

TECHNOLOGICAL CHANGES IN THE ELECTRONICS INDUSTRY

DEVELOPMENT DIALOGUE

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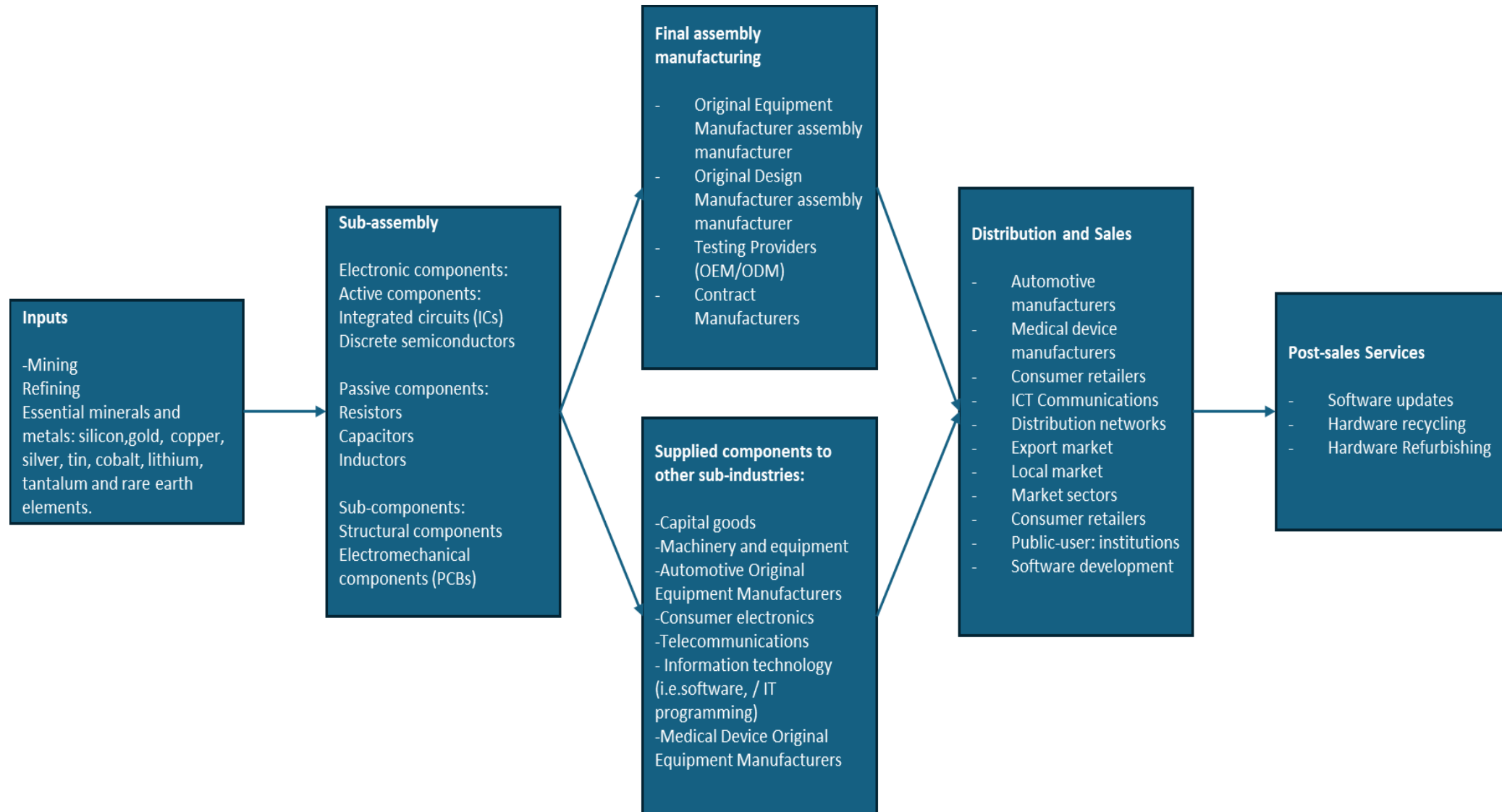
Outline

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- ▶ Industry overview: value chain analysis, economic contribution, and employment.
- ▶ Global technological changes in the industry
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Introduction

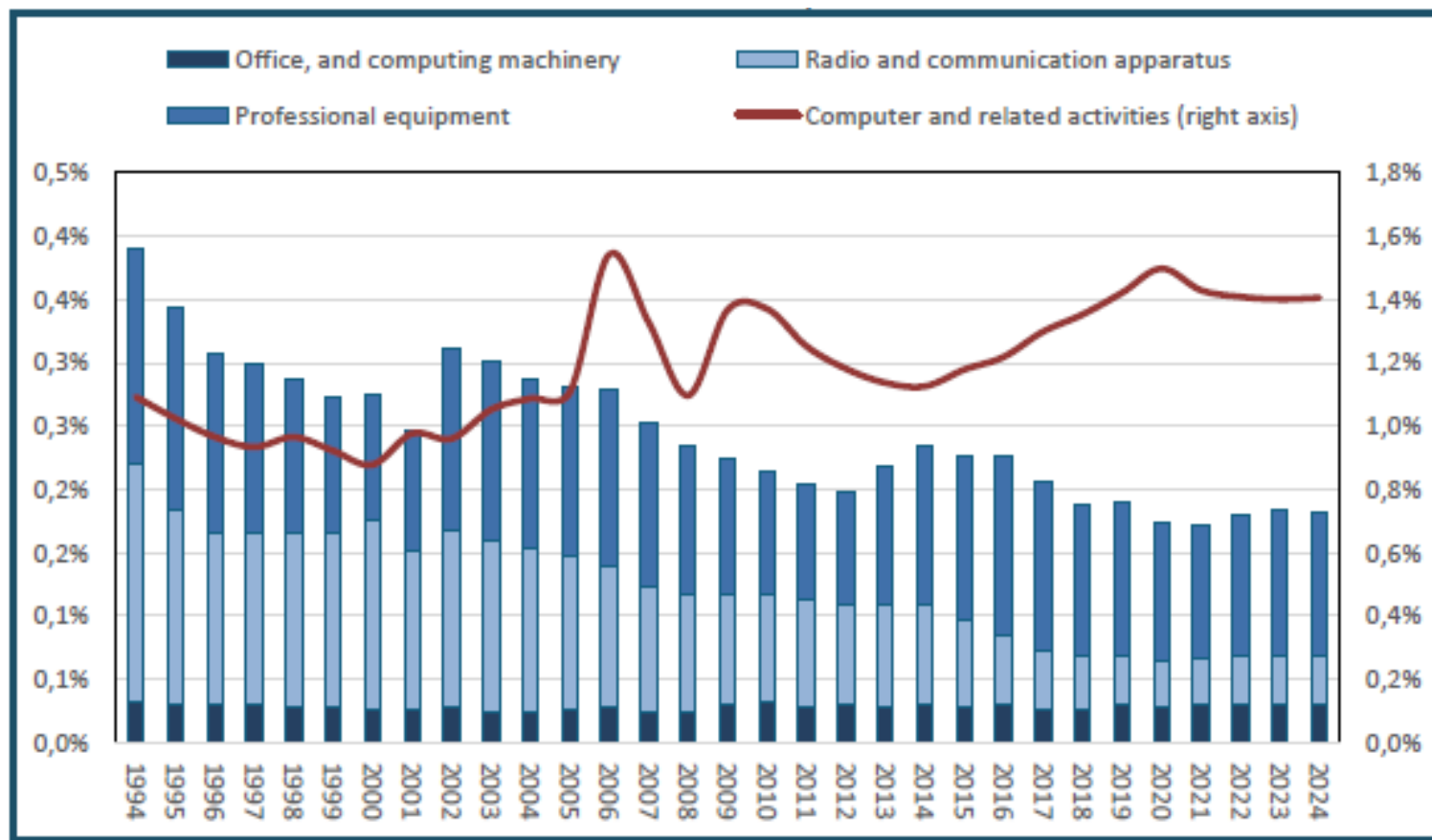
- The electronics industry spans two key areas:
 - **manufacturing**, which focuses on designing and producing electronic devices and components, and
 - **information and communication technology (ICT)**, which applies these systems to process, store, and transmit information.
- At its core, the industry produces essential components such as microchips, capacitors, resistors, and semiconductors that enable products from smartphones and computers to automobiles and medical scanners.
- These technologies drive innovation across sectors such as healthcare, automotive, aerospace, and defense.
- The industry is rapidly evolving, shaped by technological advancements and changing consumer demands.
- Devices are becoming smaller, faster, and more efficient, reflecting advances in component miniaturisation and printed circuit board (PCB) design.

1. The electronics industry value chain



2. Economic contribution

Gross domestic product (GDP) of office, accounting, and computing, radio, television, and communication apparatus, and professional equipment as percentage contribution to total GDP, 1994-2024.

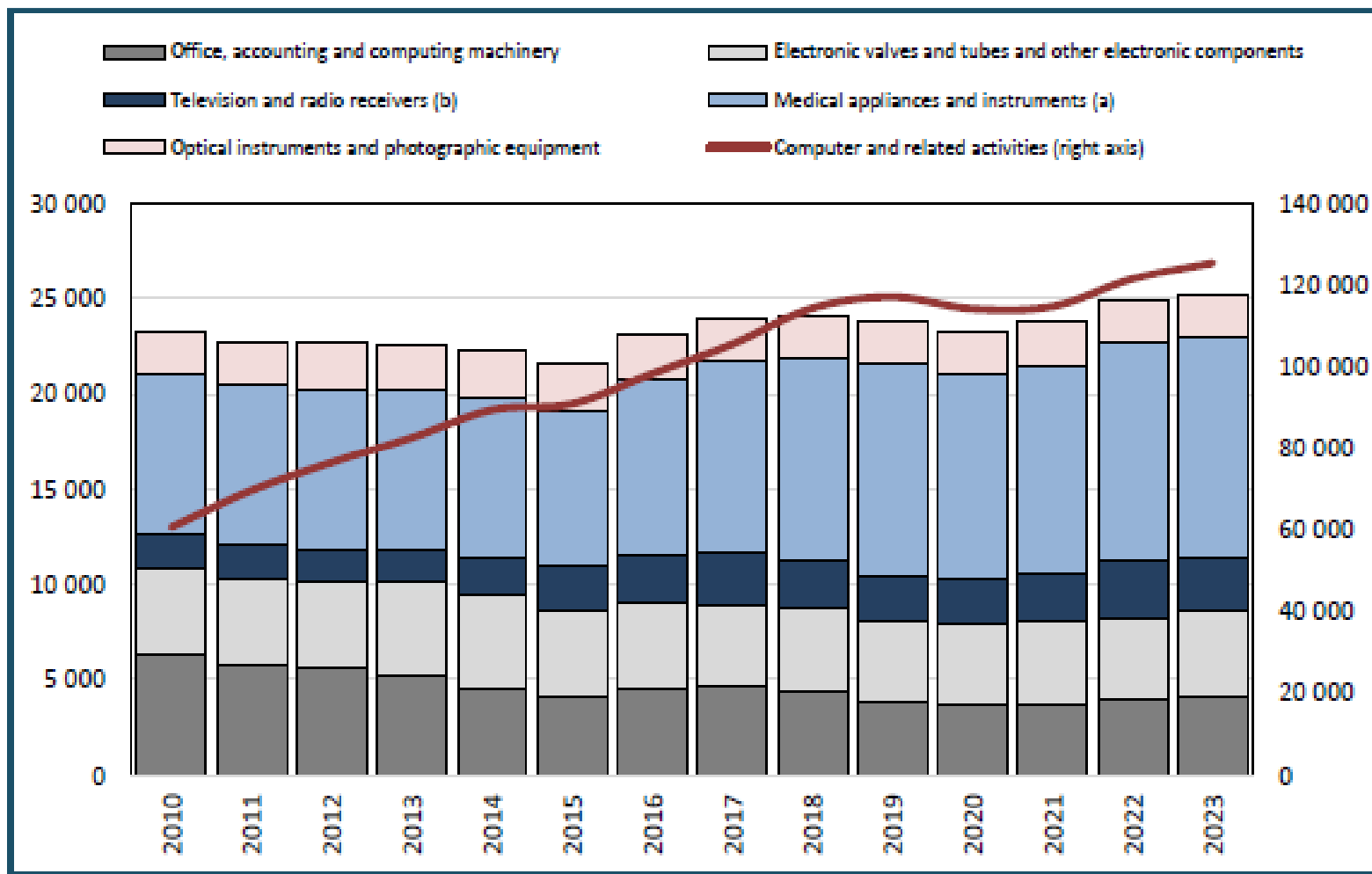


South Africa's electronics manufacturing sector (excluding computer and related services) remains a relatively small contributor to the economy, accounting for 0.18% of GDP in 2024, down from 0.29% in 2004.

- The professional equipment sub-industry, including medical devices, optical instruments, and timekeeping equipment, has fallen to 0.11% in 2024, below its 1994 peak of 0.17%.
- The radio and communication apparatus sub-industry, including radio receivers, television sets, mobile phones, set-top boxes, and related devices, experienced a sharp decline from 0.18% in 1994 to just 0.03% in 2024.
- The office and computing machinery sub-industry, primarily encompassing computers and laptops, has consistently contributed less than 0.04% of GDP.

3. Employment in the industry

Total employment in the electronics industry from 2010 to 2023



The electronics manufacturing industry employs a small workforce overall.

- Medical appliances and instruments account for most manufacturing jobs, averaging around 9 000 jobs between 2010 and 2023.
- Office, accounting, and computing machinery averaged around 4 589 jobs.
- Electronic valves and tubes and other electronic components sub-industry averaged around 4 510.
- Television and radio receivers averaged 2 276 jobs.

The small sample size in the Quarterly Labour Force Survey limits the reliability of sector-level analysis, though some long-term trends are observable. Consequently, employment trends in the sector were measured using the Quarterly Employment Survey from Statistics South Africa.

Global Technological Changes in the Industry

At the global level, electronics manufacturers are adopting advanced packaging and component mounting technologies to improve device performance, integration, and efficiency.

Advanced Packaging Technologies:

- Integrates multiple semiconductor chips into a single package to enhance processing speed and functionality.
- Reduces material usage, power consumption, and improves environmental sustainability.

Main technologies include:

- Wafer-Level Packaging (WLP): Flip Chip, Fan-out, and Wafer-Level Chip Scale Packaging (WLCSP)
- Stacked Wafer-Level Chip-Scale Packaging:
 - 2.5D Stacking: Chips placed side by side on a silicon interposer
 - 3D Stacking: Chips vertically stacked, face-down, with or without an interposer

Technologies in Electronics Assembly

- Electronics assembly involves the production and integration of Printed Circuit Boards (PCBs), which connect electronic components within a circuit.



PCBs may be single-sided, double-sided, or multi-layered, and their assembly can range from highly automated to labour-intensive processes.

Component mounting technologies include:

1. Surface Mount Technology (SMT)

- Components are mounted directly onto the PCB surface.
- Enables compact, lightweight, and energy-efficient designs.
- Replaces older through-hole methods and supports eco-friendly production, e.g., lead-free soldering.

2. Through-Hole Technology (THT)

- Components are inserted through pre-drilled holes and soldered on the opposite side.
- Provides strong mechanical connections, ideal for high-stress applications.

3. Hybrid Assembly

- Combines SMT and THT to balance design flexibility, performance, and durability.

Environmental Sustainability

- SMT reduces material waste and supports the use of recyclable components.
- Shift towards lead-free soldering aligns with global environmental standards.



Technological Trends and innovations in South Africa

Domestic manufacturers are investing significantly in advanced manufacturing equipment and technology to meet client needs and improve product quality and efficiency:

- Surface Mount Technology (SMT) and Through-hole Technology (THT) are widely used for PCB assembly, with companies like Microtronix Manufacturing and ExpandoWorks investing heavily in high-capacity, advanced pick-and-place machines.
- Advanced manufacturing techniques have transformed the assembly of electronic components, especially printed circuit boards (PCBs). For instance, Master Circuits has adopted immersion silver as a RoHS-compliant finish.
- Procircuit uses automated soldering and assembly systems, including solder paste jet printers, pick-and-place machines, and reflow ovens, to enhance PCB assembly efficiency.
- In the ICT sector, large companies such as 4Sight Holdings are using AI to develop new or significantly improved products and services, such as predictive analytics and personalised customer experiences.

Other innovations in the industry include:



Technological Trends and innovations in South Africa

cont.

- In the electronic valves and tubes subsector, SAAB Grintek Defence has introduced sophisticated electronic warfare systems, including the Land Electronic Defence System Mk 4, leveraging fully digital designs with wideband receivers.
- The Product Development Technology Station (PDTs) at the Central University of Technology utilises advanced Computer Numerical Control (CNC) machines, including 5-axis milling machines, for post-processing additive-manufactured components. CNC technologies also play a significant role in the electronics industry, particularly in the manufacturing of printed circuit boards, the assembly of electronic devices, and the production of semiconductor components.
- Local innovation includes Africa's first local needle-free IV connector and advanced dental implants made from pure titanium, demonstrating technology adoption beyond traditional electronics into specialised products.
- The medical device manufacturing sector is adopting advanced manufacturing technologies like additive manufacturing (3D printing) to create high-precision components and custom implants.

Conclusion

- The industry has a relatively small contribution to GDP and employment in South Africa.
- The electronics industry is at the forefront of technological innovation, driven by emerging advancements such as, advanced packaging, and AI integration. These technologies are reshaping manufacturing processes, product capabilities, and sustainability practices globally and within South Africa.
- South Africa's electronics industry is embracing these technological trends with investments in advanced manufacturing equipment, automation, and digital innovation.
- Going forward, sustained focus on skills development, environmental sustainability, and supportive policies will be essential to unlock the full potential of emerging technologies. Collaboration between government, industry, and academia will further drive innovation, productivity, and market expansion.

THANK YOU!

