Siemens Digital Industries South Africa

Dawn of Digitalization and its impact in Africa

> CLICK TO ENTER <
Digitalization is changing the way the world operates – impacting different spheres of human existence from houses to personal devices and ranging to complex manufacturing and industrial processes. Digitalization has been witnessing a rapid adoption and is completely transforming the way businesses operate while defining new rules of competitive excellence.

The adoption of digital technologies, the speed of innovation as well as the range of digital offerings are expected to remain varied across industries, markets and geographies. The extent and impact of digital technologies is also expected to vary, favouring businesses and industries that seek relevance and increasing contribution in international markets in addition to existing domestic markets.

While advanced analytics and digitalization are witnessing growing adoption across certain industry sectors, such as the automotive sector, there is a real opportunity for adoption of these across sectors such as mining and food & beverage which are significant contributors to major African economies.

It is against this backdrop that Siemens has collaborated with an external service provider to conduct an assessment of Digitalization and its impact on Africa. The report outlines the current state of key industries across the continent and identifies challenges and opportunities.

Manufacturing, while the most mature sector in its transformation and adoption of digital technologies in Africa, remains a marginal player, struggling to make a bigger impact on country GDPs. Failing to proactively select and position Africa within the global manufacturing industry, the risk remains of continuing a path of non-industrialization.

In the mining industry we are witnessing subdued investment, rising cost pressures and increasing labour issues, a combination of mechanisation, efficient extraction of resources and better use of data can make it easier for mine operators to cut costs and create a leaner and more efficient mining operation. As such, the successful incorporation of technology will be possible through collaborative efforts of technology providers, industry, research institutes and organisations that work for uplifting the mining industry.

In the water industry, expenditure in water infrastructure has been low when compared to the global average. Inadequate investment in infrastructure coupled with poor water utility management has resulted in a greater need for development of the water sector. However, countries have started taking cognizance of the necessity for improvement in water utility management. Digital and automation solutions are critical to tackle cost pressures and enhance asset performance while addressing issues pertaining to water resource availability and relatively high levels of non-revenue water.

For the first time in history we have an incredible opportunity to use smart technology to transform entire economies at an unprecedented rate. Africa needs to get efficient strategies in place now in order to succeed. The findings from the study are just a starting point. We hope we can begin a dialogue and provide a frame to some of the unique opportunities that exist.

Ralf Leinen
Senior Vice President: Digital Industries
Southern and Eastern Africa
Siemens supports digital transformation with a range of services from consulting through to implementation.

We support our customers on the path to digitalization – from consulting on strategies for industrial digitalization through to supporting in the implementation and optimization of digital solutions.

Consulting is based on a thorough evaluation of the digital readiness of the company, which is carried out by digitalization experts together with the customer.

Together we determine the existing level of digitalization at the relevant company and from there we develop a tailored digitalization strategy for the customer together with a roadmap.
How do I derive business value?

The digital transformation is gaining momentum. Companies are already unlocking this potential - by using end-to-end digitalization. Siemens has the domain expertise in industry verticals as well as the engineering and digital know-how to generate performance improvements across the entire value chain.

Siemens solutions shorten time-to-market and increase flexibility, quality, and efficiency. They enable new business models while assuring highest levels of cybersecurity.

Two core elements of end-to-end digitalization solutions are:

- **MindSphere** – Cloud-based, open Internet of Things operating system
- **Digital Twin** – Virtual representations of product and production

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- **MindSphere** – Cloud-based, open Internet of Things operating system
- **Digital Twin** – Virtual representations of product and production
MindSphere: Connecting devices and applications via the cloud

MindSphere is Siemens’ cloud-based, open Internet of Things operating system, connecting real objects to the digital world. By applying advanced analytics, MindSphere enables you to harness value from the wealth of data. MindSphere enables the development of powerful industry applications (MindApps) and digital services to drive business innovation. Its open ‘Platform as a Service’ capabilities enable a rich partner ecosystem for applications and services. To protect your company’s assets and intellectual property, MindSphere adheres to the strictest cybersecurity standards.

Festo – Condition monitoring services
Consumption transparency is the starting point for predictive maintenance. For Festo, the German control and automation company, Siemens provides MindSphere solutions which gather real-time data right from the plant. Energy savings of up to 30% compared to existing plants of similar functionality can be realized.
Digital Twin: Feedback insights to continuously improve product and production in the real world

Maserati – Boosting Product Design and Development

Digitalization starts with the design of a product. Maserati uses the CAD software NX for the Digital Twin to virtually create, simulate, and test their cars, significantly reducing the number of prototypes needed. In combination with the collaboration platform Teamcenter, the Maserati engineers manage their project collaboratively across various locations. The result: shortened time-to-market from 30 months to 16 months.
## Siemens serves industrial verticals in a dedicated manner

<table>
<thead>
<tr>
<th>Aerospace &amp; Defence</th>
<th>Automotive</th>
</tr>
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<tbody>
<tr>
<td>Battery Manufacturing</td>
<td>Chemicals &amp; Petrochemicals</td>
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<td>Cranes</td>
<td>Data Centers</td>
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<td>Distributors</td>
<td>Fiber Industry</td>
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<td>Food &amp; Beverage</td>
<td>Glass</td>
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<tr>
<td>Machinery &amp; Plant Construction</td>
<td>Marine &amp; Shipbuilding</td>
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<tr>
<td>Minerals – Mining &amp; Cement</td>
<td>Municipalities &amp; DSOs</td>
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<td>Oil &amp; Gas</td>
<td>Panel Building</td>
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<td>Pharmaceuticals</td>
<td>Ports</td>
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<td>Power Utilities</td>
<td>Smart Cities</td>
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<td>Solar</td>
<td>Transportation &amp; Logistics</td>
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<td>Tyre Industry</td>
<td>Water</td>
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</table>
Africa: An emerging growth destination with a need for digital evolution

Introduction

South African overview and trends

Key Sector Challenges, South Africa, 2018

- Electricity supply insecurities and rising tariffs
- Underutilised capacity, lower productivity and declining global competitiveness
- Price sensitivity of the market leading to lower adoption of advanced automation and digitalization
- Skill shortages

Overall Digitalization – Current Adoption level and Expected Scenario

<table>
<thead>
<tr>
<th>Prominent Sub – Sectors, South Africa, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining, Metals &amp; Cement</td>
</tr>
<tr>
<td>Automobile Manufacturing</td>
</tr>
<tr>
<td>Food &amp; Beverage</td>
</tr>
</tbody>
</table>

| Source: Frost & Sullivan                     |

64% increase from 2018 to 2023
Level of automation and digitalization adoption is expected to increase across South Africa

<table>
<thead>
<tr>
<th>End User Segments / Country</th>
<th>Rest of Africa</th>
<th>South Africa</th>
<th>Key messages per industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minerals: Metals, Mining, &amp; Cement</td>
<td></td>
<td></td>
<td>Minerals</td>
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<tr>
<td>Oil &amp; Gas</td>
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<td></td>
<td>Autonomous Mining Technologies &amp; Efficiency Improvement</td>
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<tr>
<td>Food &amp; Beverage</td>
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<tr>
<td>Water and Waste Water</td>
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<tr>
<td>Power Generation</td>
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<tr>
<td>Automotive</td>
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<tr>
<td>Petrochemicals</td>
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<tr>
<td>Heavy Machinery</td>
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<tr>
<td>Motion Control &amp; packaging</td>
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<td></td>
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<tr>
<td>Others (Cement, Textiles, Pulp and Paper, Glass)</td>
<td></td>
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</tbody>
</table>

Level of Product presence and market size: Rev (EUR Mn) > 60 31-60 11-30 1-10 Negligible

Minerals: Autonomous Mining Technologies & Efficiency Improvement
Oil & Gas: Future Investment in Infrastructure
Food & Beverage: Openness to Digitization makes South Africa a key market
Water & Wastewater: Investments to improve management of water utilities
Power Generation: Increasing need to reduce transmission & distribution losses
Automotive: Greater appetite for digitalisation and Industry 4.0 platforms with gradual investments governed by demand
Heavy Machinery: Mechanisation and automation entails reskilling of the workforce
Motion Control & Packaging: Growing demand for packaged food and beverages

Source: Frost & Sullivan
Digital transformation expected to be aimed at improving selective process and OPEX reduction

**Digital Transformation Journey**

<table>
<thead>
<tr>
<th>Country</th>
<th>Early</th>
<th>Developing</th>
<th>Mature</th>
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</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Ghana</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Kenya</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>South Africa</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Technology Trends**

- Asset Performance management
- Shift from product centric approach to solution centric approach
- Plant Lifecycle Services
- Remote monitoring of assets and better visualisation

Source: Frost & Sullivan analysis
## Why Digital for Industrial?

Volatility and cost pressures drive an acute focus on implementing digital technologies in industrial operations.

### Headwinds

<table>
<thead>
<tr>
<th>Headwinds</th>
<th>Digital Implications</th>
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</thead>
<tbody>
<tr>
<td><strong>Capital Efficiency</strong></td>
<td>Managing capital projects operations and process plant operations lifecycle.</td>
</tr>
<tr>
<td>Plan, build and operate economically</td>
<td>Knowledge retention and transfer, Managed services, Field workforce automation and productivity.</td>
</tr>
<tr>
<td><strong>Resource Efficiency</strong></td>
<td>Shorter turnaround/longer run links, Schedule-based maintenance ➔ Data-driven maintenance.</td>
</tr>
<tr>
<td>Skills shortage</td>
<td></td>
</tr>
<tr>
<td><strong>Asset Efficiency</strong></td>
<td></td>
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<tr>
<td>Optimize connected assets</td>
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*Source: Frost & Sullivan*
2019 and beyond: Shifts from industrial automation business. Mindset shifts are inevitable as customers and peers pace ahead

**Digital Enablers**
- Connected products
- Embedded services
- Focus on business outcomes
- Enhanced value addition
- Omni-channel distribution

**Business Models**
- On-Premise → SaaS
- Connected services
- Usage-based service
- Prescriptive services
- Outcomes based services

Source: Frost & Silvan
South Africa is the strongest positioned of the African countries on its digital journey, however it lags behind in 4IR and IIoT adoption levels.
Enable flexible manufacturing and increase operational efficiency

- **250 Kcal Per capita Consumption** for Sub-Saharan Africa in 2030
- **Urban population in Africa** is expected to grow to 56% in 2050
- **South Africa - Global Food Security Index Ranking**, 45th place
- **Raw and processed food** contributing 8% of total South Africa exports

Source: Frost & Sullivan
Both the Food and Beverage sectors are still developing in Africa. The understanding of automation and how it can assist in process optimisation exists but the adoption rate is slow.

### Lowering commodity prices
Commodities such as coffee, sugar and tea have historically driven economies such as Kenya and Ethiopia. However, the price crash in 2015/16 hampered the agricultural sector’s growth in Africa.

### Policy facilitating growth of local manufacturing
High import duties, free trade agreements and rebates in the form of tax incentives are increasingly being adopted to drive local manufacturing growth.

### Increasing demand for FMCG
The urban population in Africa is expected to grow to 56% in 2050, from 35% in 2010. This rapid urbanisation combined with preference shifts towards formal retail will drive demand for FMCG products.

### Skills shortages
Lack of skills at a local level in the industry have often resulted in a reluctance to adopt new technologies, due to operation, servicing and maintenance concerns.

### Increased competition from SMEs
Globally and in Africa, the industry has been dominated by large multinational players. Examples of local SMEs include microbreweries in the beverage industry, which has caused an increase in competition and a slight increase in price sensitivity due to these microbreweries catering to more niche products.

Source: Frost & Sullivan, World Bank**, IMF, SARS, UN Projections*
South Africa is the strongest positioned of the African countries on its digital journey, with the Food & Beverage sector showing higher propensity for advanced automation & digitalization

**Digital Transformation & Industry 4.0**

Businesses in South Africa have been investing steadily to prepare for the impact of the fourth industrial revolution.

**Value Added Manufacturing**

Shifting focus from export of raw materials and mineral resources towards development of supply chains and industry that add value to these base commodities and raw materials. However this shift will be slow.

**Give and take between automation and job creation**

Unemployment has historically plagued African countries, and remains a key challenge. This has led to an abundance of low cost unskilled labour, thus slowing down the adoption of advanced automation in Africa.

**Production Cost Optimisation**

Manufacturing industries are increasing focus on resource and cost optimisation to improve production margins and competitiveness in the global markets. While the current trend is towards utilisation of existing capabilities, investment in new facilities is expected to be gradual.

**Increasing consumer spend**

Africa’s share in global consumer spend by region is expected to grow from 5% in 2012 to 7% in 2022, with spend on Food & Beverage products expected to be one of the key driving sub-segments of this increased expenditure. While there is an appetite for automation in Africa, market price sensitivity, low skills and a slow shift towards local value added manufacturing has led to a slow uptake of advanced automation technologies.

Source: Frost & Sullivan
Automation and digitalization are ideal to tackle cost pressures and traceability limitations

High Product Standards for Food Safety
The F&B Industry is characterised by stringent standards that manufacturers are required to adhere to, automation can increase ease of conformation to these standards.

Need for Product Traceability
Product record management and traceability are vital challenges for the industry. Increased digitalization provides a means of remedying this challenge.

Volatile Market Demands
A key marker of the industry: extremely volatile and shifting consumer demands. Keeping up with these demand trends will be heavily reliant on ability to adapt, which can be aided through adoption of IIoT.

Variegated Regulations
Food regulations vary heavily from region to region: a key pain point for manufacturers to keep track of. Monitoring of conformity in complex organisations can be aided through adoption of IIoT.

Slow Product Innovation Cycles
Timely creation and movement of products across the supply chain with respect to aligning products to dynamic customer demands.

Supply Chain Complexities
Both traceability and labelling result in supply chain complexity. Stringent processes need to be followed regarding labelling and serialisation of products, while tracking products through the supply chain remains a critical issue.
Tracking and monitoring of products within the Food & Beverage industry presents great potential for the implantation of digital solutions.

"With the transformation of the industry through industry 4.0, IOT offerings and Digitalization, we are seeing changes in demands from end users, with similar adaption to meet these demands from suppliers. Furthermore, increased digitisation is something I expect to see much more of in Africa."

– A Leading OEM

"With increasing knowledge on the benefits of automation and digitisation in Africa we’re seeing a shift from like-for-like replacement to replacement with the best possible product which also meets technical specifications. Industry margins are low, hence high efficiency is becoming increasingly important."

– An Automation Solution Provider

"In my experience this has not always been the case, but with more and more pressure to innovate in the industry I feel we will see greater enthusiasm to adopt IIoT solutions."

– A Beverage Plant Head

The beverage sector in South Africa is mature in comparison to the rest of Africa, due to the presence of multinationals such as Coca-Cola and In-Bev, who utilize South Africa as an export hub into the rest of Africa.

South Africa and Kenya are expected to be at the forefront in adopting digital platforms for manufacturing. Adoption in South Africa will however happen at a much faster rate than in Kenya.

The Food Sector in Kenya, Ghana and Ethiopia are still in a nascent stage, with a strong focus placed on agriculture and cultivating raw products. There is still little focus on agro-processing in these countries, however these sectors are growing.

Source: Frost & Sullivan
### Addressing Industry Requirements.
**Siemens Solution: SIMATIC PCS 7 with BRAUMAT craft brewing libraries**

<table>
<thead>
<tr>
<th><strong>Features</strong></th>
<th><strong>Benefits</strong></th>
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<tbody>
<tr>
<td>• Designed for the beer industry.</td>
<td>• Increased production with no further staffing requirements.</td>
</tr>
<tr>
<td>• Monitoring of brew quality enabled through automatically stored production data and analysis tools.</td>
<td>• Improved quality, repeatability and consistency. This is done by automating labour-intensive tasks which have historically been done manually.</td>
</tr>
<tr>
<td>• Integration of BRAUMAT libraries and SIMATIC PCS 7 process control system can optimally run any size brewery.</td>
<td>• Automation of temperature control to optimise cooling efficiency.</td>
</tr>
<tr>
<td>• Active Interface.</td>
<td>• Reduced energy use related to heating and cooling.</td>
</tr>
<tr>
<td>• Reporting and trending capabilities.</td>
<td>• Production scheduler helps you easily manage your Production Order List and CIP orders.</td>
</tr>
<tr>
<td>• SIMATIC HMI operator interface</td>
<td>• Integrated, user-friendly system for monitoring, control, and planning is designed explicitly for the craft brewer.</td>
</tr>
<tr>
<td></td>
<td>• Allows operators to focus on ensuring quality, not on juggling all of the tasks required to get the job done.</td>
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</table>
Using Siemens technology Gruppo Campari created a unified repository for all product specifications and increased efficiency of manufacturing

Until 2012, Gruppo Campari’s approach to management of product specification remained unstructured

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solutions</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>• With Gruppo Campari’s rapid expansion (more than 20 acquisitions in the spirit industry globally in the past 20 years), there was a constant requirement to integrate new products, plants, and assets into its operation management systems.</td>
<td>• Gruppo Campari adopted Siemens SIMATIC IT Interspec from Siemens PLM Software, which is a configurable solution for product specification management in process industries.</td>
<td>• SIMATIC IT Interspec was selected for its flexibility and operation independence.</td>
</tr>
<tr>
<td>• A need to standardise and streamline data acquisition while offering an accelerated response to product information requests from consumers and/or regulators.</td>
<td>• This allows the company to develop, configure and manage all production specifications (raw materials, intermediate and finished products as well as packaging materials).</td>
<td>• According to Campari Global QHSE Content Manager, Marco Rocca:</td>
</tr>
<tr>
<td>• Previously this was done using Microsoft software such as Word documents or Excel spreadsheets, with no standard workflow or authoring.</td>
<td>• This stores all specifications in a single, controlled data repository.</td>
<td>“We can configure the systems independently, add properties, create new frames, and edit contents – virtually everything can be configured with no customisation.</td>
</tr>
<tr>
<td>• In 2012 as a result of the complex growth of the organisation, it launched an extensive digitisation process.</td>
<td></td>
<td>“Alternative solutions were more rigid and required a system engineer to do that. With SIMATIC IT Interspec, it was enough to attend a short training course to be virtually independent. The tool has been around for a few decades, so it’s proven, tested and stable.”</td>
</tr>
</tbody>
</table>
Improve the plant efficiency for beer industry - SIMATIC PCS 7 with BRAUMAT craft brewing libraries

Designed for the beer industry. Monitoring of brew quality enabled through automatically stored production data and analysis tools. Advantages include increased production with no further staffing requirements. Improved quality, repeatability and consistency. This is done by automating labour-intensive tasks which have historically been done manually.

Increase the manufacturing efficiency of liquor giant - SIMATIC IT Interspec

It is a key component of the R&D Suite but can also be implemented as a stand-alone system for global specification management in process industries. This allows the company to develop, configure and manage all production specifications (raw materials, intermediate and finished products as well as packaging materials). This stores all specifications in a single, controlled data repository.

Automates and intelligently control bottling lines - Leading soft drinks manufacturer

One of the largest carbonated soft drink bottling plants in South Africa is using Siemens PLC’s at each filling line. Siemens technology supported ~79% of total local production of 4.2bn litres in 2016.

Unified Repository for Product Specifications - Leading Italian liquor giant

Company adopted Siemens SIMATIC IT Interspec from Siemens PLM Software, which is a configurable solution for product specification management in process industries. Using Siemens technology, Italian Liquor Giant created a unified repository for all product specifications and increased efficiency of manufacturing.
New technologies and digital platforms critical to improve productivity and production margins

- **South Africa:** Input cost inflation of 6% for mining sector during 2018
- **South Africa:** R356 billion GDP contribution in 2018
- Siemens has supported ~33% of SA mining contribution to GDP
- Exorbitant operational costs continue to dent investor confidence

Source: Frost & Sullivan
Overview: Initiatives being sought and undertaken in the mining sector

Zambia
- The Zambia Development Agency Act provides incentives to firms investing substantial amounts in the mining sector in the country. The Act specifies that the threshold amount should be US$ 500,000 or above in order to qualify for fiscal and non-fiscal incentives.

Zimbabwe and Namibia
- Last year Zimbabwe scrapped its indigenisation requirements and slashed the 51% indigenous shareholding quota for all minerals; this initially excluded diamonds and platinum. The move was well appreciated by investors.
- A similar measure was implemented in Namibia. The country relaxed the requirement for mining entities to have a minimum indigenous shareholding of 5% held by previously disadvantaged groups.

South Africa
- The Mandela Mining Precinct’s role is to identify barriers and develop a vision for long term development and transformation of the mining industry. The project also emphasises on improving mining efficiencies and introducing most modern mining technologies.
- Introduction of Mineral beneficiation (Platinum Group Mineral) for fuel cell industry development.
- The Amended Mining Charter outlines the expectations of rights holders to invest in South African mining industry.

Botswana
- In 2018, Botswana announced plans to introduce the country’s new minerals policy. The policy aims to improve the investment climate in the minerals sector. Moreover, the country has completed the legislative amendments to the Mines and Minerals Act, Precious and Semi Precious Stones Act and Diamond Cutting Act to enhance the ease of doing business.
Despite increasing labour issues and a drop in investment, South African mining industry, one of the largest in Africa, is focusing on improving growth.
Digital Transformation challenges in enhancing labour skill sets, increasing efficiency of mines and changing the way the mining industry operates

**Top 10 challenges**

- Data reliability
- Absence of region specific automation solutions
- Lack of Government regulations
- Affordability
- Connectivity issues - Mines are located in remote areas
- High infrastructure and connectivity cost
- Lack of internal technological awareness and skills sets
- Dearth of service providers to implement customized solutions
- Disinterest among technology providers with no new explorations
- Extreme Weather Events

### Automation Adoption Maturity 2018

<table>
<thead>
<tr>
<th>Manufacturing Sub-Sector</th>
<th>South Africa</th>
<th>Kenya</th>
<th>Ghana</th>
<th>Rest of Africa</th>
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</thead>
<tbody>
<tr>
<td>Mining</td>
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<tr>
<td>Metals</td>
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<tr>
<td>Cement</td>
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</tbody>
</table>

- Early
- Developing
- Mature

Foreign investors are still wary of challenges facing mining projects in Africa

South Africa leads in the adoption of automation in mining sector

Automation leads to employee skills development and advanced on the job training.

Source: Frost & Sullivan
Outlook: The rise of intelligent mines is not a distant dream; Digitalization is slowly capturing the mining industry of Africa

<table>
<thead>
<tr>
<th>Current (2019) Product Focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commoditisation, multiple suppliers, varying vendors and makes</td>
</tr>
</tbody>
</table>

- Sensors
- PLC, SCADA, DCS, HMI
- Control platforms and software

<table>
<thead>
<tr>
<th>Short Term (2021 - 2022) Connected / Smart Mines</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT-OT convergence OT applications</td>
</tr>
</tbody>
</table>

- Field Device
- Sensors
- IoT Gateway
- Cloud Storage
- Online diagnostics

- Cloud, XaaS
- Analytics
- Predictability/ Preventive Maintenance

<table>
<thead>
<tr>
<th>Future (2023+) Mining-as-a-Service</th>
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<tbody>
<tr>
<td>Data ⇒ Insights ⇒ Outcome</td>
</tr>
</tbody>
</table>

- AI/ML
- M2M, 5G
- AR & VR
- Blockchain/ Digital/ Integrated Supply Chain

Source: Frost & Sullivan
Enhanced Productivity with reduced maintenance & service costs

SIMINE portfolio with complete electrical engineering, drive automation and service packages that increase productivity, improve drive system efficiency and reduce energy costs.

Optimizing Conveyor Belt Systems

Use of digital simulation tools to reveal the dynamic behavior of the whole system which allows improvements to be made in system operation while also minimizing idle times.

Optimized Processes and Operation

SIMATIC PCS7 with its open, flexible and scalable architecture forms the basis of the Minerals Automation Standard that aims at improvements in competitiveness, through optimized productivity, plant availability and efficiency.

Exploration & Excavation

Transport & Material Handling

Processing & Beneficiation

Refining & Agglomeration

Condition Monitoring Systems

SIPLUS CMS for the early detection of damage to machine and plants which aids in decision making for maintenance staff, operators and management.

Source: Siemens / Frost & Sullivan
Siemens Mining Technologies implementation

**Equipment Availability and Efficiency**

At the Sentinel Copper Mine in Zambia Siemens has implemented a SIMINE Gearless mill drive with SIMATIC PCS7 mill automation that has resulted in an operational efficiency of 95.3% in addition to lower operating costs, minimized downtimes and improved reliability.

**Automation for Underground Mining**

At the Freeport McMoran Grasberg copper and gold mine in Indonesia, SIMATIC PCS7 was installed for the DCS that controls eleven production trains and five service locomotives. The automation system allows to minimize production loss in the transition from open-pit to underground mining.

**Asset Health Analytic**

Siemens’ Asset Health Analytics creates a foundation that allows equipment like conveyors, ball mills and crushers to supply additional data. Analysis of this data provides information that allows for fact based maintenance decisions in real time while also planning maintenance and service measures.
Partnerships between technology enablers and cross-functional participants are bringing in smart capabilities to water cycle management.

Water Expenditure by Africa (1.3% of total infrastructure investment) is extremely low.

South Africa: Invested ~R12 bn in the technology upgrade and construction of three treatment plants.

Last 4 years Siemens flow meters measured the flow of ~3.7 million megalitres of water.

Source: Frost & Sullivan
Poor water utility management and inadequate water infrastructure investment results in greater need for water sector development

**Digital Transformation**

Smart and advanced technologies like leak detection and metering are being used to improve billing and efficiency.

**Improved Quality**

Preference is shifting away from cheaper products towards higher quality core products in the case of large water infrastructure projects, especially in the building services and industrial sectors.

**Decentralisation**

There is growth in the market for ‘plug and play’ treatment models owing to the development of industrial zones, gated communities and business parks. Under-sink treatment systems are growing in popularity retail will drive demand for FMCG products.

**Sustainable Buildings**

Buildings are constructed to be water efficient, reducing the amount of fresh water use, through wastewater reuse. This is driven by the increasing awareness of water scarcity.

Deployment of technological solutions is becoming common-place in the industrial and residential segments. Policy enforcement regarding effluent discharge is becoming more stringent across the continent. There is reducing dependence on the public sector to provide water and wastewater services. Industrial and residential sectors are opting to install their own small-scale water treatment and, in the case of industrial sector, wastewater treatment facilities. This has opened the door to increased private sector participation.
Water sector overview: South Africa

Municipal Water Sector Challenges, South Africa, 2018
Climate variability has led to rising levels of water scarcity across the country creating a severe deficit in water availability. This has indirectly impacted the levels of municipal revenue generation from water sales.

There are a number of options being explored to increase water resources in the country, including wastewater treatment and desalination. The main barrier is the initial capital investment required.

South Africa loses approximately 1.58 billion kilolitres of water a year as non-revenue water. The water loss reportedly costs the country around R7.2bn a year.

Industrial Water Sector Challenges, South Africa, 2018
Water restrictions, fines and rising water tariffs resulting from low water availability in parts of the country have impacted water intensive industrial sectors.

Poor feed water quality is impacting industrial players as they need to invest in water treatment technologies to ensure feed water meets quality standards. This is especially the case in the food and beverage sector.

Acid mine drainage is one of the most significant water-related environmental challenges facing the mining industry caused by old abandoned mines and increasing illegal mining activities. This water is very difficult to treat.

Water Sector Initiatives, South Africa, 2018
Municipal
Pressure management, pipe replacement and demand-side management through digital capped water meters were the top 3 initiatives taken to rapidly reduce water consumption in the Western Cape in 2018.

More than 200 users were connected to be supplied with treated effluent for irrigation and various industrial applications not requiring potable water.

Industrial
Large industrial players have made changes or investments in their business to ensure reduction in their reliance on municipal water supply and ultimately use less water.

Government has invested ~R12 bn in the technology upgrade and construction of three treatment plants specifically designed to treat polluted water from old underground gold mines across Gauteng and mitigate further problems of acid mine drainage.
Digital awareness is significant but the actual investment is expected to be challenge specific and value driven

Appetite for Technology Adoption 2018

<table>
<thead>
<tr>
<th>Sector</th>
<th>South Africa</th>
<th>Kenya</th>
<th>Ethiopia</th>
<th>Ghana</th>
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<tbody>
<tr>
<td>Water</td>
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<tr>
<td>Wastewater</td>
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</table>

- The water and wastewater sector in South Africa is mature in comparison to the rest of Africa, due to strong technical skills, and commercial and financial management of water resources.
- There has been chronic underinvestment in water and wastewater infrastructure across Africa. Currently, there is an estimated USD 12 billion investment gap. All 3 countries face cheap labour as a road block to the adoption of advanced technologies.
- In Ghana and Kenya there is increasing focus and adoption of ever more advanced technologies in the water and wastewater sector. Ethiopia is using slightly less advanced technologies to overcome their challenges.

“One of the biggest barriers to the development of the water and wastewater sector across Africa is the low investment this sector receives. However, its importance is being recognised and investment is picking up, but very slowly.”

– A leading Solution Provider

“Water and wastewater in the F&B market is a real driver in most African countries at the moment. Government is getting stricter about water discharged from industries and the enforcement of existing effluent policies is picking up.”

- An EPC

“There is increasing uptake of the small-scale plug and play/containerised water treatment modules for business parks and housing developments and underserved, rural areas. The benefit of these is that less skilled labour is needed.”

– A leading OEM

Source: Frost & Sullivan
## Technology adoption maturity: Wastewater sector

### Digital Transformational Journey

<table>
<thead>
<tr>
<th>Technology Adoption Maturity</th>
<th>Business Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
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<tr>
<td>Developing</td>
<td></td>
</tr>
<tr>
<td>Maturity</td>
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</table>

### Current and Future State of Key Automation Product Adoption

<table>
<thead>
<tr>
<th>Technology</th>
<th>Current State</th>
<th>Future State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile and decentralised treatment systems</td>
<td>Industrial Water Treatment</td>
<td>Enhanced Adoption</td>
</tr>
<tr>
<td>Web-based technologies and Cloud Computing</td>
<td>Better data acquisition and real-time control and management</td>
<td>Enhanced Adoption</td>
</tr>
<tr>
<td>IIoT and AI for fully automated treatment systems</td>
<td>Integration of industrial treatment with central facility</td>
<td>Water Treatment as a service</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Continue
Automation is an ideal solution to tackle cost pressures and enhance asset performance leading to efficient CAPEX and reduced OPEX.

Key Imperatives
- Capital Efficiency: Plan, build and operate economically
- Resource Efficiency: Skills shortage
- Asset Efficiency: Optimise Connected assets

Automation Implications
- Managing capital projects operations and process plant operations lifecycle.
- Knowledge retention and transfer, Managed services, Field workforce automation and productivity.
- Shorter turnarounds/longer run links, Schedule-based maintenance – Data-driven maintenance.

Top 10 challenges:
- Value of Water and Non-Revenue Water (NRW)
- Water Resource Availability and Water-Energy Nexus
- Population Growth and Urbanisation
- Public Health – Water Quality, Access to Sanitation and Safe Disposal
- Climate Change and Extreme Weather Events
- Risk in Water Intensive Industry and Global Trade
- Relatively High Capex and OpEx
- Governance and Accountability
- Institutional Capacity and Resources
- Sustainability of Water Utilities and Cities

Source: Frost & Sullivan
Expected transformation in the African water sector

<table>
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<tr>
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<tbody>
<tr>
<td>Commoditisation, multiple suppliers, varying vendors and makes</td>
<td>IT-OT convergence OT applications</td>
<td>Data &gt; Insights &gt; Outcome</td>
</tr>
<tr>
<td>• Sensors</td>
<td>• Cloud</td>
<td>• AI / ML</td>
</tr>
<tr>
<td>• Analytical instruments</td>
<td>• Machine learning</td>
<td>• XaaS</td>
</tr>
<tr>
<td>• Control platforms and software</td>
<td>• Predictability</td>
<td></td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Poor water utility management and inadequate water infrastructure investment results in greater need for water sector development

<table>
<thead>
<tr>
<th>Weak policy implementation due to poor coordination</th>
<th>Limited availability of funding</th>
<th>Limited expertise and necessary skills in the water and wastewater sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• SSA countries have various policies in place to prevent the release of untreated wastewater from industrial processes. The inherent fragmentation at different government levels responsible for water and wastewater management results in limited enforcement of these policies. As a result, industries are not penalised for releasing untreated wastewater.</td>
<td>• Although the need for investment in water and wastewater infrastructure is being increasingly recognised, the availability of funding is a persisting issue.</td>
<td>• There are limited individuals with the necessary expertise and skills to implement and manage technologically advanced water and wastewater solutions. This results in low demand for non-legacy products and is further compounded by the lack of available in-country training.</td>
</tr>
<tr>
<td>•Governments are becoming stricter with policy enforcement and the impact should decrease over the next 5 years.</td>
<td>• Water is not a high revenue commodity and non-payment is fairly common, resulting in decreased municipal funds for water projects.</td>
<td>• Adding to this, the low cost of labour, compared to the high cost of advanced instrumentation, is a major restraint.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Industry Specific Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sector Approach to water and wastewater Challenges</td>
</tr>
<tr>
<td>Mining</td>
<td>• Water plays an integral role in the mineral processing stage of the mining operation.</td>
</tr>
<tr>
<td>Food &amp; Beverage</td>
<td>• The food &amp; beverage industry requires an enormous amount of clean water.</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>• Oil &amp; Gas production requires large volumes of water.</td>
</tr>
<tr>
<td></td>
<td>• High environmental impact from effluent water.</td>
</tr>
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<td></td>
<td>• Poor wastewater quality that requires rigorous treatment methods.</td>
</tr>
<tr>
<td></td>
<td>• Regulations around effluent and reclaimed water standards are becoming more stringent, resulting in the need for rigorous treatment methods and increasing demand for zero-liquid-discharge solutions</td>
</tr>
<tr>
<td></td>
<td>• Remote locations far from water treatment plants.</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Outlook: The African water / wastewater sector is expected to witness a gradual transformation with cost and skill implications of technology adoption emerging as key challenges for the sector.

**Siemens Flow Solutions:**
Siemens has provided South Africa with simple, flexible flow solutions for more than 30 years. Some of these solutions are; standard electromagnetic flow meters with modular pulsed Direct Current (DC) technology, high-performance pulsed Alternating Current (AC) electromagnetic flow meters, external powered flow meters and battery-operated water meters with 3G information transmission.

**In South Africa:**
Siemens flow meters combine world-class performance with a low cost of ownership, tailored for the toughest water applications. Siemens assists the Water Boards in efficiently measuring water usage which improves productivity and ultimately the financial health of the Water Boards.

**Siemens Future Focus:**
Promote greater awareness, among customers and end-users, of the other uses of Siemens flow meters such as; water leakage detection, pipeline water management and irrigation flow measurement.

**Siemens Smart Metering Solutions – Addressing Industry Requirements**
- Siemens Smart Metering helps in Water Balancing
- Key Features: Designed for Water Industry Application
  One battery driven water meter DN 25 – 600 (1” - 24”), 10 years battery operation & AC + battery backup

**High Precision Flow meters usage across Water Boards**
Siemens’ high-precision volume measurement flow meters are used by various Water Boards across South Africa, such as Rand Water, East Rand Water Care Company (ERWAT), Lepelle Northern Water, Umgeni Water, Johannesburg Water.
Digitalization and Industry 4.0 ideal for optimizing production costs and enhancing global competitiveness

Focus on manufacturing to boost economic prospects and create employment

South Africa: Local content in automobile production to be increased from 39% to 60% by 2035

Siemens technology has supported ~57% of SA local car production in 2018

US$ 459 million annual investment by South African businesses to prepare for impact of 4th Industrial Revolution

South Africa: Local content in automobile production to be increased from 39% to 60% by 2035

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US$ 459 million annual investment by South African businesses to prepare for impact of 4th Industrial Revolution
Mega Trends: Impacting the manufacturing sector in Africa

- Increasing population and rising percentage of urbanisation across African economies will have a significant impact on demand for manufactured goods and the need for creating employment opportunities across manufacturing segments.
- Growing GDP per capita is expected to boost local demand for manufactured goods and while also providing the opportunity to create an export driven manufacturing setup. Local demand alone is however not expected to justify investment in the sector.
- FDI influx in Ethiopia and Ghana has witnessed a positive development owing to government initiatives and policies that are being implemented with regards to improvement in the manufacturing sector, infrastructure etc. Private investment in manufacturing is expected to increase with these initiatives.
- Growing imports especially from Chinese and other Asian countries. This has a direct impact on foreign exchange and employment opportunities created in the manufacturing sector. There is a need for reversal of the trend and necessity to increase exports & value add from Africa.
- Reducing local demand and highly competitive global prices are challenging for local African industries. Higher operational costs of production in most African countries when compared to global standards.
- African countries are rich in mineral resources which are exported without much value addition and as such have a lower market value. The finished goods are however imported at a much higher price. Countries are losing out on valuable foreign exchange. Hence, the focus is to develop industries and supply chains that can add value to these raw materials and contribute in a greater way to the local economy.

Stagnating growth in countries like South Africa impacting disposable income levels, hampering sectors like the automotive industry where new investment in production expansion is constrained.
South Africa: Manufacturing sector overview

Prominent Manufacturing Sub – Sectors, South Africa, 2018

01 Mining, Metals & Cement
02 Food & Beverage
03 Automobile Manufacturing

Manufacturing Sector Challenges, South Africa, 2018

Issues pertaining to stability of electricity supply and rising costs of electricity/energy has eroded manufacturing margins that South African industries enjoyed in the past.

Under utilised capacity, lower productivity levels and labour unrest have negatively impacted margins and net operating surplus levels.

Development of local supply chains and content are not exactly aligned with the requirements of the country’s manufacturing industry. This would also entail technology modifications that suit local operating environments and skills available.

Availability of proper infrastructure is a key impediment to the manufacturing sector in the country. Logistics and inefficient modes of transportation not only add to final product cost but also incur additional time in reaching the final destination.

Manufacturing Sector Initiatives, South Africa, 2018

Increasing automobile production to 1% of the total global production from the current 0.68%. Local content utilisation also to be increased from 39% to 60% by 2035.

Investment of USD 459 million annually by South Africa businesses up until 2021 to prepare for the impact of the fourth industrial revolution.

Manufacturing Competitive Enhancement Programme (MCEP) to improve competitiveness of existing manufacturing facilities.

Mineral beneficiation (PGM) for fuel cell industry development.

Growing market share of domestic mining equipment manufacturers.

Mandela Mining Precinct focusing on mining efficiencies, mining 4.0, modernisation etc.
Automation, Digitalization and Industry 4.0. The ideal platforms for addressing concerns of the African manufacturing sector for achieving optimal production costs and enhancing competitiveness in the global/ export markets. However, implementation has its challenges.

### Top 10 Challenges

1. **High CAPEX associated with digital systems**
2. **Policy & Regulations favouring domestic production**
3. **Availability of skilled workforce**
4. **Focus on ROI and immediate tangible benefits**
5. **Preference for global OEMs in system design, engineering and assembly**
6. **Price sensitivity of end users towards automation/digital platform adoption**
7. **Growing pressure on production margins**
8. **Reducing demand for domestic manufactured goods**
9. **Competition in African export and global market places**
10. **Rising level of imports from Asian countries**

### Key Imperatives

- **Operational Efficiency**
  - Plan, manage and operate economically

- **Business Sustainability**
  - Growth amidst challenging business environment

- **Asset Performance and Management**
  - Connected assets

### Automation Implications

- **Operational Efficiency**
  - Managing supply chains, resource utilisation and production processes efficiently; minimizing delays and production related losses.

- **Business Sustainability**
  - Leapfrog technology adoption to enhance quality and competitiveness in global export markets.

- **Asset Performance and Management**
  - Data analytics, predictive maintenance and reduced production down times.
Outlook: The African manufacturing sector is expected to witness a gradual transformation with cost and skill implications of technology adoption emerging as key challenges for the sector.

**Siemens Digital Twin:**
The digital twin in the automotive industry is the precise virtual model of a vehicle or a production plant. It displays their development throughout the entire lifecycle and allows operators to predict behaviour, optimizing performance, and implement insights from previous design and production experiences. Siemens offers the digital twin of product, production and performance that helps reduce the number of prototypes, predict performance of production and products through a combination of domain expertise and optimized tools.

**In South Africa:**
Siemens technology automates, drives and intelligently controls assembly lines, paint shops and body shops. Siemens also plays in integral role in the manufacturing process of the upstream automotive segment with industrial control technology playing a role in the automotive component and the tyre manufacturing industry.

**Siemens Future Focus:**
Siemens is committed to working together with its customers to ensure that their production facilities run at optimal efficiency. Siemens digitalization solutions make it easier for manufacturing entities to adapt quickly to new market situations and evolving technology while ensuring greater flexibility in meeting customer specific requirements.

### Siemens Digital Twin – Electric City Car

Uniti, Sweden used Siemens engineering to develop their electric city car. Employment of the digital twin optimized development of the new car, allowing simulation and optimization of design in a complete virtual environment. Simcenter and Tecnomatix platforms ensured efficient production planning.

### Comprehensive Product Portfolio

Siemens offers a comprehensive portfolio of products, solutions, systems and services that optimizes the entire product and production lifecycle of Automotive companies – from efficient product design to flexible production and maintenance of the plant and supporting some of the largest automotive manufacturers in South Africa.
An understanding of the impact of digitalization & advanced manufacturing on processes exists. Steps are being taken by governments and industry associations for their adoption to increase competitiveness in local and global markets.

Appetite for Technology Adoption / Digital Transformation 2018

<table>
<thead>
<tr>
<th>Manufacturing Sub-Sector</th>
<th>South Africa</th>
<th>Kenya</th>
<th>Ethiopia</th>
<th>Ghana</th>
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<tbody>
<tr>
<td>Automobile Manufacturing &amp; Assembly</td>
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<tr>
<td>Food &amp; Beverage</td>
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<tr>
<td>Mining, Metals &amp; Cement</td>
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<td>Pharmaceutical</td>
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<tr>
<td>Leather, Textile &amp; Light Manufacturing</td>
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</tbody>
</table>

- Early
- Developing
- Mature

“Technology and vendor preference for local OEMs is defined by product cost, service network, technical expertise & capabilities, availability of product/ stock and past experience of the OEM with the brand.”

- Global Mining Equipment OEM

“Manufacturing conglomerates have a preference for global OEMs which hampers participation of local players. Increased local OEM participation would increase demand and procurement of automation & digital products and solutions from regional partners and solution providers.”

- Local Automotive Assembly Line Developer

“Manufacturing sector has a greater appetite for Digitalization and Industry 4.0 platforms. However, new investments in the sector will be gradual and governed by market demand. This will invariably impact the demand for advanced automation and digital solutions in the short to medium term.”

- NAAMSA

Contribution of the manufacturing sector has been declining across key economies like SA and Kenya. South Africa and Kenya are expected to be at the forefront in adopting digital platforms for manufacturing. ROI is a key metric for determining investment in digital platforms across manufacturing sector.
**Conclusion**

In line with global peers and the business transformation, mindset shift is key to success

**Growth Focus**

**Challenge - specific solution focus**

- Partner with solution providers who can be your business transformation enablers
- Transform from focus on capital (CAPEX) and operational (OPEX) expenditure to total expenditure (TOTEX)

**Smarter Operations**

- Utilise technology to drive down operational costs and shift to lifecycle/outcome based service mode
- Demand proof of value (POV) based pilot projects
- Transform from plant centricity to business centricity – think of business objectives while adopting technology

**Align with Government Initiatives on Technology Adoption & Localization**

- Consider automation and digitalization as an enabler of skilled force development and workforce augmentation rather than skills replacement
We hope you enjoyed reading through the findings and look forward to sharing further insights related to specific countries and industries.

In the meantime, please reach out to us to start your digital transformation journey.

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