CHEMICAL INDUSTRY

Emerging Technologies for Innovation and Automation

Application of Robotics, AI, IoT, Data, and Quantum Technologies for R&D to Smart Manufacturing Application in the Chemical Industry

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Defining Quantum Possibilities

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Technology Adoption - The Need of the Hour

With the advent of Industry 4.0/5.0 and Artificial Intelligence-driven Automation across businesses, almost all industries are racing to deal with the integration and adoption challenges related to these emerging and next-generation technologies. This has triggered an exponential disruption in the way these industries operate and evolve. Along with IIoT and AI, Robotics is getting applied across manufacturing lines in almost every industry vertical. It is, therefore, of utmost importance for Multinational Companies to devise both short-term and long-term strategies to enable system integration between domain-specific and technology functions within their respective industries, thereby improving the throughput of their business processes and enhancing business productivity.

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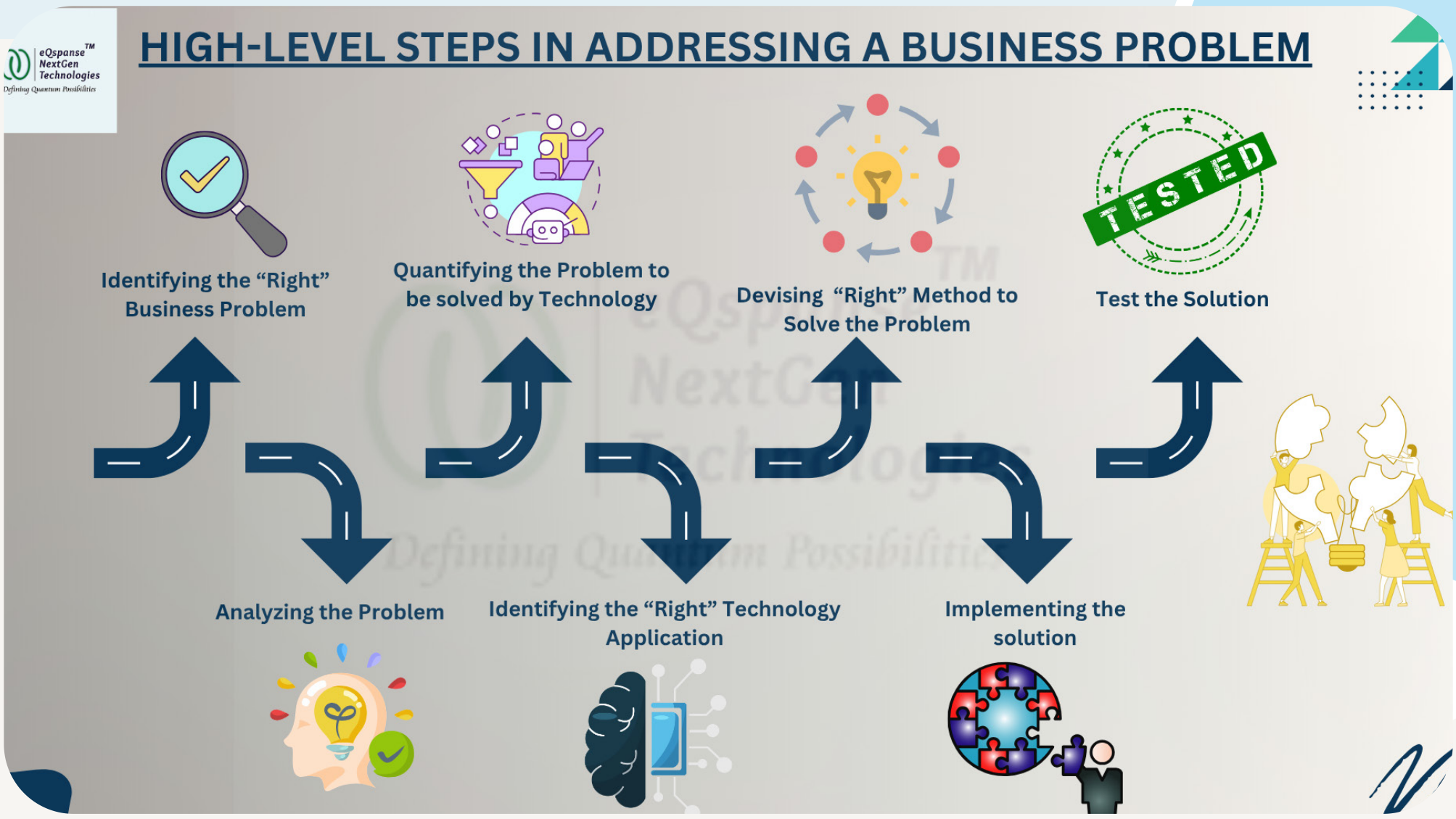
Merging Technology State-of-the-Art with Business Excellence

The right marriage of emerging technology disciplines with established industry excellence has always been a bottleneck in the evolution of businesses.



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Emerging Technologies in the Chemical Industry

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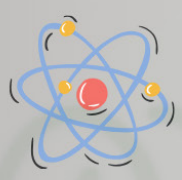
TECHNOLOGIES IN CHEMICAL INDUSTRY SECTOR

01 Chemical Informatics & Chemometrics

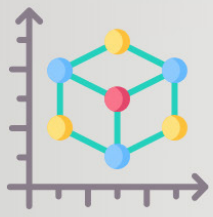
02 High Throughput Research Informatics(HTRi) & Robotics



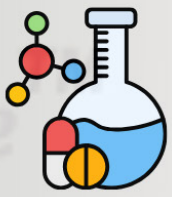
03 Manufacturing Automation using Robotics and AI Automation

04 Laboratory Automation Technologies

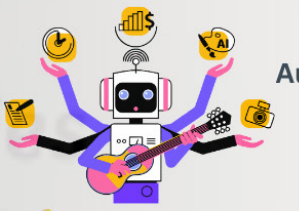
05 Process Design, Simulation and Optimization



06 Material Modeling and Simulation for New Materials Development and Synthesis

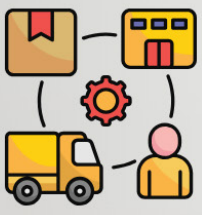


07 Experimental Design for Materials Formulation and Catalysis Synthesis



08 Robotic Process Automation (RPA) for Sensor Data Processing and Integration

09 Computer Vision for Materials Testing



10 Robotics and AI applied to solve Supply Chain Management and Optimization

Several interdisciplinary technologies have emerged in the past couple of years, involving the integration of emerging technologies to achieve business excellence. In this white paper, we shall provide a brief overview of the same.

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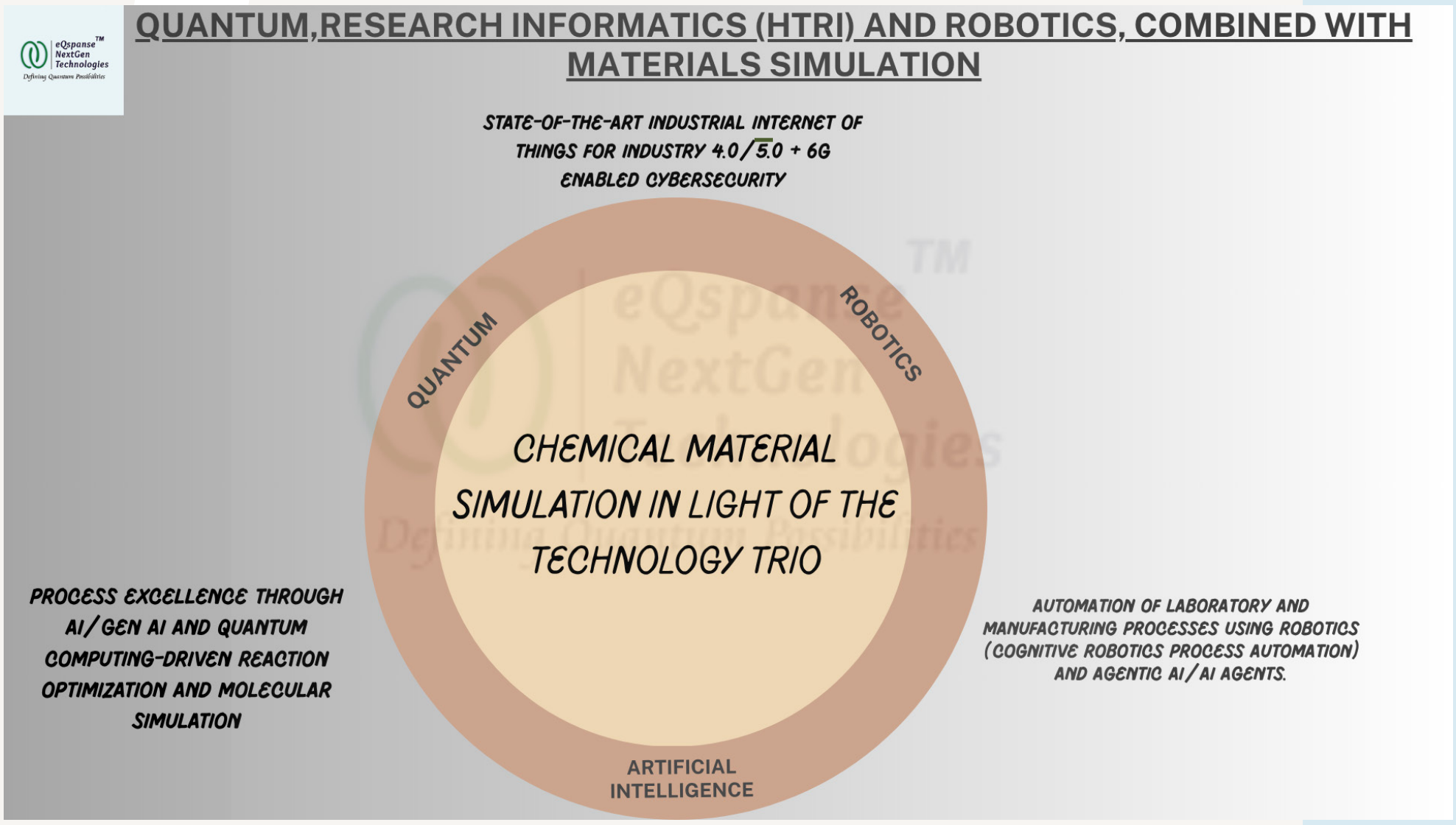
Chemical Industry Case Study: High Throughput Research Informatics (HTRi) and Robotics combined with Materials Simulation



Chemical Industry R&D to Manufacturing Journey, powered by technology-led innovation, is crucial in achieving the right product rollouts and further scaling out the products to manufacturing excellence. Without this scale-out productionization, it is difficult to achieve the right time-to-market with an early mover advantage as an early adopter of emerging and next-generation technologies such as Artificial Intelligence (AI), Robotics, and Quantum. These three technologies possess huge disruptive potential and are integrated into manufacturing plants and processes.

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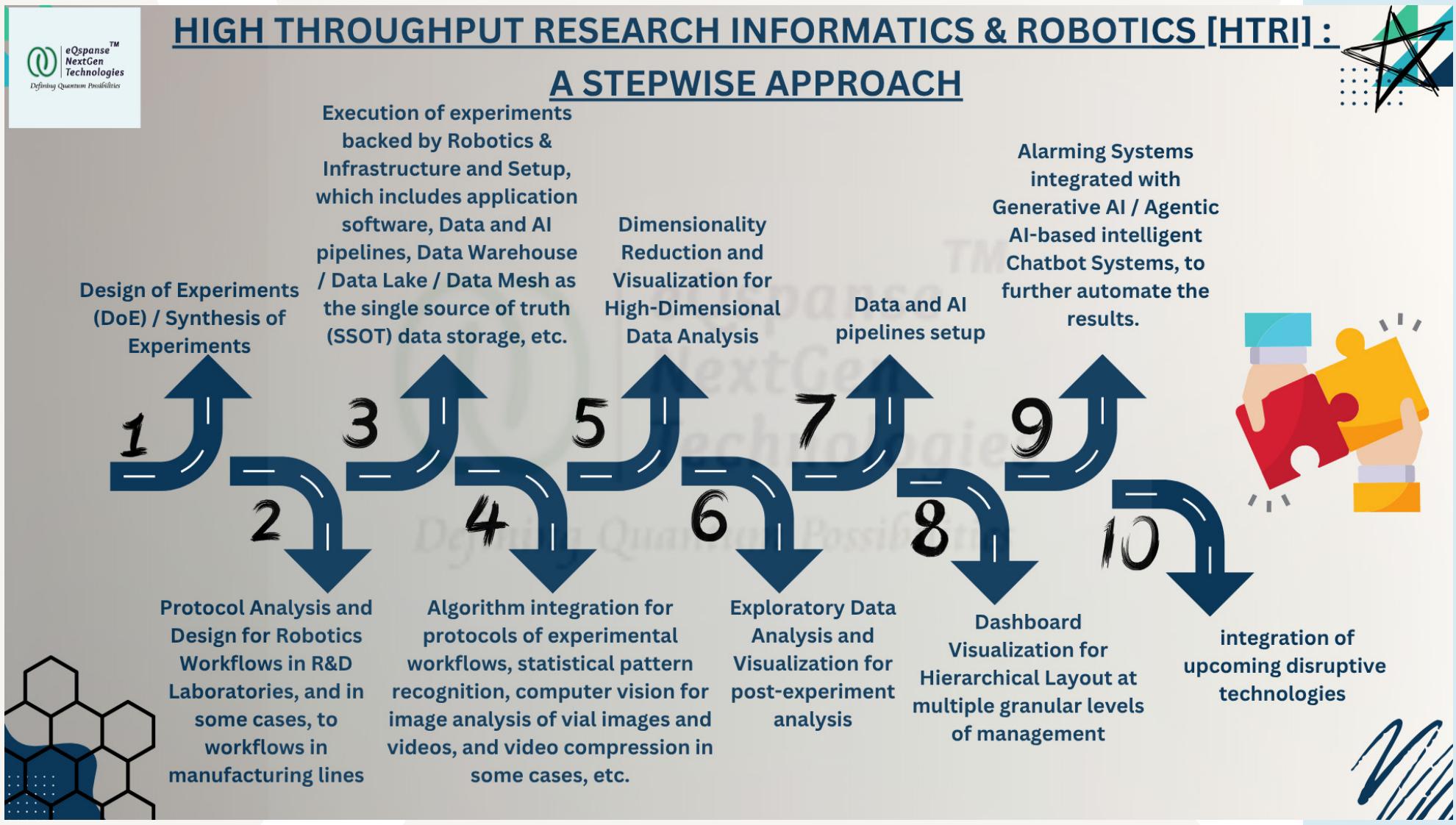
HTRi and Robotics End-to-End Process

Laboratory and Manufacturing workflows related to Materials Formulation and Catalysis Synthesis can be automated using Intelligent Robotics and AI-driven Informatics, often referred to as High Throughput Research Informatics (HTRi) and Robotics. Laboratory Automation and Manufacturing Automation automate across a broad range of R&D and manufacturing processes, as opposed to HTRi and Robotics, which are confined to R&D automation using specific robotics equipment that automate the laboratory experiments from design to production, using Informatics and Robotics workflows.



Similar to the above example of HTRi & Robotics, Laboratory and Manufacturing Automation also involve the application of specific technologies, such as RPA/Cognitive RPA, Application Software for Laboratory Processes, Sensor Data Integration for intelligent IoT systems integration (using mesh, fog, and cloud computing), etc. Deployment of Robots on Manufacturing Lines further requires a smart integration of Data, IoT, and AI technologies, including AI Agents and Agentic AI embedded in the intelligent workflows.

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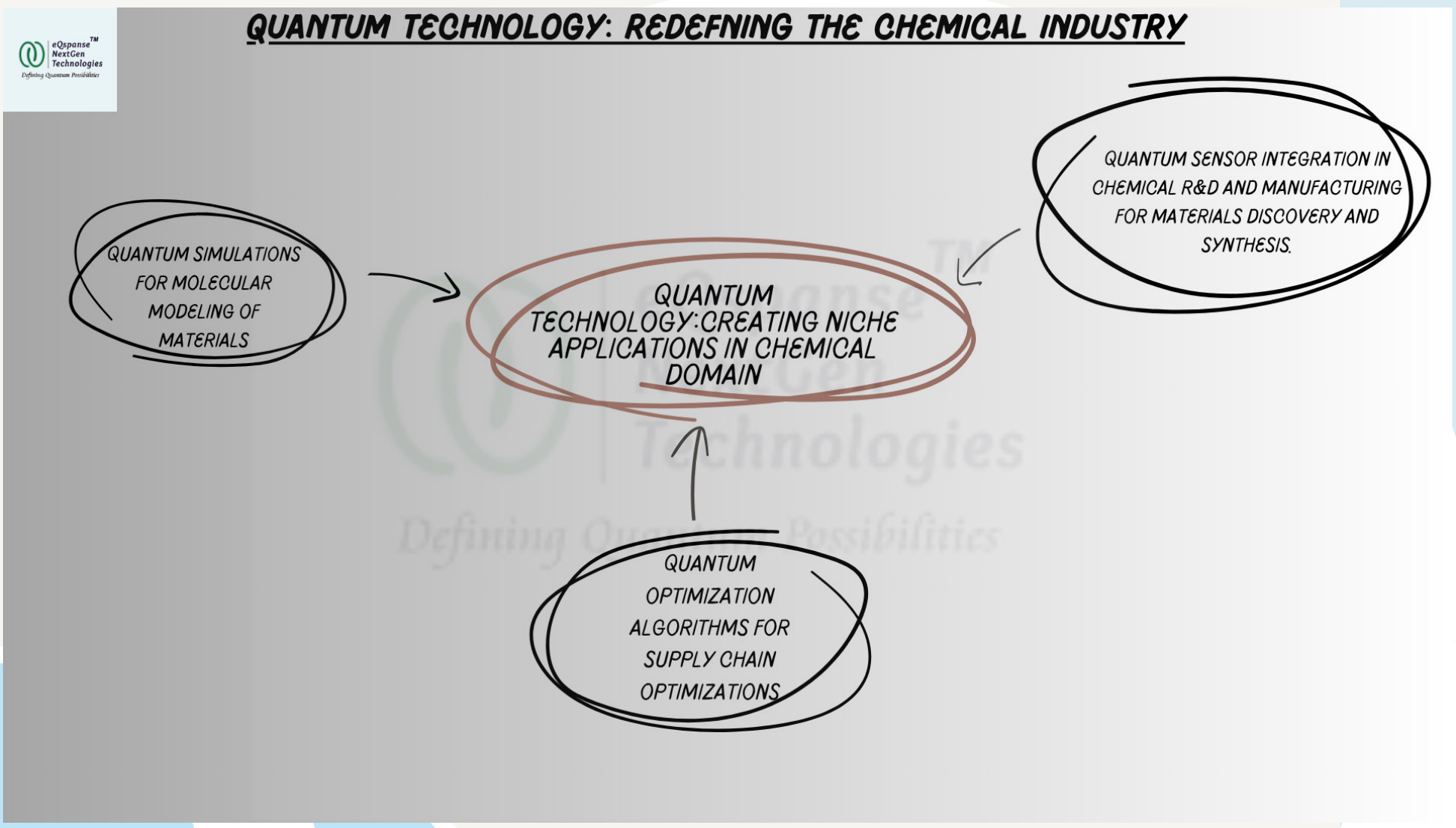
Niche Applications of Quantum Technologies, as an Emerging Field of Excellence

Quantum Communication Technologies, such as Quantum Cryptography, offer a widely adopted solution for protecting sensitive data and information, whether at rest or in transit. Also, Quantum Simulations, Quantum Sensor Integrations and Quantum Algorithms have specific applications in Material Modelling, Discovery and Synthesis respectively.



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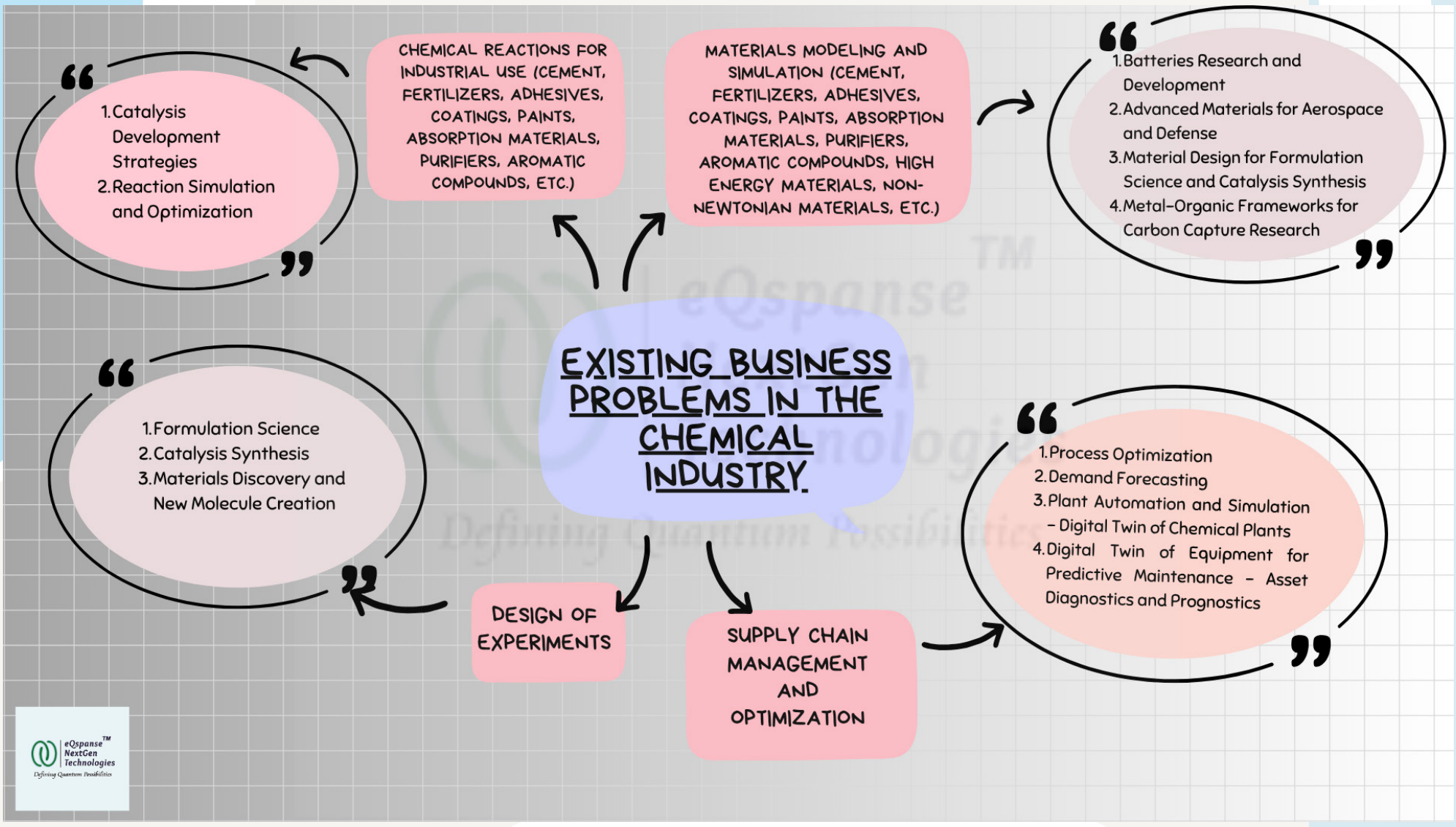
Existing Business Problems in the Chemical Industry: An Overview



It is very important to correctly identify the business pain point and associate the correct technology solution to solve the identified business problem. For this, it is necessary to convert the problem statement into a form in which technology solutions can be applied. This requires significant efforts in assessing the problem domain, marrying the business domain with technology solution strategies at hand, completing the feasibility study of the prospective solutions, and then implementing the technology solution.

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What We Offer
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eQspanse™ NextGen Technologies

At eQspanse NextGen Technologies™, we seamlessly work to not only learn the state-of-the-art in the emerging and next-generation technology space but also apply it to solve real-world business problems by discovering and applying the right technology integration for your industry workflows, products, and processes. We are your true system integration partners for intelligent systems that require the integration of Data, AI, IoT, and Quantum technologies. We have built in-house expertise in applying these disruptive technologies for building useful software products and platforms that are of immediate use to specific industry domains. We believe that the right strategy for merging disruptive technologies with business usage is the need of the hour, and we are ready to contribute to this Global Change !!!

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