



INTELLECTUAL CAPITAL

Imbibing a culture of innovation and efficiency

Material issues addressed

- Digitisation
- Product innovation

Key risks considered

- Product quality risk
- Digitisation risk

SDGs impacted



Information Technology

Technology can significantly enhance our ability to withstand and recover quickly from difficult circumstances. This might include cloud solutions to protect data, AI-driven predictive analysis to anticipate market changes, or advanced automation to maintain operations under a variety of conditions. Innovation can also foster resilience by encouraging a culture that is adaptable and capable of pivoting in response to new challenges or opportunities.

Furthermore, technology can help in streamlining operations, reducing inefficiencies and freeing up resources. This includes automation technologies to reduce manual work, AI and machine learning to optimise processes and data analysis tools to inform



decision-making. Innovation in operational procedures and business models can also drive efficiency.

We are upgrading our ERP system to SAP S/4HANA with the industry best practices, which is going to be hosted on Google Cloud. Most of the operations are being optimised and going to be seamlessly integrated with technology platforms such as RPA(Robotic Process Automation), data lake, dashboards and analytics. SAP S/4HANA offers a single source of truth for all business data. This means that every department in the manufacturing process, from procurement to sales, is looking at the same data, leading to better decisions. RPA ensures that data entry and transfer between systems are consistent and error-free. SAP S/4HANA comes with powerful analytics tools that provide

real-time insight into operations. We intend to use these insights to improve processes and optimise resource allocation.

Commencement of Digital Twin Journey

To maintain an edge in the current business scenario and take advantage of emerging technologies, we are continuously working towards adopting and embracing changes. We worked to enable Digital Twin Platform for all business processes like Enterprise Data Management, Advanced Process Control, Asset Performance Management, Asset Information Management, Predictive Maintenance, Intelligent 3D Models development and integration of all functions with RPA (Robotic Process Automation), Analytics, Artificial Intelligence & Machine Learning Models, etc.

Our vision and our step-by-step approach are driving our actions such as SAP Implementation, Predictive Maintenance, etc. It is refining all business processes and establishing cross-functional clarity to reap benefits by strengthening best practices, establishing better controls and achieving higher level performance. This enables better and meaningful visibility and transparency at Digital Twin platform and acts as a dependable source of facts and truths.

Few activities are highlighted below for activity level sense of progress:

- 1) BVA: Business Value Assessments & Return of Investment Exercise are done for forward path.
- 2) Various Databases like Equipment Database, MRO Database are identified and enriched for better results.
- 3) Structures like Asset Structure, Business Structure, Organisation Structures are identified at Group level and in configuration in view of the next level of agility in all processes.
- 4) Maintenance & Reliability Business Process with Cross-functional requirements are identified and tested with a target to implement APM PM and other modules by September 2023.
- 5) Vendors for APM, Analytics, Artificial Intelligence and Machine Learning, developing Intelligent 3D Models and integrations are identified and will be taken up with appropriate time for realisation of above vision with best cost & benefit insight and planning.
- 6) Condition Base Maintenance are implemented like Vibration Analysis, Risk Base Inspections, Root Cause Analysis and CAPA monitoring and next level of improvement are targeted to implement by enabling continuous monitoring.
- 7) Considering the existing level of operation and diversity of plants and sites of the Group progressively, phase-wise implementation approach is taken up. The purpose is to ensure smooth and seamless transformation addressing all the change management aspects with current level and due stress and strain needs to handle site-specific business requirements.



Talent Management Research and Development

Our innovation infrastructure is comprised of a centralised research facility (Deepak Research and Development Centre, DRDC) at Nandesari, Gujarat. DRDC is recognised by the Department of Scientific & Industrial Research, Government of India and is equipped with state-of-the-art equipment for developing sophisticated technologies. Our R&D team consists of highly skilled and competent team members who bring in the best practices in the industry.

Within DRDC, we also have advanced facilities such as a state-of-the-art process engineering lab, a kilo lab and a process intensification lab. These setups play a crucial role in generating scale-up data for all the products developed in our R&D Centre. To enhance the efficiency of lab scale development, we utilise the Design of Experiments (DOE) methodology, supported by specialised software for screening and optimisation. This approach significantly accelerates the pace of our development process.

To support new technology platform and continuous process development, we have invested in flow reactor, flow meters, etc. under Process Engineering Research & Innovation (PERI).

The Analytical team plays a pivotal role in supporting synthetic chemistry, hence the analytical capabilities for additional requirements are also enhanced by purchasing various new analytical tools such as Gas Chromatography (GC), Gas Chromatography/Mass Spectrometry (GCMS), High Performance Liquid Chromatography (HPLC), Liquid Chromatography/Mass Spectrometry (LCMS), Ultra Performance Liquid Chromatography (UPLC) and Ion Chromatography (IC). The Analytical Lab has also been expanded to accommodate these additional instruments.

During the year, DRDC developed process for two key monomers for the Speciality polymers serving multinational customers. It also developed continuous process of two products with a complete digitalised system which enables in-process data generation with robust process control. It also facilitates online analytical data extraction for specific experiments. The online behavioural-based safety portal is in function which gives online updates on unsafe acts, incidents, etc. which has helped the team to work more safely and efficiently.

Key R&D focus areas:

- New product development
- New technology platform development to serve the niche requirements of our customers
- Improvement of productivity as well as yield in existing products
- Reduction of our resource consumption

Process Safety Activities

DRDC has a dedicated process safety team which analyses the chemical processes for safe operations based on in-house ARC, DSC, RC (with gas evolution analysis). The team also takes help of third-party labs for other safety data generation e.g. powder safety data.

Technology

We are actively engaged in the development of several new technology platforms. Currently, we are focussing on advancements in fluorination and Photo chlorination chemistry, high-pressure oxidation reactions for acid formation and gas-solid reactions for acid formation for pharma use. To support these efforts, we have established a pilot facility specifically designed for vapour phase processes. In order to improve yield and quality while reducing operational costs, we have implemented laboratory-scale CSTR setups. These setups enable us to convert batch mode reactions into continuous mode, thereby achieving better efficiency and cost-effectiveness in our operations.



98

R&D professionals employed

17

Ph.Ds employed

60

Cumulative patent applications filed

4

New products launched

21

Cumulative patents granted

State-of-the-art pilot plants

Furthermore, we have established two cutting-edge pilot facilities, strategically located in Roha, Maharashtra and Nandesari, Gujarat. These pilot facilities play a crucial role in bridging the gap between our R&D activities and the commercial production of intermediates for various industries such as agrochemicals, dyes and pharmaceuticals enabling us to seamlessly deliver high-quality products. The pilot facilities are equipped with state-of-the-art infrastructure, including stainless steel and glass-lined reactors, as well as distillation columns for both gas and liquid raw materials. Moreover, they are fully equipped with advanced instruments, a Distributed Control System (DCS) and essential utilities such as chilled brine, low-pressure steam, cooling water, temper water and more.

Development of idea to plant process (ITP)

The Technical Organisation plays a vital role in generating ideas, developing sustainable processes and transitioning them into the manufacturing plant. To ensure efficient progression, a dedicated team conducts a thorough review of the entire process, starting from idea generation, through technical development and up to the production plant. This comprehensive evaluation is known as the Idea to Production (ITP) process. The activities are carefully mapped and relevant documents are formalised to facilitate the seamless flow of information and tasks. The primary objective of the ITP project is to define the technical process, identify the required infrastructure and establish a document system to support the entire process. Additionally, in-depth safety reports for both chemicals and processes are included, ensuring a comprehensive understanding of potential hazards and necessary safety measures.

The overall ITP concept includes:

1. Process flow:
 - Idea collection and assessment (ICA)
 - R & D process
 - Technology transfer
2. Responsible team identification
3. Responsibility matrix

Digitalisation of ideas to plant trials

- To enhance data management throughout the entire process, we have implemented a highly secure web-based suite of tools. This suite allows us to efficiently manage all data, from initial ideas to commercial trials
- The system is designed to store data in a structured format, ensuring that information is organised and easily searchable. It helps prevent knowledge loss and facilitates seamless information flow within the organisation

CASE STUDY

During the year, we successfully implemented the process for a chemical used as an agro-intermediate. This involved processes where a lot of new ideas across chemistry and engineering were implemented to achieve the desired stringent quality. The process involves the removal of unwanted isomers efficiently to achieve the target CTQ parameters. The commercial samples of the said product have been approved by potential customers.

Benefits of digitalisation of ideas to plant trials

- Auto curate dashboards to connect Board rooms to Laboratory
- Documentation of the Lab Records are all digitised and on-line mode
 - Formats designed to extract data/information
 - Reports and presentations are created by the system through aggregation
- Ensures data integrity, data security and data traceability
- Reduce the time spent by scientists in making management reports significantly
- Open and transparent R&D team availability
- Using fortnightly reports and reduce the time of technical reviews
- No orphan data points and complete audit trail and tracebacks

Training of technical team

We organised two workshops on process safety and process scale up which saw participants from all the functions of Deepak Group. This workshop introduced the salient features of process safety pertaining to Deepak Group competency. The complete aspects of process safety and process scaleup were explained in detail during the workshop. This will help the teams in developing processes where the emphasis on scalability and safety starts from the lab itself.

Currently, the team is working on Aspen – for engineering data generation, Mixit – effects of mixing parameters, ai.minits – instant generation of minutes of meeting and also for follow-up with relevant stakeholders.

Key initiatives in FY 2022-23:

- Two new continuous Vapour phase processes were developed in the lab and successfully validated at pilot scale and the industrialisation work is in progress
- Several process optimisation and waste reduction activities were undertaken by the technical team to improve productivity and profitability