Innovation in the chemical industry
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The chemical industry is based on innovations. However, innovation can mean many things to many organizations. In essence, the multitude of descriptions, definitions and examples can lead to two main observations:

1. **Innovation is seen as something very positive and no company wants to be classed non-innovative, and**
2. **Innovation is a very broad, imprecisely defined field.**

As a consequence, innovation is often used as a buzzword. Sometimes the innovation might be more in the marketing than in the core business of a company. This variety and inconsistent use of the term innovation is of little help to decision makers.

Innovation is seen as a global topic with no particular regional peculiarities, save for the point of inception. The 2010 “Innovation in Gulf Petrochemical and Chemical Companies” study, conducted by the global consultancy firm Stratley together with the Gulf Petrochemicals and Chemicals Association (GPCA), revealed that Middle East players need to concentrate more on developing their human resource competencies in order to unleash their potential. Overall, the quality of the innovation infrastructure / institutions was also ranked poor. Here we describe the many facets of the innovation process and discuss them in the light of their overall context for the chemical industry in the Middle East.
What is innovation in the chemical industry?

Value creation in the chemical industry continues to be dominated by manufacturing. For this reason, it is understandable that product innovation – in its traditional meaning as innovation to the physical product – is the first aspect that comes to mind when the term innovation is mentioned. The growing business with services, however, also plays an important role when considering innovation in the chemical industry. These services can be closely related to the physical product (e.g., packaging options) or a separate business (e.g., distributors). The combination of services with the physical product itself can even be considered as products. In addition to innovation on the product itself, there are also options for innovation in the application of products. Even at this stage, it is clear that innovation goes far beyond mere R&D. Intelligence on markets and customers is required – a key innovation role carried out by Marketing & Sales. In light of this, Marketing & Sales can be a major driver for product innovation if practical market innovation processes are established. This also encompasses the complementary change process from technology to market driven thinking.

Product innovation frequently goes hand in hand with innovation in the manufacturing process. For existing products, innovation in the manufacturing process can be an opportunity to increase efficiency. One of the most prominent examples of innovation in this area is the Verbund system. Additional triggers for manufacturing process innovation can even originate outside the business-related topics, e.g., through regulations for environmental protection or health & safety.

The goal of increasing efficiency is not just limited to manufacturing. Lean management, reductions in time-to-market etc. are drivers for innovation in processes of all parts of a company. As an example, technical capabilities in IT combined with the desire for transparency driven by the globalization of businesses has led to many innovations in the area of business reporting. This may entail setting up business and strategic information platforms based on a detailed analysis of the clients business. Improvement in human resource processes to select better talents is another example of non-technical innovations.

Innovative changes can also happen at a more superior level and even lead to transformation across the whole company. Strategic considerations on the business always question the business and or operating model of a company. The chemical industry has seen revolutionary innovations to traditional business models, such as the establishment of chemical parks or specific distribution models, e.g., a separate commodity business (see Exhibit Xiameter).
EXHIBIT: XIAMETER

Dow Corning realized that their silicones customers did not need much technical services any more and preferred a reliable supply of basic products at low prices. Xiameter was founded by them and became a brand in 2002, to decrease the cost structure of silicone distribution.

Xiameter is an internet based ordering platform.
Only full truck loads can be ordered and only a minimum of technical services is offered.
Changes to orders or visits of technicians are charged additionally.
Very little staff is required to handle the business.

The complete process of implementing Xiameter took 3.5 years. It started with interviews of long-term customers by external experts.

FIGURE 1
Innovation in the chemical industry can be clustered into four main categories: Product innovation, manufacturing process innovation, business process innovation and business & operating model innovation.

Source: Stratley

<table>
<thead>
<tr>
<th>Categories of innovation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product and its application</td>
<td>Physical</td>
</tr>
<tr>
<td></td>
<td>Improved chemical properties of a material</td>
</tr>
<tr>
<td></td>
<td>Service</td>
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<tr>
<td></td>
<td>Customized material selection support</td>
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<tr>
<td>Manufacturing process</td>
<td>New synthesis route for chemical product which saves 30% of energy</td>
</tr>
<tr>
<td>Business process</td>
<td>Improved human resource process to select better talents</td>
</tr>
<tr>
<td>Business and operating model</td>
<td>Separate commodity business (besides specialty business)</td>
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</tbody>
</table>

Figure 1 gives an overview of the aforementioned categories. The Middle East currently focuses much of its innovation effort on products and manufacturing processes. Technology is mainly developed through co-operations and Joint Ventures or else directly acquired. The main product focus in the Middle East lies on polyolefins and aromatic hydrocarbon compounds. Due to the developments in the downstream, companies will be faced with the need to consider a broader product portfolio. Therefore, business processes and models will become more complex and require new and innovative approaches.
**How can innovation contribute to success in the business?**

Linking the subject of the business model (the product and/or the service itself) to its contribution to the success of a business can be done by looking at the life cycle of a product or a service (Figure 2).

**FIGURE 2**

During the four phases of the product life cycle, different innovation categories are leveraged to boost the business.

Source: Stratley

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Commodity</th>
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<tbody>
<tr>
<td>Establishment</td>
<td>Decline</td>
</tr>
<tr>
<td>Growth</td>
<td>Maturity</td>
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<th>Predominant categories of innovation during the product life cycle phases:</th>
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<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
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</tbody>
</table>

- Product innovation (physical product, services)
- Manufacturing process innovation
- Product innovation (new applications, new industries)
- Manufacturing process innovation
- Business process innovation
- Business and operating model innovation

A new product is developed at the beginning of the life cycle. If this product is unique to the chemical industry as a whole, it is typically classified as a specialty. A new manufacturing process to produce this product may also have to be designed. Growing business with this new product requires a clear value proposition that is recognized by the market. Many other aspects, such as pricing, need to be carefully considered. During the maturity stage, the product starts to commoditize. On the one hand, the creation of new variants or new applications can enable a new start or prolongation of the product life cycle. On the other hand, the focus of innovation for a mature product might shift to efficiency increases and therefore process innovation. This covers the production process as well as all other necessary business processes. These cost reduction measures open up chances to postpone the point in time when revenues fall below the variable gross margin. This event clearly indicates the entry into the decline stage. Innovation to business processes and the business model might be triggered by commoditization of a physical product or a service as we have already seen in Exhibit Xiameter. In addition, cost pressure triggers manufacturing process innovation at this stage.
Innovation directly impacts the bottom line and can have many other effects on the business which indirectly contribute to success in sales. As described above, innovation is almost always correlated with positive opinions or expectations. Therefore, recognition as an innovative company will contribute to a positive image. This positive company image can be leveraged to attract elite employees, which in turn improves innovation capability.

There is a realistic threat that in the Middle East talent will turn out to be a bottleneck of innovation pace, as talent is felt to be scarce when compared to the ongoing growth plans. Thus, developing the talent and skills of people being already in the company and making them stay long-term will be more and more important.
How can innovation be supported and promoted?

Innovation consists of idea generation, selection of the most suitable ideas, and focused as well as efficient translation into practice. This is independent of the type of innovation. In addition, innovation needs to be managed properly and requires an innovation strategy. An innovation-enabling company culture is the basis of every innovative company. It gives the employees and the management the right mindset to cope with innovation. When analyzing the status quo of innovation in a company, a holistic approach is recommended before working on the single elements of innovation. This ensures a smooth integration. Figure 3 gives an overview on the 3 major innovation levers: Strategy & Management, Process & Organization and Culture.

FIGURE 3
Successful innovation depends on three major innovation levers: Strategy & Management, Process & Organization (with the 3 phases: idea generation, filtering and implementation) and Culture.

Source: Stratley
Finding ideas for innovations

The generation of ideas has a content-wise aspect, as well as a process-related and organizational aspect. In practice, the content-wise aspect is given priority. An innovation strategy is needed as guidance for basic content-wise orientation of innovation, e.g., e-mobility as a target market. The selection and implementation of adequate methods and processes for idea generation depends on the capabilities and capacity of the company. This requires an assessment of the status-quo of these aspects with regard to the defined content followed by decisions on how to deal with any discovered gaps. Determining how close the target market is to the currently supplied markets is a prime example. Is there sufficient know-how of the market needs within the company? Target markets that are completely new to the company are more or less disconnected from the company, and knowledge on these markets is not available right away. Discovering the unspoken needs of the markets is an even greater challenge. External experts can be drawn upon to provide methods to discover these needs, e.g., by market interviews, surveys or customer behavior studies. The sales force or technical marketing may already have databases full of product ideas for currently supplied markets.

Idea generation can be market driven (pull) and/or technology driven (push). In the latter case, new or unfamiliar technologies or processes may serve the production of existing products more efficiently. In these instances, the same aspects already described for market intelligence apply for technical expertise. Idea generation methods can be divided into constant idea generation (such as gathering ideas from the sales force in databases) and dedicated idea generation efforts (such as idea generation workshops). Although all these methods are the basis for innovation, it is real people, who actually innovate. It may appear trivial from a technical point of view, but companies must achieve the right balance: “The more, the better” is obviously as wrong as a drying feed of ideas to the innovation process.
Focusing effort for efficient innovation

After idea generation, prioritization and selection inevitably become important. What are the best suited ideas? And what does “best suited” mean at all? Guidance on this should be derived from an innovation strategy. Past experience proves that without such an innovation strategy, companies fail to deliver innovations focused to support their business strategy or even at all. An example for such guidance might be the decision to position the company or the business units as leading in price, quality or technology for a certain product. This will have implications on the organization. Leadership in technology might trigger the prioritization of ideas that are merely derived from the assessment of future megatrends on the economy. This may reveal large potentials in areas of products that are currently not in the portfolio of the company, which means that no business unit is willing to actively support or fund the development due to a lack of “responsibility”. Central units of the company, e.g., corporate development or corporate innovation can take over the development stage to respond to this problem. In this case the corporate units must stay connected to market insights, which are usually generated in the business units. Solving these issues should not be underestimated. Ideally, the required set-up and processes have already been laid down in the innovation strategy.

The idea selection process encompasses an analysis and an evaluation phase. Each idea has to be analyzed with respect to its characteristics before the ideas are evaluated by a scoring model (see Figure 4). The applied scoring and ranking models need to be carefully planned and designed (and themselves continuously evaluated) to fulfill the requirements of the innovation strategy. Management of this whole process of analysis, evaluation and ranking requires careful balancing of effort and benefit. The analysis effort required for reliable evaluations must be considered to ensure optimal resource allocation and achieve the anticipated time-to-market – and by this a maximum innovation result. Several challenges may arise during this phase: A common agreement on an accepted confidence level needs to be achieved and – often even more complicated – consequently followed. This definition determines the resource requirements. How much capacity and capability in terms of market intelligence does the company have? Are people in the company to support the analysis and evaluation process that have the required expertise and can they dedicate the appropriate time? The result of this phase is a set of clearly prioritized ideas and convincing, albeit rough, business cases for them.
FIGURE 4
Filter dimension matrix to comprehensively visualize the filter dimensions “attractiveness”, “feasibility” and “resource efficiency” of different ideas and thereby help to decide which projects to pursue.

Source: Stratley
Turning ideas into practice

The next step deals with turning ideas into effective innovations for the company. In case of a product innovation idea this step includes product development and introduction to the market. Shortest possible time-to-market as a goal and early integration of customers as a lever are often key success factors as our experience proves. Reception of a new product in the market is decisive. The customer is supposed to contribute important insights concerning value proposition, pricing or technical parameters. These aspects are also important for process innovation. For instance, it might be possible to enable more competitive pricing by decreasing costs in the manufacturing process. Experience shows that clear processes and responsibilities are crucial for the whole process of development and market introduction.

Implementation requires a different mindset than the more creative idea generation part. Keeping focus, being pragmatic and, ideally, an entrepreneurial mindset are the characteristics that are essential in this phase. Therefore, a tailored process starting with a clear focus description and milestone timeline for review of the progress is highly recommended. Management needs to express goals clearly and dedicate the right resources. Goals for innovation have a much broader quality than would first appear. They not only define the ultimate reason and justification for all effort, but are also the limitation of effort: Every project can potentially fail and reasons for this can vary, such as changed market conditions or strategic refocusing. Such goals allow to determine the failure of the project in time and terminate it without further wasting resources. This reveals that failure of a single innovation project is not necessarily the fault of management or anybody else within the company – if the innovation process is set up and followed reasonably! Stopping the project at the right time and securing and documenting developed know-how should be honored by the management. This is one aspect of a positive, innovative company culture. For a successful project, the handover to the regular business and a structured resolving of the project organization have to be organized. Besides, failed projects should be filed properly as their insights can contribute to the success of others later on. Past experience shows that this knowledge management is often not executed with the same care as the rest of the innovation process since it does not contribute to the current project. Therefore it is of great importance to design roles and responsibilities accordingly.
Steering the innovation process requires an innovation strategy

The innovation strategy is a key element for innovation. Organization, processes, culture and management have a strong impact on innovation. These components already exist in every company, thus, the innovation strategy is a measure to guarantee that they actually support innovation. The innovation strategy is intended to provide guidance on the direction of the innovation effort and support sustainable growth efficiently (see Figure 5).

Setting up processes and the required organization for innovation requires strong steering by management on the one hand with respect to clear objectives and responsibilities, and sensitivity for people and their interaction on the other. What drives the complexity of managing innovation? Many people and different departments – as well as even customers, suppliers or research institutes – are involved, which requires careful management of co-operations. E.g., open innovation or just early requests for customer feedback must not interfere with Intellectual Property handling. Different mindsets are required for innovation: idea filtering and development mostly require process orientation and, ideally, entrepreneurial thinking. This is contrasted by the creative mindset needed in the idea generation phase. Hence, addressing innovation holistically is much more than just writing job descriptions and drawing process charts but has to include a strong change component which rarely can be created from inside the company only.

FIGURE 5
The innovation strategy is based on and aligned to the business strategy. The innovation strategy defines actions and guiding principles for innovation.

Source: Stratley
Growth that exceeds the growth of the competition is only possible by differentiation – of products, processes, or business models. The business strategy and the organizational set-up of a company define such differentiation. The innovation strategy has to be tailored to the specific company situation. A basic overview is given in Figure 6. Changes in culture, organization, processes and even management can only be achieved if the starting point is known. Examples are hard facts such as capabilities of the R&D or Marketing department, but also such soft factors as the openness of staff to corporate change.

This analysis itself, which incorporates large parts of the company, is already a first step in change management which is certainly required for a successful transformation to an innovative company. Determining the state of innovation at a company can be supported by effective methods such as innovation surveys that can easily be adapted to the specific company and complemented with scoring concepts. All further aspects, such as targeted areas of technology up to decisions on the measurement of the innovation success are a consequence of this analysis and the agreement on goals. Development of all this within the organization will ensure identification with the results. If required, necessary changes in the company culture have to be planned and managed in detail. Management faces a complex set of challenges to keep all aspects of this transformation smoothly aligned. Experiences, tools and frameworks from outside the company can support and accelerate this process.

**FIGURE 6**

*When setting up an innovation strategy, a common understanding on the definition of innovation is key. After evaluating the status and defining the innovation targets, the innovation strategy can be prepared.*

Source: Stratley
Top managers of Middle East petrochemical and chemical companies rank an innovation strategy as the most important instrument for strengthening innovation. In our 2010 innovation survey, only a quarter of the participating companies stated that they have such a strategy in place. In recent years, a growing number of research centers and university co-operations have sprung up in the Middle East. Managing them effectively and transferring their results into market success absolutely requires a well defined strategy.

While innovation is regarded as a major driver for business, the focus in Middle East companies is mostly on R&D. As already pointed out, innovation should have a broader perspective as it is not just restricted to product innovations. We believe that the full potential of innovation has yet to be released. This report is a call for action by all the chemical companies in the Middle East to invest in “innovation” to enhance their competitiveness in an increasingly more competitive market place.

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About GPCA

The Gulf Petrochemicals and Chemicals Association (GPCA) is a dedicated and non-profit-making association serving all its members with a variety of data, technical assistance and resources required by the petrochemicals and chemicals industry. The GPCA’s mission is singular and specific in that it intends to support the growth and sustainable development of the petrochemical and chemical industries in the Gulf in partnership with its members and stakeholders and be both a sounding board and a meeting point for debate and discussion. It is the first such association to represent the interests of the industry in the Middle East and it has brought a major dimension to its task by creating both a forum for discussion and a place where like-minded people can meet and share concepts and ideas. Since its inception in March 2006, the GPCA has earned an enviable reputation for steering the regional industry towards a whole new level of cooperation and raising the standard in terms of common-ground interests. Additional information is available at www.gpca.org.ae.

About Stratley

Stratley is a leading consulting firm for the chemical industry with offices in Cologne, Hamburg, Dubai and Shanghai. We work at corporate and business unit level, as well as for in-house functional services. At corporate level, we help to develop corporate strategies, to identify new investment options or acquisition targets as well as divestment concepts, carve-outs, etc. Another area is the definition and implementation of companies’ organisations to position them well for the future in dynamic markets. At business unit level, company-specific marketing and sales strategies are one focus area, the definition of successful product portfolios another. Leveraging a company’s innovation potential can be tackled on corporate as well as on business unit levels. Our focus on the chemical industry ensures that we instantly take up new trends such as “Shale Gas” and understand their implications on a wide range of products. With its presence in Dubai, Stratley aims to reach decision makers from the Gulf chemical industry, as well as authorities potentially participating in the region’s development of the chemical sector.

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