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**Business Transformation
in the Chemical Industry**

Are you ready?

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The chemical industry – proud of the past

Today's chemical industry is a €3,347bn market with growth rates exceeding 5 percent per annum, a value 1.8 times that of Germany's GDP as well as considerable profitability and stability. It has created more value for shareholders, employees and customers than most other industries.

And it has the unique ability to transform natural resources into formulated products and materials that provide better solutions, differentiation and innovation to both customers and consumers.

Better solutions create additional growth by substituting other materials, such as glass, stones, metals, ceramics, paper, rubber, natural textiles or leather. Differentiation and innovation trigger growth by enabling new products, solutions and applications, such as new forms of mobility, zero-energy housing, precision farming, 3D printing, computing power, touch screens, and OLED displays. This, coupled with the demographic development of the middle class, accounts for the strong growth in the industry.

Recycling, resource-efficient production, and material-efficient precision applications will reduce the specific and absolute demand for virgin chemicals and materials, but despite these negative volume demand effects we anticipate that the chemical industry will continue its upward trend

and grow in excess of 4.5 percent p.a., well ahead of its supplier and customer industries. Consequently, we are seeing increasing investment in global chemical capacity and new process technology to transform natural resources directly into chemicals, avoiding the stagnating refinery value chain step.

Unlike high tech and other industries witnessing above-average growth, the chemical industry has also been enjoying considerable profitability due to high entry barriers such as physical dependencies (pipelines, economies of scope, transport and storage access), favorable access to infrastructure and resources (energy, feedstock, raw materials, skilled labor, capital), regulatory protection (license to operate, product approval and registration, transparency of origin, regulatory compliance, tariffs, taxes and duties), and high switching costs (single source situations, requalification costs, exclusive distribution agreements).

At the same time, the industry has been very stable due to high barriers to exit, examples being non-transferable assets, high redundancy, and clean-up and discontinuation costs. This has been true in spite of several structural step changes from Chemistry 1.0 to now 4.0 in the industry's over 150-year-long history.

Fig. 1 - Value chain in the chemical industry (schematic)

Natural Resources

Power & Utilities

- Electricity
- Steam
- Water

Oil & Gas

- Crude Oil
- Natural Gas
- New Fuels/Hydrogen
- Biomass/Renewables

Metals & Mining

- Minerals
- Metals
- Coal

Feedstock

Energy

Chemical industry

(€3,347bn revenues in 2018)

Building Blocks (40%)

Inorganics (11%)

- Ammonia/Urea
- Chlorine/Caustic/Hydrogen
- Oxygen/Nitrogen/Argon
- Sulfur
- Acids /Lyes
- Inorganic intermediates

Organic Petrochemicals (29%)

- Methanol (C1)
- Ethanol (C2)
- Olefins
 - Ethylene C2
 - Propylene C3
- Butadiene (C4)
- BTX (C6-8)
- Fats & Oils (C8-20)
- Organic intermediates

Chemicals, Ingredients, Additives & Materials (60%)

Consumer Chemicals, Ingredients & Additives (37%)

- Care Chemicals, Soaps, Detergents
- Cosmetics
- Adhesives & Sealants
- Coatings, Paints, Inks & Dyes
- Crop Protection
- Food & Feed Ingredients
- Leather, Textile, Pulp & Paper Chemicals
- Construction Chemicals
- Industrial & Institutional Hygiene
- Oil & Gas, Coal, Mining Chemicals

Polymers & other materials (23%)

- Plastics, compounds, masterbatches
- Synthetic Rubbers & Fibers, Insulation
- Battery materials, Nanomaterials
- Pigments, Catalysts
- Enzymes, Proteins, Biomaterials

Customers & Consumers

- Rubber & Plastics
- Processing
- Automotive/Transportation
- Agriculture
- Food & Beverages
- Pulp & Paper
- White & Brown Goods
- Packaging
- Building & Construction
- Recreation & Sport
- Medical Devices
- Pharmaceuticals
- Personal Care
- Textiles
- Leather
- Wood
- Electrical & Electronics
- Publishing & Printing
- Furniture
- Machinery & Equipment

The chemical industry going forward – mind the gap

Since late 2018, we have observed slowing growth and diminishing profits. According to the European Chemical Industry Council, chemical output in Europe is on course to grow by just 0.5 percent this year.

Is this a normal effect of the business cycle, as we have seen several times before? If so, we should not worry, just ride out the business cycle and introduce cost-cutting and restructuring measures as usual. Or is it more than that this time? We believe the latter is the case and have identified four key reasons why the current trend is a structural and fundamental issue.

National players/incumbent nations capture the growth

China has become the driving force in the global chemical industry in recent years. At present, China accounts for 36 percent of the global chemical industry, but its share is expected to grow to about 50 percent by 2030. China currently employs more than 8.8 million people in the chemical industry, which is more than five times the number of employees in EU28 and NAFTA together. It also invests 3–4 times more in assets and 20–40 percent more in R&D than NAFTA and EU28. Also it has improved its cost competitiveness by 2–3 percent every year compared with its global competitors. China is the growth engine of the chemical industry, far more so than the U.S. and Middle East with their energy and feedstock advantages. The climate-driven fossil fuel discussion will further benefit China. Whereas western companies focus on profitability and value add, producers in China and increasingly India are taking market share and capturing the industry's growth,

not only in Asia, but also in the Middle East, Africa, and Central and South America.

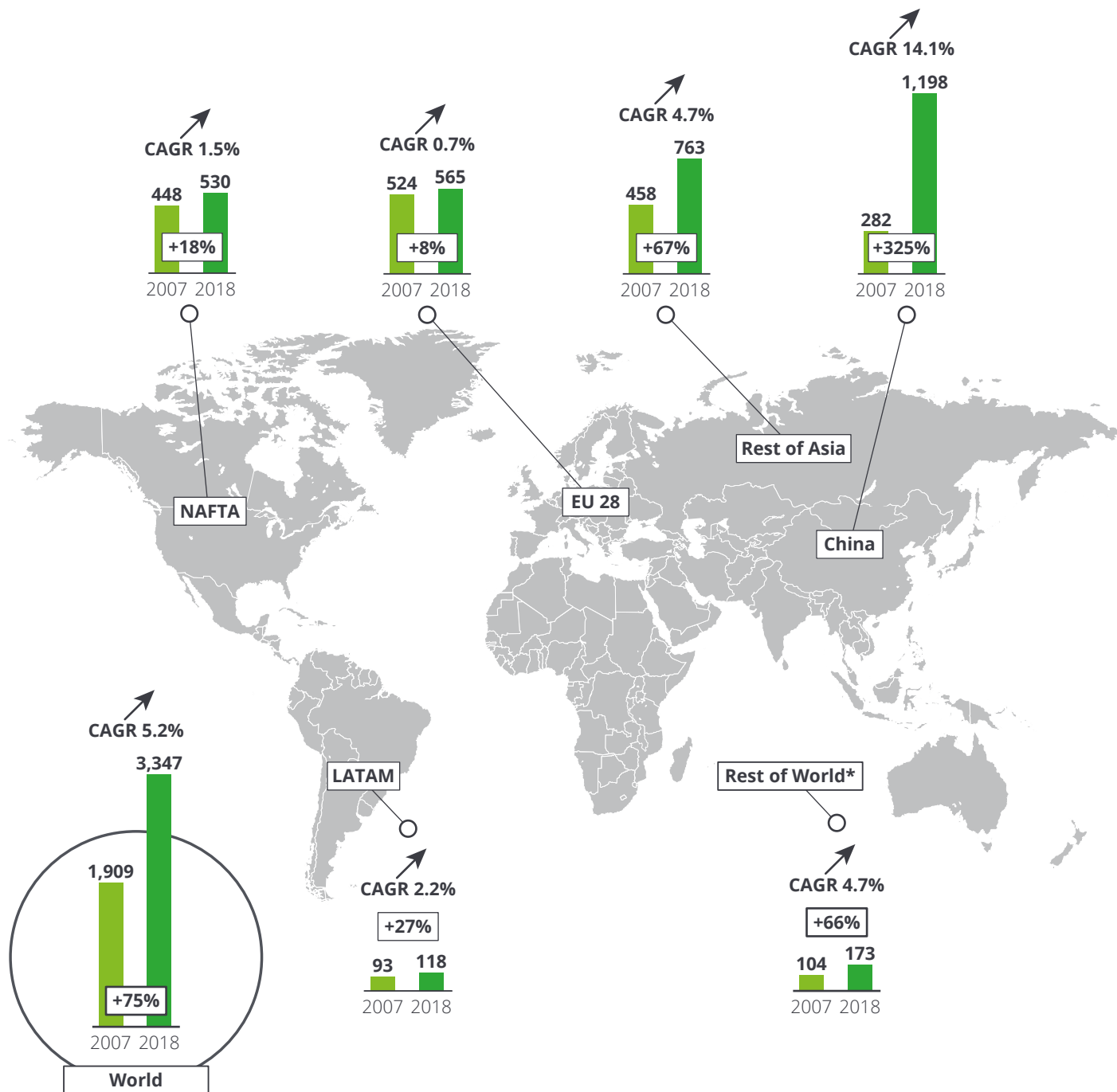
The logic is simple: product and process innovation is insufficient to support profitable growth. While western companies are switching portfolios and customers for the highest price and margin, Chinese and Indian chemical companies are building segment leadership positions, growing their market share, and forging long-term relationships in regions of high growth. Western chemical companies are growing almost exclusively through acquisitions and higher priced value adding services, whereas Asian chemical companies are capturing the full organic growth potential of the industry. Many of the fast-growing incumbents are national players, fulfilling different strategic objectives compared to value-maximizing western chemical companies. Up to now, the western strategies have worked very well, but going forward we anticipate that these companies will lose impact in the different sectors and will

ultimately no longer be credible players in selected segments of the chemical industry. We can already observe that western companies have been able to maximize profits and net working capital, but have failed to grow organically and gain market share. This phenomenon is likely to accelerate as demand in India and Africa increases. And if there are no major innovation breakthroughs for western players, the situation promises to get a lot worse.

Fig. 2 – Geographical overview of chemicals turnover 2007–2018

Turnover Chemicals industry 2018 [€bn]

100 percent = €3,347bn (excluding €1,261bn pharma turnover)



* e.g., 2018 €173bn, thereof €128bn other Europe, €24bn Africa and €21bn Australia/Oceania

(Digital) Disruptions create winners and losers

Together with the VCI and its members we have identified 30 major trends on the supply/energy side as well as on the customer/consumer side of the chemical industry. Only five of those trends were incremental and economically driven by chemical companies. Twenty-five of the trends were disruptive and politically driven by society or regulators. Digital innovations caused the majority of these disruptive trends, ranging from precision farming and gene editing to 3D printing and eHealth. Those disruptive trends create winners and losers among the chemical companies, depending on the product and market portfolio that they are currently servicing.

Disruptive trends are much more prevalent on the supply or demand side of the chemical industry than in the chemical industry itself. This is also the reason that we often see the chemical industry as behind the digital curve, which is actually inaccurate upon closer scrutiny. Within the chemical industry we can observe incremental trends brought about by digital innovation that can improve internal costs and efficiency, such as process automation, failure prediction, and demand forecasts. The disruptive potential in the industry involves primarily introducing new routes to market to attract new customers and retain existing ones, offering superior products, and preventing other e-sellers and start-ups from poaching clients.

The circular economy requires new operating and business models

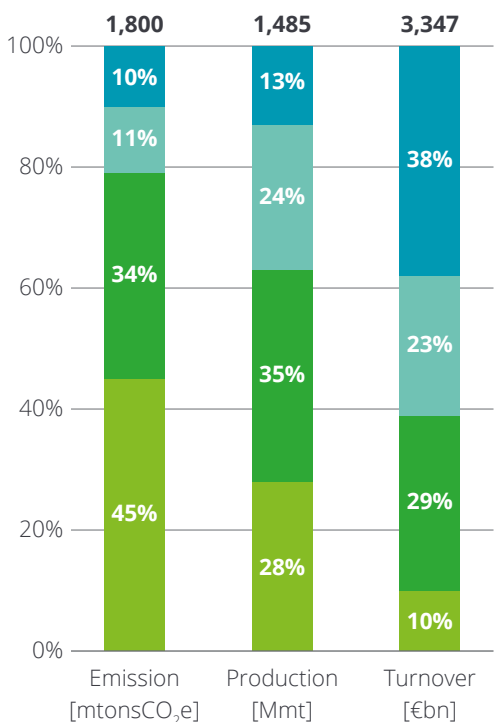
The traditional chemical industry is linear. It is about producing chemicals and materials and selling them directly or indirectly to the relevant markets. This is posing challenges for more and more companies. Depending where you are in the value chain and what product-market segments you serve, this can be very different. We have classified the chemical industry into four different segments:

- Consumer chemicals, ingredients & additives
- Polymers & other materials
- Organic building blocks
- Inorganic building blocks

These four segments face very different challenges.

Fig. 3 – Challenges and issues of the chemical industry 2018

Chemical Industry 2018



Critical Issues & Actions for each Segment
(schematic)

- Consumer Chemicals, Ingredients & Additives
 Re(Design) products to allow for superior performance in applications, but also safe handling and low harm for the environment
- Polymers & other materials
 Re(Design) products for superior properties as well as resource and energy efficiency, also avoiding waste and closing material flows, across all sectors and applications
- Building Blocks**
 Produce Building Blocks resource and energy efficiently, using renewable energy
- Organic Building Blocks
 Additionally use bio- or waste-based feedstocks or green hydrogen power-to-product routes instead of fossil hydrocarbon raw materials
- Inorganic Building Blocks
 Additionally explore energy-chemicals sector convergence synergies

Societal and regulatory requirements challenging the license to operate

Society and regulators are increasingly challenging the license to operate on grounds of accidents, overdue inspections, resident concerns, noise or emissions into soil, water, and air. At the same time, they look at unwanted side effects during the product lifecycle, for example the issue of ocean pollution caused by single-use plastics. Regulators reacted quickly in banning the production of single-use plastics and the export of plastic waste. However, the impact of the regulator on operations is not a Western European phenomenon, but a global issue. Take, for example, the Chinese government, which is currently in the process of closing down thousands of the country's chemical sites and companies that do not comply with antidumping and/or environmental standards. This is having a real impact, which we can observe, for instance, in the significant reduction in supply security for certain agro and pharma fine chemical precursors. A similar challenge comes from less predictable duties, tariffs, and taxes, which have a direct impact on the competitiveness and existence of local production serving international markets.

Unfortunately, the DNA that has made the chemical industry so successful throughout its history and into the present is also the biggest obstacle to overcoming these four strategic-structural challenges and winning the future. Entry and exit barriers are becoming a hurdle to adapting quickly to the new challenges. Moreover, the culture and ways of working that made the chemical industry strong in the past are not the right ingredients for successfully leveraging opportunities and mitigating risks in the future. And finally, the industry is not attractive for the digital talent we so urgently need to succeed in the future.

Transformation of the chemical industry and its business and/or operating model is vital if we want to mitigate the downsides and capture the upsides.



Business transformation in the chemical industry

It is important to note, however, that the chemical industry is not homogeneous, which is why the impact of the four strategic-structural challenges outlined earlier varies considerably based on product and market segment as well as country/location. External challenges can range from weak to strong, depending for instance on whether you are a mid-sized coatings manufacturer, a large fertilizer company or a technology-driven wind blade producer and whether your operations are in the U.S., China or Germany. Furthermore, those challenges might become relevant immediately or only over the longer term.

We recommend determining how significant the challenge is for all product market segments in their major countries/regions and when you can expect to first encounter the challenge.

In parallel, we recommend evaluating your specific competitive position and internal fitness to master those challenges. For this we analyze market share, relative cost position, financial and operational performance, cash generation, asset and organizational effectiveness as well as workforce profile and skills,

especially with regard to keeping pace with digital trends.

The combination of external strategic-structural challenges (y-axis) and competitive position and internal fitness (x-axis) creates four business transformation archetypes for individual businesses:

Fig. 4 - Overview transformation archetypes

Competitive Position and Internal Fitness

Are you acting from a position of strength or weakness?

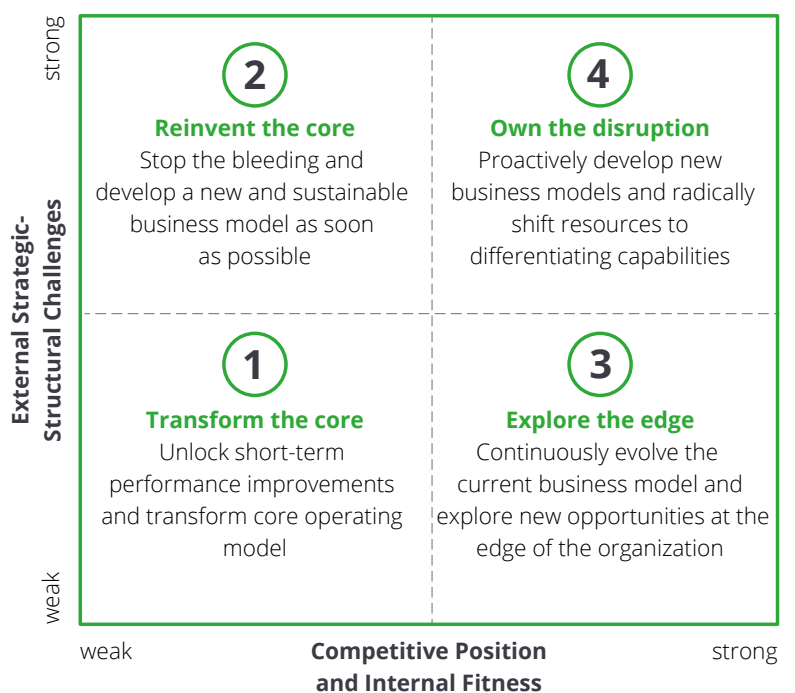
- Market share and relative cost position
- Financial & operational performance
- Cash generation
- Asset & organizational effectiveness
- Workforce profile & skills

External Strategic-Structural Challenges

How fast do you see your business environment changing?

- Impact of (digital) disruption
- Organic growth potential against incumbents
- Circular economy needs
- License-to-operate risks

Transformation archetypes



Businesses with a weak competitive position and low financial performance that are facing limited external challenges (quadrant #1) should focus on “Transform the core.” Short-term efficiency gains within procurement, supply chain or sales enable continuous improvement of the core operating model. The focus is on short-term cost reduction while maintaining the competitive position in existing markets.

As the level of external strategic-structural challenges increases (quadrant #2), the immediate need for transformation emerges. “Reinvent the core” focuses on reframing the current business and developing new and sustainable operating models. The focus is on unlocking short-term earnings and cash generation potential to stop the bleeding. Funding for entering new markets must be provided at the same time. This highly complex transformation requires full commitment.

By contrast, businesses with a strong competitive advantage that are facing limited challenges (quadrant #3) should challenge their operating model and “Explore the edge” by considering expanding their current business. The focus is on developing a sustainable innovation pipeline, improving efficiency, and securing market share with sufficient CAPEX.

Businesses with a strong competitive position and financial performance that are facing a high level of external challenges (quadrant #4) should proactively drive the transformation and save-to-transform. Investing into digital technologies and technology infrastructure is done in order to make operations more efficient and effective and to enable new and more agile business models to prosper, especially in digitally disrupted markets. In contrast to the previous category, it is the technology factor here that sets their business apart from the competition.

Doing this intellectual exercise is useful, as it will help you get a fresh idea of the challenges facing your individual businesses given their current position and your readiness to seize opportunities and mitigate the risks. However, only concrete actions that strike at the heart of your operating model will really help you to improve.



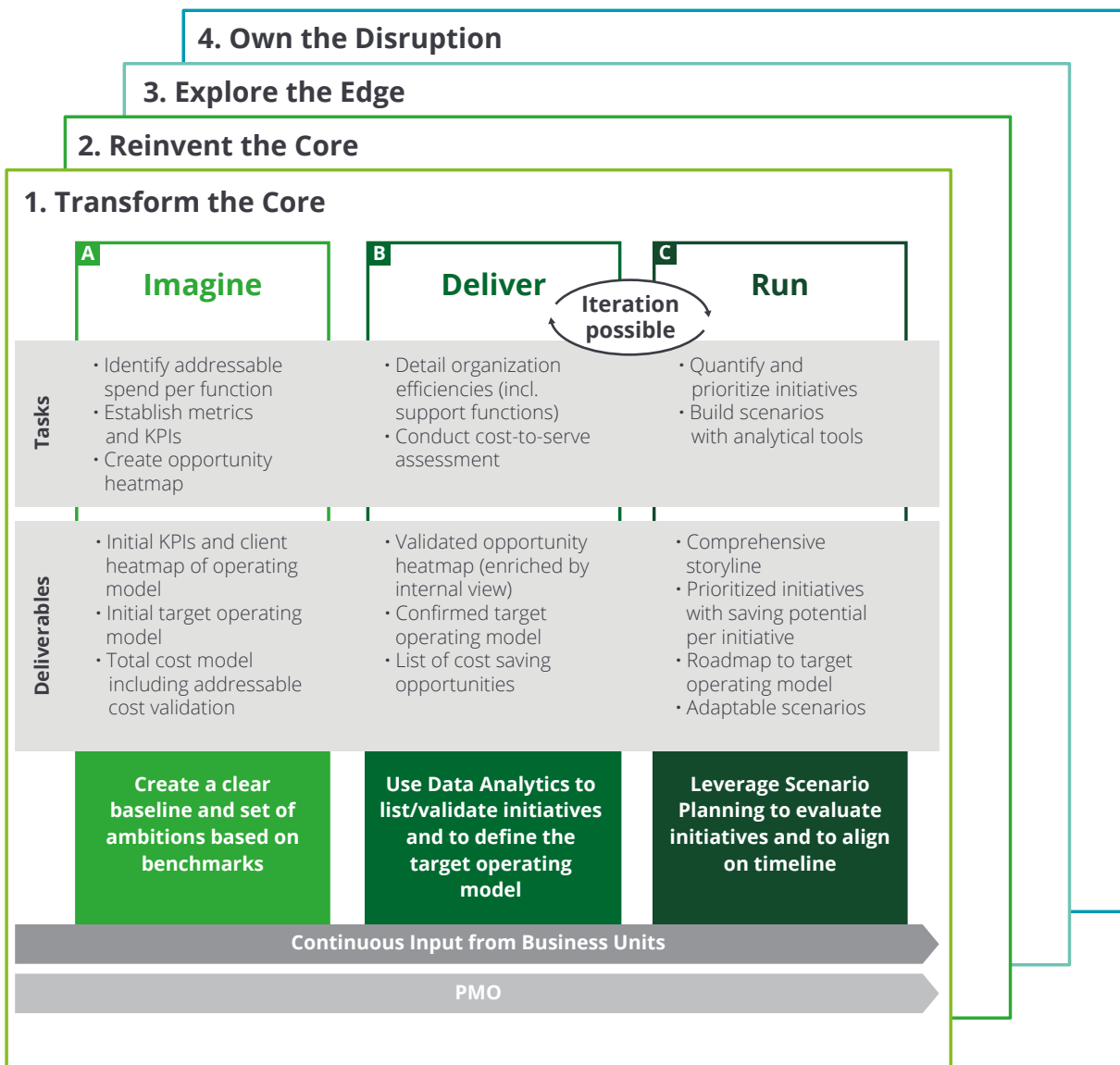
Typically, companies will need a set of consistent actions to balance profitability against value growth for the next business cycle. The aim of these actions is to enhance efficiency, foster structural change, and drive innovation into your business over the next business cycle.

Realizing business transformation success is more than defining a set of actions. Not all operations and business models are the same, and different strategies and costs drive results in different ways. In the end, there is no perfect portfolio of actions or investments. An efficiently managed portfolio is one that balances short-term and long-term objectives.

The transformation of the predominant operating model in the chemical industry will create additional and sustainable value.

Key aspects of the relevant operating model must be addressed with the transformation program but with a different focus depending on the strategic initiatives going forward.

Fig. 5 – Transformation programs – Project approach



Deloitte – The partner for a successful business transformation

During a business transformation, you need a variety of capabilities and support. At the beginning, you can build on Deloitte's broad expertise in similar tasks with peers, suppliers, and customers in the relevant regions, as well as on our digital expertise. It is essential to first assess your strategic-structural challenges, competitive position, and operating/financial performance. This will allow us to shape the specific ambitions for your business transformation and determine where action is required.

In a series of workshops, we will define your business transformation roadmap by selecting the right combination of actions and estimating how much they are likely to contribute to profitability and growth. We will also assist with leadership alignment and organizational readiness.

Actions on portfolios, partnerships, investments, innovation, routes to market, and supply chains often require not only a strategic-commercial view, but also a tax, regulatory/legal, financial, audit/assurance, operational, technological, IT, digital, and, very importantly, a local/regional view. If the actions involve a strategic partner or

an acquisition or divestiture, Deloitte can provide M&A services from identification to integration. If they require rerouting or a footprint change, Deloitte offers tax, tariff, duty, supply chain, and transfer pricing expertise. When it comes to technology, Deloitte has digital and IT competence teams that will tailor their services to the client's need.

Every successful transformation requires ongoing monitoring to ensure your business benefits from full implementation and unlocks its full potential. Thanks to the clear KPIs we define, we will create full transparency for your transformation project, measure its overall financial impact and demonstrate its full potential.

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