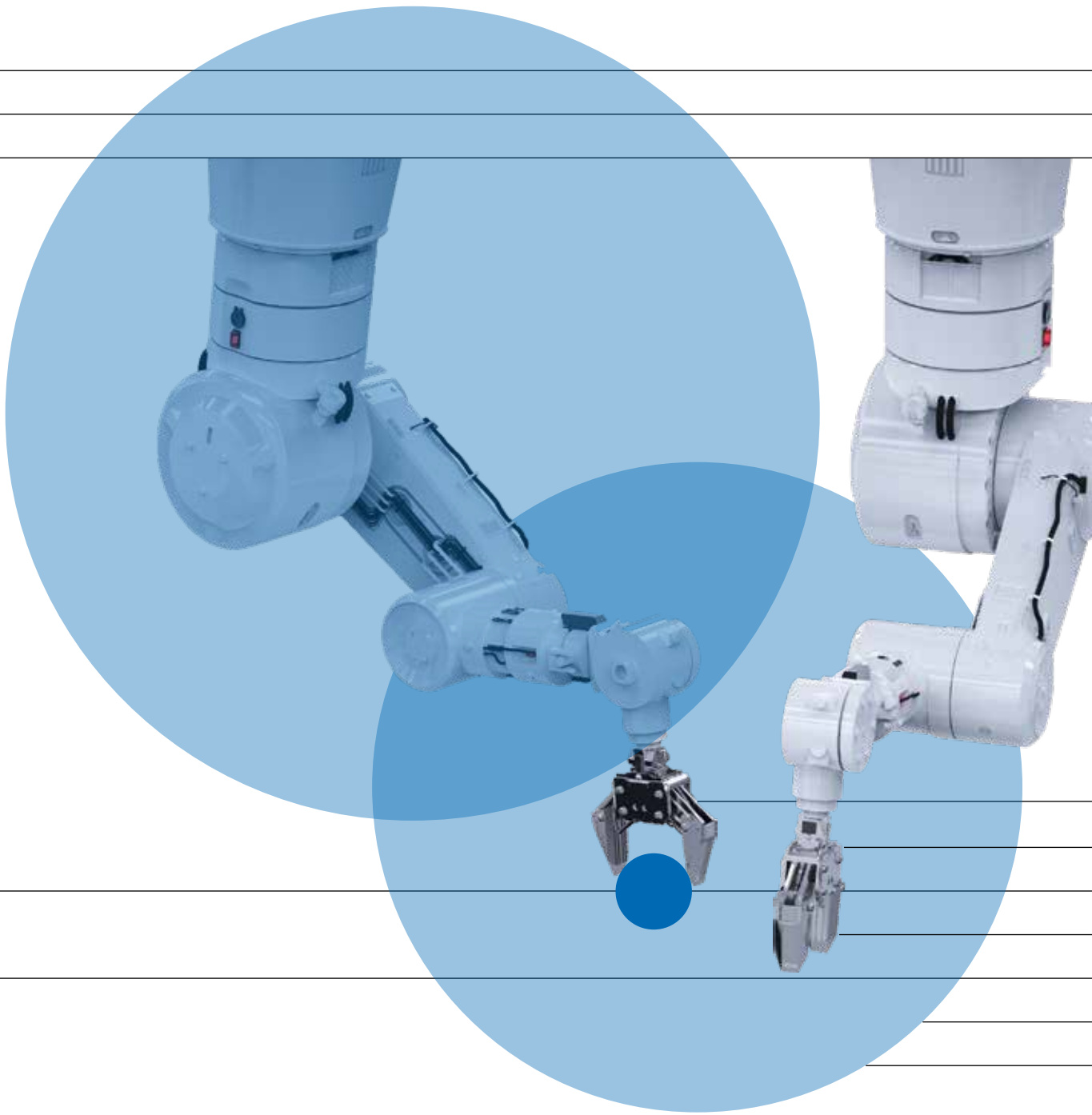
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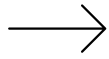
The speed and nature of globalization, technological advance and innovation, changes in work organization, environmental variations and demographic trends take on very different forms, but regardless of form, these phenomena have affected the kind of work that is done, who does it and where and how it is accomplished. These transformations affect "traditional" jobs and employment relations, while creating new demands for innovative jobs in emerging or traditional economic activities.

Given this framework, it is essential not only to have a model that allows systematically and consistently to anticipate the changes generated by technological and organizational shifts in the labor market, but also to adapt this model to these variations. This means having a model with flexibility to apply several prospective tools, according to the object of study, the theme and the time horizon established.

Another point to highlight is the monitoring of technological and organizational developments. As these trends are the basis of analysis for the discussion about new professions and changes in the existing professions, it is fundamental to have a model of established trends monitoring to allow feedback on the prospective model.

One of the possibilities for monitoring technological evolution is the visits in sectorial technology trade shows, which aim to observe the evolution of the technologies identified by the SENAI and SESI Foresight Model, in addition to identifying other new technologies, which were not observed. This monitoring takes place through the visit and the survey with the main technological exhibitors. This action allows establishing a systematic process of watching the dynamic technology of each studied sector.

The choice of sectorial technology trade shows to carry out the technological monitoring is explained by its diversity of exhibitors (small, medium and large), visitors (medium and high purchase potential), and high number of related events and participation of institutional organizations. This diversity allows generating an environment conducive to the search for more information about new technologies and possible evolutions of specific emerging technologies, and represent a reliable picture of the technological offer of a certain sector.