

SMecoMP

WP2 Project dissemination and communication

Del. 2.2.3 (II.1.6.5 5th Article)

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GREEN CHEMISTRY – The INNOVATION in CHEMICAL INDUSTRY

The global chemical industry¹ with a worth of \$2 trillion has an enormous impact on economy, society and the environment, is undisputed². However, with regard to the nowadays unstable economic and political situation worldwide, an increasing rate of development in science and technology and higher customer demands, chemical companies have to struggle for competitive advantages.

A key factor for a company to maintain its market position and even enlarge it is successful innovation. Furthermore, the direction of innovation plays a major role for sustainable growth of a company.

Nowadays, the basis of innovation in chemical industry is defined by sustainability and environmental protection due to climate change, pollution and therefore stricter regulations. But of course every manufacturing company, as most of the companies in chemical industry manufacture, searches for ways to produce more efficient, faster and cheaper. So might there be a way to combine both desires and transform the chemical industry to be more sustainable and increase their economic benefit at the same time?

Even if one can hardly imagine, “green” chemistry is about to achieve both of these goals and leads to transformational changes in chemical industry due to “green” innovations in various chemical fields. Pike Research, a market research and consulting firm, predicts that “green chemistry represents a market opportunity that will grow from \$2.8 billion in 2011 to \$98.5 billion in 2020” and, which is also extremely promising for chemical companies, that green chemicals will save industry \$65.5 billion by 2020³.

Categories of Innovation in the Chemical Industry

Due to the uniqueness of the structure of chemical industry, innovation can arise there in four main categories as they are outlined in Figure 1.

It is obvious that product innovation plays a huge role in chemical industry as it is characterized by value creation through manufacturing. This includes not only innovation to the physical product but also innovative services concerning the product or separate businesses. At this point it becomes clear that the innovation process in chemical industry nowadays goes well beyond simple R&D. To compete in an economic environment that has become much more fast, aggressive and competitive to meet customers’ needs, market orientation plays a key role for innovation. The pivotal change from technology to market driven thinking therefore craves for product innovation, including both physical products and services.

Closely related to product innovation are innovative manufacturing processes as they, if successfully implemented, can save costs and increase efficiency. But innovation in chemical industry doesn’t stop at chemistry and manufacturing. Every process across a company in chemical industry can possibly be transformed by innovation. This goes from innovation in

business processes, such as improved human resource processes to select better talents, to new innovative business models of a company, e. g. separate commodity businesses. Changes across the whole company are needed to satisfy the demands of growing complexity and highly cross-linked processes.





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

Figure 1. The four categories of innovation which are most important for manufacturing companies

Critical Innovation Success Factors. The three P’s

Especially for branches with a high dependency on scientific findings and the quality of R&D like the chemical industry, there are three critical innovation success factors, namely the three P’s - People, Processes, and Partnerships.

Hereof, people are considered as the most important factor for successful innovation because of mainly three reasons. First, people define their environment and therefore, to evolve an innovative environment it acquires the appropriate people. Proactive teams have to be built so that everyone is able to aim the different aspects of innovation in accordance with their individual abilities. The accurate resource deployment is therefore crucial for innovation. Second, ideas, which are the very heart of innovation, are created by people. Third, sharing ideas is the first step to use the advantage of teamwork rather than the work of a single person. People have to listen to each other and combine their ideas by sharing them in order to achieve the highest innovative outcome.

Next, work processes which provide a guideline for an innovation process are especially required for highly complex innovation tasks which are mostly the case in chemical industry.

The last critical determinant for successful innovation is partnerships whose number is increasing in chemical industry. Reason for this is the increasing degree of specialization and therefore industry is restructuring. Furthermore, to be the first in the marketplace a company has to keep their focus on the speed of product launches, but because of the fast change of the market and its influences, such as customer needs, competitors and technology, it is not possible to possess all the right skill sets internally at the same time. Partnerships face these needs. Finally, as it was already mentioned above, the change of technology to market oriented thinking occurs and this requires as well much higher skill sets. To meet unmet customer needs, partnerships are therefore indispensable.

Substream: F3 -Factory

A concept which converts all these findings above into a practical model is the concept of the F3 - Factory (Future, Fast, Flexible) which is a visionary idea for the future of chemical production⁴. This project was launched in 2009 to enhance the EU chemical industry's competitive position by developing faster, more flexible and efficient manufacturing methods. It is innovative in all the four mentioned categories where innovation can occur in a chemical company. It is product innovative due to the targeted development of “solvent-free specialty polymers, innovative surfactants, compounds for the healthcare industry and materials from renewable sources”⁵.

The heart of this project is about modularising chemical manufacturing and developing new standards which revolutionizes chemical manufacture processes. Therefore, it is a paradigm for innovation in manufacture processes which again influence business processes and force innovations in that field. Due to the modular structure of the manufacturing it creates a basis for new business processes because of high production flexibility, facilitating of new processes and possible delocalization of chemical processes. This again is able to revolutionize chemical companies' business models because chemical manufactures won't have to be fixed on one location and individual customer needs can be met much cheaper, faster and more sustainable.

Since its inception around 25 years ago, green chemistry is one of the most promising, innovative and important directions towards which the chemical industry emerges. It is a possibility for companies in the chemical industry to achieve as well environmental and economic prosperity.

¹ Green Chemistry. The Innovation in Chemical Industry, Seminar Paper, 2017.

² http://www.strategyand.pwc.com/global/home/what_we_do/industries/chemicals/c_introduction

³ <http://www.navigantresearch.com/newsroom/green-chemicals-will-save-industry-65-5-billion-by-2020>

⁴ Centi, G. & Perathoner, S. (2008) “Catalysis, a driver for sustainability and societal changes”, Catalysis Today, 138: 69-76.

⁵ Britest Ltd, F3-Factory Consortium (2010), “A new paradigm in sustainable production technology for the EU chemical industry”, f3factory.eu.