Technological Change in Capital Goods

TIPS Development Dialogue
08 October 2024

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Outline

- Drivers of technological change
- Automation in mining equipment
- IoT in pumps
- IoT in lifting and handling equipment
- Technological trends in South Africa
- Key takeaways

Drivers of Technological Change

- Digitilisation
  - Internet connectivity enables the collection and sharing of data, as well as remote monitoring and control of operations.
- Environmental concerns encourage decarbonisation
  - Carbon taxes to lower GHG emissions.
    - Manufacturing machinery is energy intensive.
      - Companies made investments in solar generation and battery storage.
  - Demand for environmentally friendly products
    - Mining companies are shifting towards buying electric trucks from OEMs.
      - Global sales of electric trucks surged by 35% in 2023.
      - Shift from diesel-powered trucks makes ET suitable for areas with strict emissions regulations.
- Occupational Health and Safety Regulations
  - DMRE amended the Mine Health and Safety Act No. 29 of 1996 in 2017.
    - Requires Trackless Mobile Machinery in mines to be fitted with tracking technology to avoid collisions.
      - TTM's are now fitted with sensors and Collision Avoidance Systems.

Automation in Mining Equipment

- Dump trucks either have a manual or an automatic transmission.
  - A driver shifts gears using a gear lever and a clutch in a manual dump truck.
  - Automatic dump truck shifts gears automatically. The driver focuses on steering and loading.
    - Both are laborious and unpredictable.
- Komatsu commercialised Autonomous Haulage Systems in 2008.
  - Operates autonomous dump trucks – loading, hauling and dumping.
  - Improved safety, operational efficiency and profits for mining companies.
  - Rio Tinto's Pilbara iron ore mine in Australia bought 80 driverless trucks from Komatsu in 2008.
- Technological change in mining is headed towards autonomous mining operations.
  - Syama Gold Mine in Mali became the first fully automated mine in 2019.
    - Sandvik supplied Syama with a complete set of autonomous equipment and digital solutions.
      - A fleet of Sandvik dump trucks, autonomous drills and fully autonomous loaders.
        - Remotely monitored and controlled.

IoT in Pumps

- An IoT-based pump monitoring system is a network of connected devices that analyse and monitor pumps in real-time.
  - Collects information from pumps and sends it to a centralised system for fault identification, performance forecasting, and optimisation.
  - Operators remotely monitor and operate smart pumps.
    - Stormwater management systems use smart pumps to reduce water runoff.
- Mines use pumps to remove underground water, transport slurry and pump water for processing.
  - IoT pumps optimise these processes.

IoT in Lifting and Handling Equipment

- IoT sensors are integrated into overhead equipment for remote monitoring and control.
  - IoT sensors are linked through a local network, wirelessly transmitting data to operators and OEMs via a cloud computing system.
- Lifting and handling equipment previously required a technician to connect a laptop or tablet to a crane to retrieve data for a batch download.
  - Cranes fitted with IoT technology now allow for instant access to information.
    - Some older cranes are fitted with the new technology.

Technological Trends in South Africa

- Bell Equipment's autonomous Articulated Dump Truck was in the adoption stage in March 2023.
- Mogalakwena Platinum Mine in Mokopane acquired an electric rope shovel from Komatsu in April 2024.
  - Lower GHG emissions than diesel-powered excavators (90g of CO_2 vs. 273g of CO_2).
- Blesberg Lithium and Tantalum Mine in the Northern Cape was in the process of buying two sensor-based ore sorting plants from Rados International Technologies.
  - Blesberg mine commissioned an X-ray fluorescence ore sorter to advance its ore processing capacity and increase production.
  - Sensors in sorting equipment identify and separate concentrate from waste.
    - Improved spodumene recoveries to 89%.

Key takeaways

- Drivers of technological change in capital goods include digitalisation, environmental concerns, and occupational health and safety regulations.
- The mining industry is experiencing a shift towards autonomous mining operations because of technological advancements.
- New technologies have improved safety and operational efficiency.
  - Remote monitoring and control.
- Automated industrial processes are replacing jobs and require new skills.
  - Workers will require upskilling, reskilling, and training to use digital technologies or transition into new roles.

Thank you!

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