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Innovation through digitalization of chemical industry

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RESUMEN

La digitalización es un modelo de negocio emergente que incluye la extensión y soporte de los canales electrónicos, el contenido y las transacciones. Las empresas están adoptando esta estrategia para transformar sus negocios, e impulsar la innovación y equilibrar las capacidades electrónicas con las prácticas comerciales tradicionales. Este estudio abarca algunos temas importantes: la innovación y sus diversos componentes, cómo la digitalización forma parte de la industria química, ¿cómo la digitalización representa una oportunidad importante para el desarrollo de nuevos productos, elementos del programa de marketing digital, y cómo debe ser organizado el marketing digital en las grandes empresas químicas. El estudio muestra que las grandes empresas químicas están adoptando la digitalización a muy alta velocidad. La atracción de los consumidores, el impulso tecnológico y el beneficio económico ha llevado a las compañías químicas más grandes a adaptar la digitalización en las partes principales del negocio. Los dos pilares de la digitalización de una empresa son la operación digital y marketing digital. Las empresas químicas han adaptado el marketing digital como un método innovador de promoción de sus productos y servicios.

Palabras clave: digitalización, industria química, marketing digital.

ABSTRACT

Digitalization is an emerging business model that includes the extension and support of electronic channels, content and transactions. Companies are embracing this strategy to transform their businesses, and driving innovation while balancing electronic capabilities with traditional business practices. This study covers few important topics: innovation and its various components, how is digitalization part of chemical industry, how does digitalization represent an important opportunity for new product development, elements of digital marketing program, and how should the digital marketing organized in large chemical companies. The study shows large chemical companies are adopting digitalization at very high pace. The consumer pull, technology push and economic benefit digitalization brings led the larger chemical companies adapt it in their

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main stream of business. The two pillars of digitalization of a company are digital operation and digital marketing. The chemical companies have adapted digital marketing as the innovative method of promoting their products and services.

Keywords: Digitalization, chemical industry, digital marketing

Introduction

Economic and business trends are making it crucial for manufacturers to find new method for managing their operations and their business. As an example, chemical manufacturers and oil refiners face complex global supply chains, increased and dynamic regulatory requirements, rising costs of feedstock and energy, and mergers and acquisitions that result in disconnected computer systems. One way to achieve new efficiencies that can help address these business challenges is to leverage new developments and trends in technology to establish a unified set of information technology (IT) architecture principles. This paper covers few important topics: innovation and its various components, how is digitalization part of chemical industry, how does digitalization represent an important opportunity for new product development, what elements are included in the digital marketing program, and how should the digital marketing organized in large chemical companies.

Innovation

Innovation is the process of translating an idea or invention into a goods or service that creates value or for which customers will pay. In business and engineering, new product development (NPD) is the complete process of bringing a new product to market. Product development is a risky business: a significant number of new products that enter the market fail. New product development is described in the literature as the transformation of a market opportunity into a product available for sale (Brown and Eisenhardt,1995) and it can be tangible (that is, something physical you can touch) or intangible (like a service, experience, or belief).

Innovation in an industrial environment

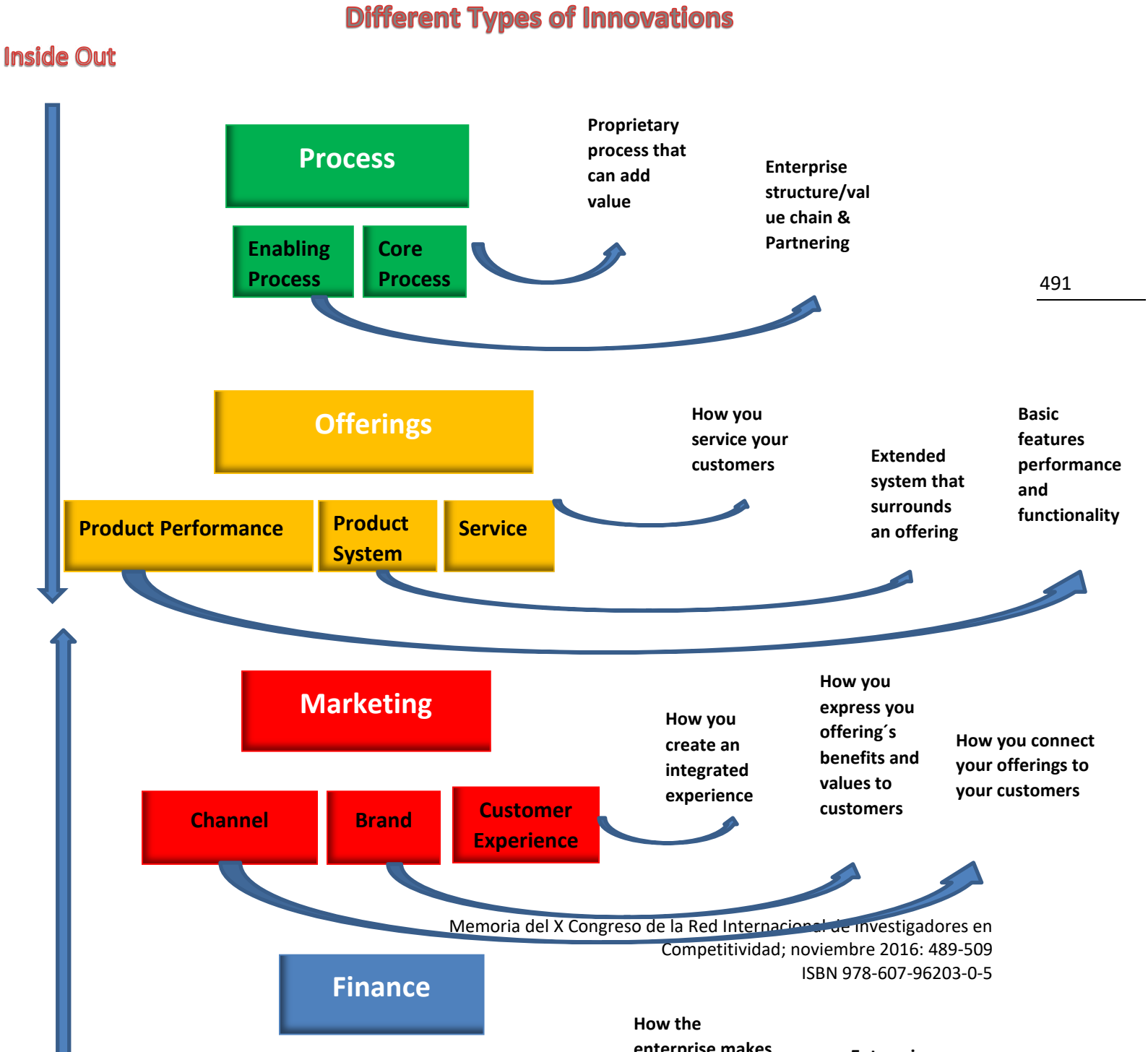
According to Han, Kim and Srivastava (1995), innovation is generally a new idea, device or process which can be viewed as the application of better solutions that meet new requirements, in articulated needs, or existing market needs. This is accomplished through more effective products, processes, services, technologies, or ideas that are readily available to markets, governments and society. Innovation is at the heart of economic change. Schumpeter (1934) comments that “radical” innovations shape big changes in the world, whereas “incremental” innovations fill in the process of change continuously.

Various types of innovations as proposed by Schumpeter (1934) are:

- introduction of a new product or a qualitative change in an existing product;
- process innovation new to an industry;
- the opening of a new market or changes in industrial organization;
- development of new sources of supply for raw materials or other inputs;

According to UNESCO (2012), the innovation in a company can be broadly divided into four types: Product innovation, Process Innovation, Marketing innovation, Innovation in Finance. This can be sub-divided into ten groups of innovation as shown in the figure 1.

Figure 1: Ten different types of innovation in any business.



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Source: Author

Digitalization of business

Digitalization is an emerging business model that includes the extension and support of electronic channels, content and transactions. Companies are embracing this strategy to transform their businesses, while balancing electronic capabilities with traditional business practices (hard-copy documents and correspondence, face-to-face interactions, and call center volume). The effects of an increasingly digitized world are now reaching into every corner of our lives because three forces are powerfully reinforcing one another:

Consumer pull: A good understanding of customer needs and wants, the competitive environment and the nature of the market represent the top required factors for the success of a new product. Cost, time and quality are the main variables that drive the customer needs. Aimed at these three variables, companies develop continuous practices and strategies to better satisfy the customer requirements and increase their market share by a regular development of new products.

Technology push: Digital technology continues to expand its influence. Data-driven innovation forms a key pillar in 21st century sources of growth. The history of innovation is scattered with products and processes which only came into being as a result of an accident or proper planning. The confluence of several trends, including the increasing migration of socio-economic activities to the Internet and the decline in the cost of data collection, storage and processing, are leading to the generation and use of huge volumes of data – commonly referred to as "big data". These large data sets are becoming a core asset in the economy, fostering new industries, processes and products and creating significant competitive advantages. The infrastructure backbone of the digital world is bringing affordable broadband to billions of consumers. In parallel, low-cost connected devices are being deployed in every industry, and cloud computing, and the vast information-processing machinery it requires, is developing quickly.

- **Economic benefits:** The economic benefits to be captured through digitization are real. A wave of capital has poured into the new digitization technologies and companies, and the public markets reward early movers with unprecedented valuations.

  The influence of digitization is moving quickly through every company. Digitization is not just the adoption of new technologies, but the resulting transformation of life and work. Today's new technologies, such as the cloud and big data are rapidly being woven into the fabric of business, as other technologies were before them. This is having a more dramatic effect than many people realize — not just on their customers, but on the industry that supplies these tools.

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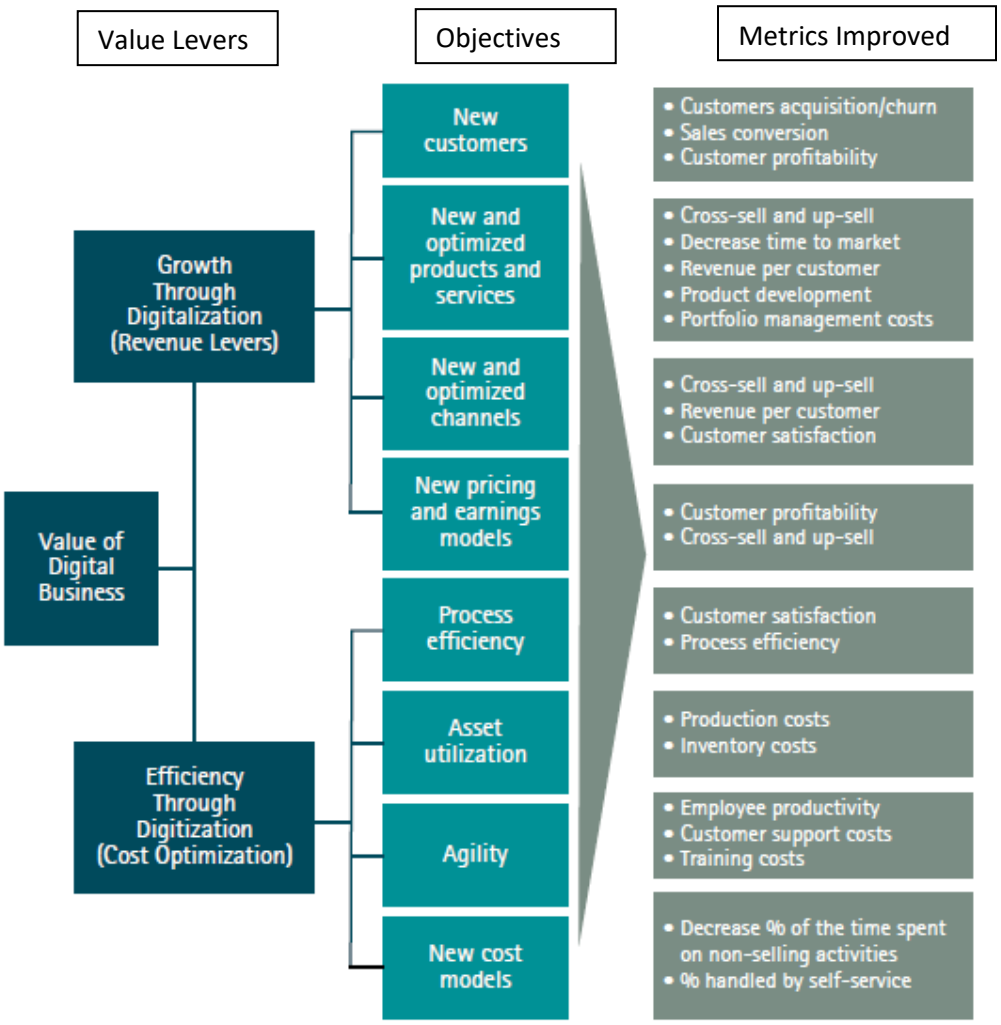
The figure 2 shows the objectives of digital business and various metrics to measure it. The chart shows that it is not only to do business in digital way but brings significant values to the business such as creating: new customers, new products, new marketing channels, new pricing models, improved manufacturing and process efficiency. A digital business can create revenue and results by using innovative strategies, products, processes and experiences. Companies may not be able to realize digital ambitions if they continue to be shackled by the cost, complexity and limited capacity of their legacy infrastructures (figure 2).

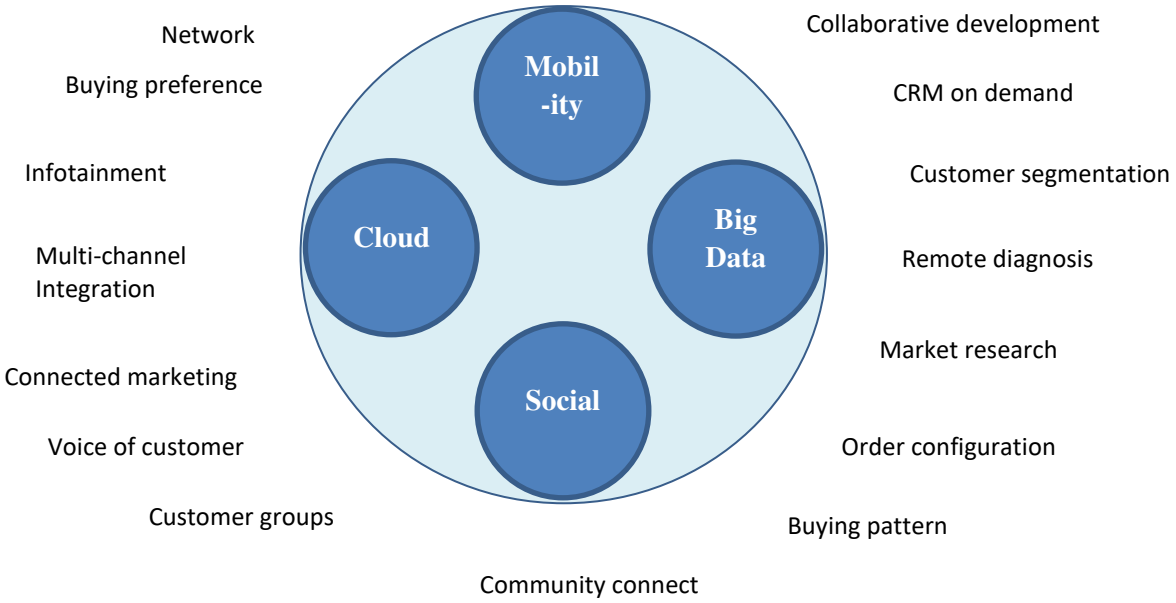
Figure 2. The value and impact of digital



Source: McDonald and Mcmanus (2014)

The various components of a digital wave in a company can be broadly divided into four parts: Mobility, Cloud, Big Data, Social. This can be divided into several sub-groups as seen in figure 3.

Figure 3. The various component of digital



Source: Tata Consultancy Service (2014)

Digitalization of chemical industry

Shifting business requirements in the chemical manufacturing and oil refining industries are driving new trends and requirements in information technology (IT) architecture.

To be a digital chemical company is no different. Chemical companies have an opportunity to turn their digital capabilities into a competitive advantage that will create a digital divide in the industry. To get the most from digital systems, chemical companies need to manage the context in which the systems are used; that is, to transform the business to take full advantage of new technologies throughout the value chain (Table 1).

Table 1. Chemicals digital value chain

R&D / Laboratory	Plant Development and Investment	Material Sourcing and Acquisition	Product Manufacture	Inventory Management and Distribution	Sales Management
Co-innovation	Portfolio management	Collaboration and integration with suppliers	Plant automation	Automated warehouse and route management	Connected consumers
Closed-loop digital product lifecycle	Planning agility	Supply-volatility analytics	Resource optimization	Track and trace	Customer analytics

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Product sustainability	Project finance	Commodity risk management	Remote monitoring	Collaboration with third-party service providers	Differentiated customer service
Virtual prototyping	Project execution and monitoring	Inventory and demand balancing	Asset performance	Inventory visibility	Dynamic pricing
			Quality automation		Execution compliance
			Track and trace		

Source: Accenture (2014)

Accenture (2014) has identified seven elements fundamental to harnessing digital capabilities for greater business outcomes. By understanding and working through these phases, chemical companies can put themselves in position to take advantage of today's digitally enabled solutions.

Table 21. Digital Landscape in chemical Industry

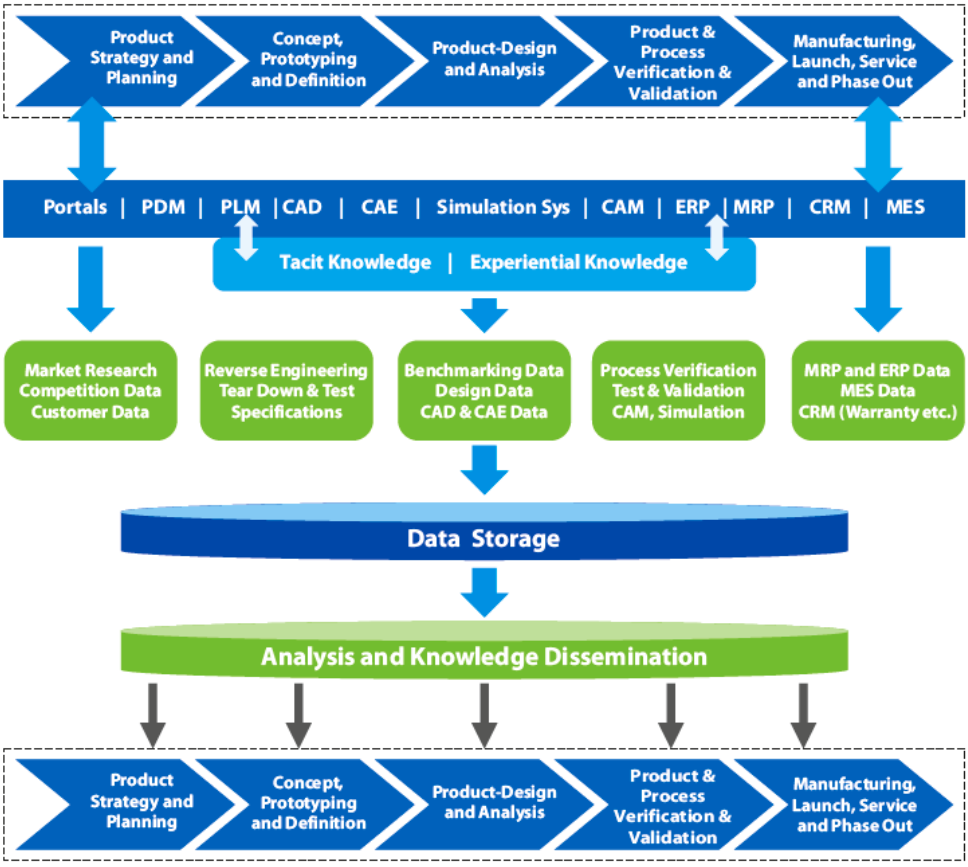
Digital plant	**Digital sales and marketing**	**Digital supply chain**	**Digital capital projects**	**Digital organization**	**Digital Marketplace presence**
Combines value chain integration with increased digitalization across the value chain for more efficient and profitable operations	Improves planning integration to discover and exploit new revenue and profitability opportunities according to market updated relevant information	Digitalization of stock and fleet management across the value chain	Includes a digital portfolio strategy that simulates financial and operations scenarios, evaluates bottlenecks, interdependencies and digital capital project execution	Leverages digital technologies to improve enterprise function efficiency through better visibility, financial performance and workforce collaboration	Using digital tools and capabilities to maintain an ongoing presence in the digital marketplace to identify and capture opportunities and mitigate risk

Source: Author

A Big Data strategy requires the ability to sense, acquire, transmit, process, store and analyze the data to generate knowledge that can be stored in a repository for later use.

The figure 4 below shows the full infrastructure of a Big Data and how is it integrated with the new product development process. The first row of the chart shows the new product developments process. It is integrated to various portals and platforms from which the data are collected and stored. The data is then analyzed and fed back to the product development process.

Figure 4: Big data and data analytics for new product development



Source: Tata consultancy service (2013)

Innovation in Marketing in Chemical companies: Digital Marketing

Digital technology is changing all. Consumers who used to seek out family and friends for word-of-mouth product recommendations now read online reviews, compare features and prices on Websites, and discuss options via social-networking sites. This information flow not only empowers consumers but also allows marketing departments to be part of the conversation consumers have as they actively learn about product categories and evaluate choices.

According to Oxford Economics, online sales are projected to reach $20.4 trillion in 2013, representing 14 percent of the global economy and growing faster than sales in traditional channels. Of the world's 7 billion people, there are more than 6 billion mobile subscriptions and 3 billion active users of the Internet. Digital technologies drive change from the outside in. Technologies such as mobility, analytics, social media and cloud are intrinsically customer-focused, giving customers the information and connections to change the meaning at every moment of truth. Growth is no longer a matter of creating new products and marketing playbooks that move customers through linear purchasing processes. By coordinating the consumer´s end-to-end experience, companies could enjoy revenue increases of 10 to 20 percent as shown in table

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Table 3. Trends in customer engagement to increase sells

Capture Internet Traffic	Increase Consumer Engagement	Capture Qualified Leads	Build Consumer Loyalty	= Increased online revenue
Capture 50-100% of fair-market share of traffic	Meet or exceed 50 % of best competitor´s engagement rate	Convert 10-15 % of engaged traffic into qualified leads Convert 20 % of loads into sales	Build 60 % loyalty rate. Achieve 40 % sales conversion rate annually from loyalists	Earn 10-20 % of total incremental revenue from new and loyal customers through online channels

Source: Accenture (2014)

Moving from a one-way, company-driven sales mentality to a two-way relationship with consumers requires core changes in the way marketers do business. Companies are buying thousands of search terms across their lines of business, and new agencies keep popping up to serve marketers' increasingly keen desire for innovative content, user tools, or social experimentation.

Digital Marketing Strategy

As many other industrial sectors, digital marketing in the chemical sector has the website as the core component of their digital marketing strategy. Website could be textual, visual or aural content that is encountered in a website. It may include text, images, videos, sounds and animation. It is seen all the top chemical companies have an elaborate website which is the window for information of the company to the outside world. When the website of these companies were analyzed in details, seven key components were observed: Search Engine Optimization, Pay per click, Development, Social Media, Content Management, Additional Marketing, Content, Social Media, software. For our current study, we have focused on three digital marketing tools which are being extensively used in chemical industry: Blogging, Article Marketing, E-commerce, social Media Marketing.

Figure 5. Various components of digital marketing strategy of a chemical company

Source: Author

Each of the components of the digital marketing can be sub-divided into several sub components. These sub-components are shown in table 4.

Table 4. Sub-components of the digital marketing relevant to chemical industry

Search Engine Optimization (SEO)	Development	Pay-per-click (PPC)	Social	Software	Additional Marketing	Content
Link Building	CMS	Search	Facebook	Technologies	CRO	PR
Multi-lingual	Mobile	Ad Schedule	Twitter	Reporting	Shopping Feed	Blogs
On Page	Bespoke	Mobile	Linkedin		Cookie / Audit Law	Articles
Mobile	Design	Display	Youtube		EmailMarketing	Content
Local			Google+			
			Other			

Source: Author

The figure 6 below show extracts of the blogs of some of the top chemical companies. It is seen that the companies have their own blogs while some of them have blog for specific business and also specific products.

Figure 6. Website with blog web page

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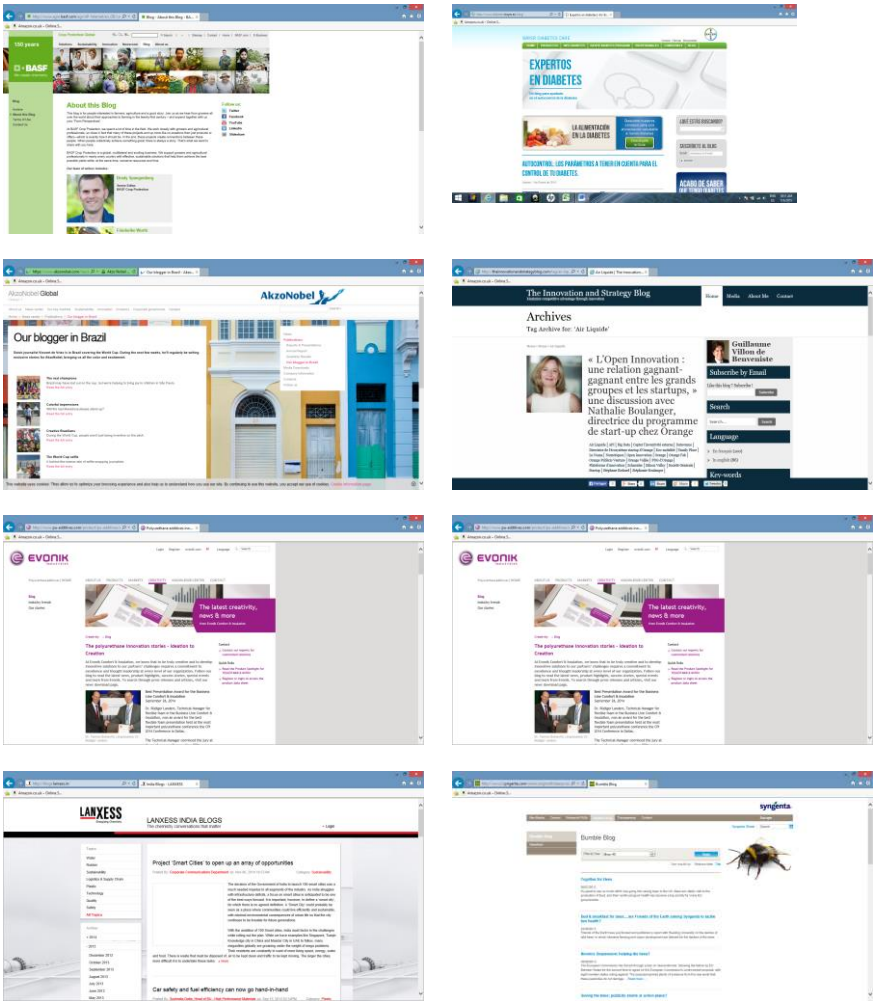
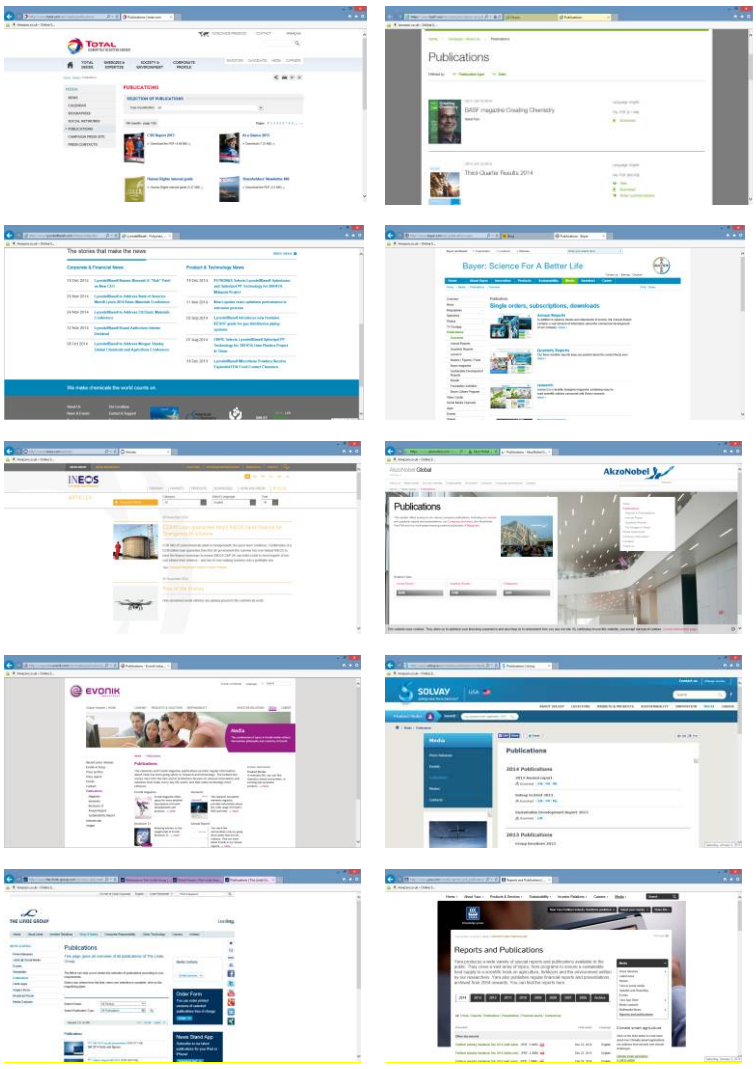


Source: Individual company webpages (2014)

Article marketing is a type of advertising in which businesses write short articles about themselves, their company or their field of expertise as a marketing strategy. Internet article marketing is used to promote the authors expertise of their market, products or services online via article directories. Article directories with good web page ranks receive a lot of site visitors and may be considered authority sites by search engines, leading to high traffic. These directories then give PageRank to the author's website and in addition send traffic from readers.

Figure 7. Article and publication web pages of the top chemical companies



Source: Individual company webpages (2014)

Articles and article directories attract search engines because of their rich content. Business Owners, Marketers and Entrepreneurs attempt to maximize the results of an article advertising campaign by submitting their articles to a number of article directories. However, most of the major search engines filter duplicate content to stop the identical content material from being returned multiple times in a search engine results page. The figure 7 shows screen shot of the article page or publications of the top chemical companies under study.

Electronic commerce, commonly known as E-commerce or ecommerce, is trading in products or services using computer networks, such as the Internet. Electronic commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. Modern electronic commerce

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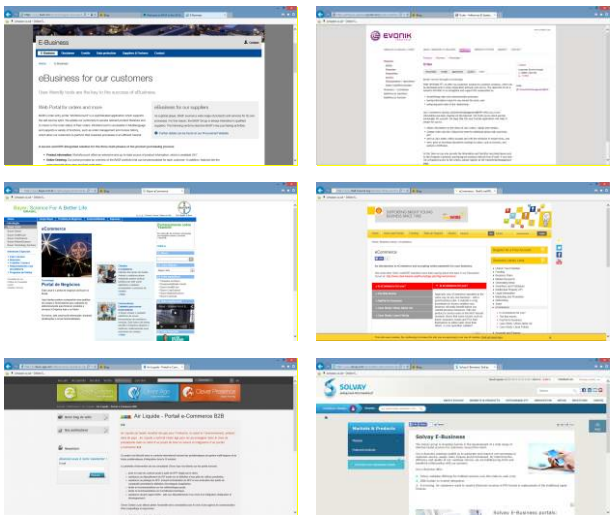
typically uses the World Wide Web for at least one part of the transaction's life cycle, although it may also use other technologies such as e-mail. It is seen that the top chemical companies in Europe has in most case e-commerce website where they sell some of their products (figure 8).

Figure 8. E-commerce web page of the top chemical companies



Source: Individual company webpages (2014)

Social media marketing refers to the process of gaining traffic or attention through social media sites. Social media often feeds into the discovery of new content such as news stories, and "discovery" is a search activity. Social media can also help build links that in turn support into SEO efforts. Many people also perform searches at social media sites to find social media content. Social connections may also impact the relevancy of some search results, either within a social media network or at a 'mainstream' search engine.

Social media marketing programs usually center on efforts to create content that attracts attention and encourages readers to share it with their social networks. A corporate message spreads from user to user and presumably resonates because it appears to come from a trusted, third-party source, as opposed to the brand or company itself. Hence, this form of marketing is driven by word-of-mouth, meaning it results in earned media rather than paid media. It is seen that all the top chemical companies are involved strongly in social media marketing. The table 5 shows the study of the top chemical companies websites and the social media link available on their website. All the companies under study is seen to be focused on social media marketing having involved with top five social media: Facebook, Twitter, LinkedIn, Google+, YouTube. Many of them also have a RSS Newsfeed which provides latest updates of the companies (table 5).

Table 5. Active involvement of social media channels by the top European chemical companies

	Facebook	Twitter	LinkedIn	Google+	YouTube	Flickr	Slideshare	Instagram	Xing	Pinterest	RSS Newfeed
BASF	X	X	X	X	X	X					X
Shell	X	X	X	X	X	X					
LyondellBasell	X	X	X	X	X						
Bayer	X	X	X	X	X						X
IneosGroup	X	X			X						X
Akzo Nobel	X	X		X	X	X	X				
Air Liquide		X	X								X
Evonik	X	X	X	X					X		
Solvay	X	X	X		X						
Linde	X	X	X	X	X				X		
Yara	X	X	X		X		X				X
DSM	X	X	X	X	X						X
Lanxess	X	X			X						
Syngenta	X	X	X		X						X
Arkema	X	X									X
Eni	X	X	X	X	X	X	X	X		X	
Styrolution		X	X	X	X						
Total	X	X									X

Source: Author

Table 6 shows the activities of top chemical companies in various social media domain. Since all of them have Facebook page, “likes” on the Facebook was taken as important statistics for analysis. Shell leads the list with over 5 million likes, followed by Total as distant second and Bayer as the third. In terms of Tweets, Total is the leader followed by Syngenta and DSM. In terms of followers on Twitter, Bayer is the leader with over 101000 followers. YouTube has established itself has a strong social media channel through video. Most of the chemical companies under study have YouTube channel and it is seen that shell has highest numbers almost 24000 subscriber followed by BASF with almost 5000 subscribers.

Table 6. Degree of engagement of top chemical companies in various social media channels

As on 21-11-2014	Facebook	Twitter					Linkedin	Google+	Youtube	
	likes	Tweets	Following	Followers	Favorites	Lists	Followers	Followers	Views	Subscribe
BASF	208.562	2.590	683	26.4k	364	6	268.993	3.322	1.455.859	4806
Shell	5.375.981	1.632	130	260k	8		1.236.175	229.306	2.241.993	23.941
LyondellBasell	1.312	313	1.964	3.355	18	1	31.762	75	35.270	38

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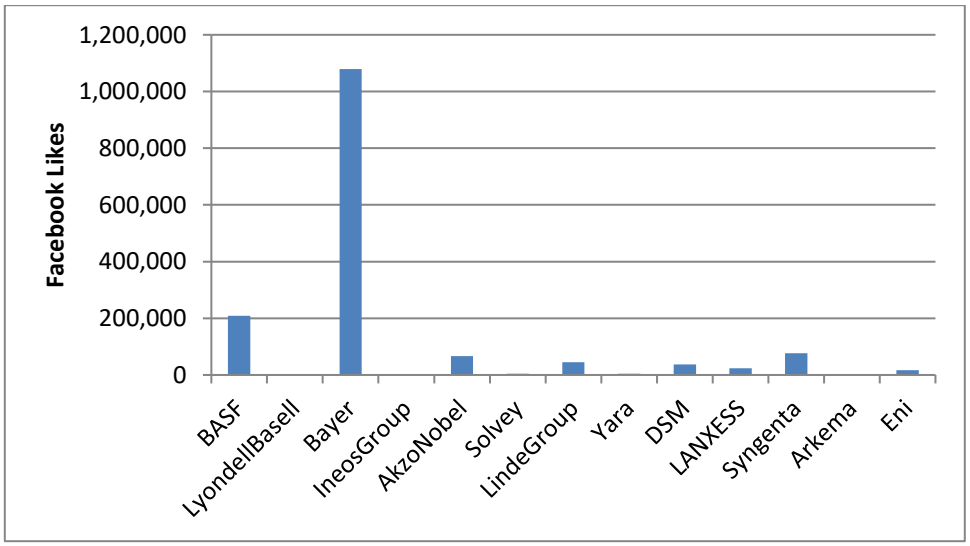
Bayer	1.079.279	1836	1801	101k	1.362		310.454	1958	689.256	910
IneosGroup	609	410	186	3.599	3					183
AkzoNobel	67.016	1.428	682	11.3k	84			608	281.715	776
LindeGroup	45.575	1.395	1.232	5.640	181	6	49.652	544	266.996	705
Yara	4.419	2.398	1.367	3.647	175		49.652			756
DSM	37.337	5.481	437	66.7k		1	55.617		311.772	1.071
LANXESS	23.063	900	95	3.092	305	1				232
Syngenta	76.799	5.920	1.521	33.9k	5.786	4	82.148			
Arkema	1460	546	233	2.409	2	10				
Eni	16.830	2.115	397	14.1k	518	1	178.037	122	85.620	3.847
Styrolution		21	6	52	7		65	17	2.560	18
Total	2.042.088	7.133	371	52.1k	109					

Data Source: Individual Websites; Author's calculation

Figure 9 shows a comparative graph as how the Facebook page is liked by the visitor. It is seen that Bayer is way ahead than most of the chemical companies and seen to be very active in their Facebook website. Distant second is BASF while for most other activity is pretty low. This shows that even though every chemical company has a Facebook page, they are not very active there and do not emphasize the importance of Facebook marketing. On the other hand, the oil companies even though not appearing in this graph are way ahead of chemical companies in terms of activity at the Facebook page.

Figure 9. Facebook likes of various chemical companies



Source: Author

Information technology challenges faced by the Chemical Industry in Europe

Chemical companies have specific concerns relating to cyber security, supply chain and logistics. At the same time, trends like big data, cloud computing and social media have begun to exert an influence on the industry. Chemical companies are moving in and out of markets as their strategy dictates, so portfolio churn is an issue. Margins are tight, so mitigating costs is on the list. Data management and security, especially in new markets, is a concern. Global regulation is another. And while everyone has a basic ERP system, companies are looking upstream and downstream in their value chain, trying to find ways to reduce costs and increase margins.

According to Ray Adams (IBS Chemicals Solution Manager at SAP), IT is helping to integrate groups like R&D to drive down cycle times in the commercialization process.

Some segments like coatings and ink companies introduce hundreds of products each year. They have to commercialize these things quickly. IT provides the tools and mechanisms to make that as seamless as possible, integrating into finance, the regulatory environment, into environmental health and safety databases, and flowing into the manufacturing environment.

Conclusion

From the above study the following conclusions can be drawn:

Large chemical companies are adopting digitalization at very high pace.

The consumer pull, technology push and economic benefit digitalization brings led the larger chemical companies, particularly in Europe to adapt it in their main stream of business. The two pillars of digitalization of a company are digital operation and digital marketing. The drivers for the operational digitalization in larger chemical companies are: very complex supply chain, drive to innovate at very high pace, employee inclined to new technologies, new regulatory requirements and very fast information technology growth. The digital value chain in chemical industry has become very complex starting from R&D laboratory and ending in sales management.

The larger chemical companies in Europe have adapted digital marketing as the innovative method of promoting their products and services

The current study shows that digital marketing is playing a key role in chemical industry in influencing purchasing decision both in case of business-to-consumer (B2C) and business-to-business (B2B). The study also showed that the purchasing decision no more follows a vertical stereotype path and follows a more inter-active route until the decision is made. The chemical

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companies which have been selling through traditional methods are moving to online tools. Several of the large companies we studied have an ecommerce website where they are selling their products. It should be mentioned here that the business to business sell is still done in the conventional method while business to consumer sell is moving more towards online. All the companies we studied have a very detailed website and every effort is being made to capture the internet traffic. Software tool such as search engine optimization (SEO) is used extensively by these companies to drive more traffic to their websites which can eventually lead to increase in consumer engagement, capture qualified leads, build consumer loyalty and ultimately bring in sell. Although being late, the chemical industry is catching up in case of social media marketing. Every company we researched is involved in more than one social media in order to promote their product. Facebook has been the first choice for most of the companies and have on YouTube a dedicated video channel which is regularly updated with product or company related promotional video. We also found that these social media channels have a huge fan following, but it was difficult to know if they were employees or dedicated customers or just general public. Another aspect of digital marketing they all are focused on is blogs and article marketing.

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