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Table of Contents

A Business Report on the Dow / DuPont Merger and People Management Strategies Analysis.....	2
1. Introduction.....	2
2. Mergers and Acquisitions in the Business World.....	2
2.1 Drivers of Merger and Acquisitions.....	3
2.2 Types of Merger and Acquisitions	3
3. Background of the Merger	4
3.1 Dow Chemical Company	6
3.1.1 Dow Chemical Company – Business before the Merger.....	6
3.1.2 Dow Chemical Company – Divestiture and Restructuring	8
3.2 DuPont.....	9
3.2.1 DuPont – Business before the Merger	9
3.2.2 DuPont – Divestiture and Restructuring	11
4. Merger of DowDuPont.....	12
4.1 Major Milestones of the Merger.....	12
4.2 Strategic Integration	13
5 People Management Issues of the Dow-DuPont Merger.....	14
5.1 Corporate Leadership and Decision on Research and Innovations	14
5.2 Proposed People Management Strategies to Enhance Employee Engagement in Research and Innovation.....	17
6. Conclusions.....	18
7. References.....	19

A Business Report on the Dow / DuPont Merger and People Management Strategies Analysis

1. Introduction

The Dow Chemical Company (Dow) and E.I. du Pont de Nemours & Company (DuPont), two of the giants in the Chemicals industries, announced the completion of an equal merger, effective from 31st August 2017. Shares of DuPont and Dow ceased trading at the close of the New York Stock Exchange (NYSE) on 31st August 2017 (Athena Information Solutions Pvt. Ltd., 2017). The DowDuPont Company's stock began trading on the NYSE under the new stock ticker symbol "DWDP", which also took DuPont's spot as the representation of chemical industry in the Dow Jones Industrial Average on 1st September 2017 (Alexander H. Tullo., 2017; Lombardo, C., 2017). The then Chief Executive Officer of the new US\$150 billion chemical giant Edward Breen reported the merge would reduce at least US\$3 billion and generate another billion from new growth (Alexander H. Tullo. 2017). Apart from the stock value and annual synergies in a dollar sign, the Dow – DuPont merger also meant streamlining of manpower, integration of corporate systems, changes of competition in the industry and pricing of the supply chain (Alexander H. Tullo., 2017; Michaela Wilson, 2019; Ungerleider, H. and Warner, J., 2021). This article reviews the background of the Dow – DuPont merger and discusses the people management issues involved in shaping the new company structure and tackling the research and innovation performance.

2. Mergers and Acquisitions in the Business World

Mergers and Acquisition (M&A) is a worldwide practice for corporate restructuring. It is a buy-to-use concept for companies to achieve strategic objectives quickly. M&A activities create shareholder value. Since the 1990s, the M&A activities had significantly heightened in the global commerce sectors regarding frequency, the capital volume involved, and popularity (Weber, Y. and Tarba, S.Y., 2013). M&As became a high-speed rail for corporates to penetrate new markets, adding new resources to strengthen their position and acquire innovations. In other term, M&As provided corporate an alternative route to achieve and sustain growth. In 1992, the value of the M&A deal was US\$200 billion. The figure rose to US\$4.74 trillion in 2017. Dyer *et al.*, 2004 called the period of 1994/95 – 2000/01 the titanic acquisitions and alliances wave, during which American companies

announced 74,000 acquisitions and 57,000 alliances. Dyer *et al.* described that CEOs of American corporates were signing an acquisition or partnership every hour every day during the six years.

2.1 Drivers of Merger and Acquisitions

Conventionally, M&A occur usually because of: economic of scale, financial synergies, market power, market discipline, self-serving for corporate expansion, and advantage of opportunities for diversification (Andrade, G., Mitchell, M. and Stafford, E., 2001). The wave of globalisation led to the new demand for goods and services in new geographical marketplaces. Corporates made use of M&As to speed up their growth to catch up with the market needs and opportunities, which was much slower or even unrealistic for any organic growth strategies. That FinTech and innovation in the financial system enhanced the accessibility of capital created an external impetus to support corporates in conducting M&As (Kumar, B.R., 2019). Recently, there was evidence that innovation and technology reasons, or called corporate innovation activities, were raising drivers of M&As and created a positive impact on merger outcomes. The potential value from the combination of two pre-merge companies' innovation capabilities catalysed corporate M&As (Bena, J and Li, K. 2014).

In recent decades, the new incentives and business needs drove the M&As in various industries. In the pharmaceutical sector, the corporates merged to foster the growth of scale, market share, global expansion and return on the research and development investment. Patent expiry plus the long drug approval period was a major incentive for M&A among pharmaceutical firms. For instance, Pfizer's epilepsy drug Neurontin, anti-depressant Zoloft, antibiotic Zithromax, and cholesterol-cutting drug Lipitor faced patent expiration in 2005-2011 (Greg Stohr, 2007; Aaron Smith, 2006). Pfizer merged with other firms, like Wyeth, to acquire the lineup of products. Similar practices happened in other innovation-driven sectors, including information and communication technologies, digital entertainment, energy and materials. Corporates merged with others to acquire new products, knowledge, technology and market share. Microsoft acquired 111 companies for the enhancement of their product lineup and research and development capability in these ten years (Microsoft Corp, 2022).

2.2 Types of Merger and Acquisitions

A merger is about combining two corporates into one, during which all the original corporates are dissolved while the new corporation would take over all the assets and liabilities. A merger can be classified as vertical, horizontal, conglomerate, and congeneric. A vertical merger is about the combination of a buyer and a seller. A horizontal merger describes the merger of corporates serving

the similar market with similar products. In a conglomerate merger, two corporates with complete different businesses fuse into one. A congeneric merger is the merger of two players in the same industry but with no buyer-supplier relationship. The Dow – DuPont case was classified as a horizontal merger by the European Commission's then Chief Economist (Lofaro, A., *et al.*, 2017). However, it was more likely a congeneric merger, as the then Chief Finance Officer of Dow discussed the two corporates' businesses were in similar markets but in different parts of the value chain or different applications (Ungerleider, H. and Warner, J., 2021). It was also reported as a merger of equals (Alexander H. Tullo., 2017; Dow Corporate., 2017).

Drori, I., Wrzesniewski, A. and Ellis, S. (2011) described, "merger of equals means that both companies receive not only equivalent stock shares, but equivalence in all aspects of the merger such as resource sharing, dividing tasks and responsibilities, and shared management positions. In short, a merger of equals cultivates expectations of wide business synergies as well as fairness, mutual trust in each other's intentions and deeds, and the presentation of a united front."

An acquisition is usually the taking over of a small corporate by a larger corporate. Cases of a small corporate acquiring a larger corporate are called reverse acquisition. Economists also classified acquisitions by strategies. Platform acquisition is the acquisition of another corporate to form a new line of business. Product acquisition describes the acquisition of a business unit of another corporate for acquiring new products. Technology and talent acquisition occurs when a corporation takes over a business unit of another corporate to transform it into new internal components (Brueller, N.N., *et al.*, 2014).

3. Background of the Merger

Dow and DuPont were two of the giants in the agricultural chemicals and materials science industries globally. These two big names had a total of 300 years of corporate history. Apart from agriculture chemicals and materials, Dow was a significant player in plastics and chemical productions, hydrocarbon business, electronics, transportation and energy products and services. On top of chemical and polymer production, DuPont's businesses covered electronics and communications, biotechnology, healthcare, and production of seeds, food ingredients and other crop-related materials (Wilson, M. 2019; Kumar, B.R., 2019). Each of them was with market capitalisations of around US\$65 billion (Chang, J., 2015). There was a sharp change in the global agricultural chemicals market in 2008. The market value recorded a continuous reduction of -1.6% in 2009 and -7.5% in

2010. The five years market value forecast shrank from 60.6% in 2009 to 34.3% in 2010. In parallel, the five years market volume forecast was reported 16.2% in 2009 and 13.4% in 2010 (Fertilizers & Agricultural Chemicals Industry Profile: Global 2011, 2010, 2009). The industry was expecting a significant weakening in the profitability of its products.

That the annual revenues and net income of Dow and DuPont showed weak momentum for dramatic growth created an internal catalyst for the merger. Meanwhile, activist investors influenced the pressure on corporates to shift from big portfolios to accelerated growth. The then Chief Financial Officer of Dow said, "the idea (of merger) dated to the early 2000s... Then Chief Executive Officers of Dow, Andrew Liveris, and of DuPont, Edward Breen agreed to meet in the fall of 2015" (Ungerleider, H. and Warner, J., 2021). This move sparked the Dow and DuPont merger to transform the inter-competition into opportunities for agricultural chemicals' development and sale growth.

Table 1: Revenue of Dow and DuPont in 2006 - 2010

	2006	2007	2008	2009	2010
Revenues (US\$ Million)					
Dow	49,124	53,513	57,514	44,875	53,674
DuPont	27,421	30,446	31,796	27,218	32,347
Net Income (US\$ Million)					
Dow	3,724	2,887	579	336	1,970
DuPont	3,148	2,988	2,007	1,755	3,031

(Fertilizers & Agricultural Chemicals Industry Profile: Global 2011, 2010, 2009)

Kumar, B.R. 2019 quoted the financial highlights that Dow had been on a declining trend for more than five years in 2012-2016. Both the net income and return on equity fluctuated over that period of time. The figures on the DuPont side were also unpleasant. DuPont's total assets value, net sales and net income recorded a straight decline in 2013-2015. The scholar described Dow's and DuPont's performance was showing a continuous declining trend in millions of dollars before the merger.

Table 2: Financial Highlights of Dow

	2012	2013	2014	2015	2016
Net Sales (US\$ million)	56,786	57,080	58,167	48,778	48,158
Net Income (US\$ million)	1,100	4,816	3,839	7,783	4,404
Return on Equity %	5	19.4	18.6	34.4	15.3

(Kumar, B.R. 2019)

Table 3: Financial Highlights of DuPont

	2013	2014	2015
Net Sales (US\$ million)	52,142	50,490	41,166
Net Income (US\$ million)	28,998	28,406	25,130
Total Assets (US\$ million)	4,862	3,636	1,959

(Kumar, B.R. 2019)

3.1 Dow Chemical Company

Dow was with 120 years of history and was officially incorporated in 1947 under Delaware law (Kumar, B.R., 2019; Ungerleider, H. and Warner, J., 2021). In 2016, Dow's manufacturing sites covered 34 countries, was producing over 7,000 families of products, and was employing 56,000 people. The company drove innovations that extract value from material, polymer, chemical and biological science to address world-wide issues, such as the need for fresh food, safer and more sustainable transportation, clean water, energy efficiency, more durable infrastructure, and increasing agricultural productivity. The corporate was offering various technology-based innovations and products, with five operating segments, namely Agricultural Sciences, Consumer Solutions, Infrastructure Solutions, Performance Materials and Chemicals, and Performance Plastics (The Dow Chemical Company, 2016).

3.1.1 Dow Chemical Company – Business before the Merger

The Agricultural Sciences segment's businesses were 75% crop protection and 25% seed biotechnology products in terms of sales in 2016. Geographically speaking, approximately 80% of the sales were from the American market. The products covered insecticides, fungicides, herbicides, seeds and others, which were widely adopted in the cultivation of canola, cereals, corn, cotton, range and pasture, rice, soybeans, sunflower, trees, fruits and vegetables (The Dow Chemical Company, 2016). In addition to manufacturing and trading, the business invented and developed new products and technologies in germplasm, traits, proprietary chemistries, and formulations to drive business growth (Kumar, B.R., 2019; The Dow Chemical Company, 2016). Agricultural Sciences registered patents and trademarks to protect its intellectual properties in crop protection, seed biotechnology products, plant technologies, urban pest management solutions and healthy oils. The intellectual properties were also licensed to third parties to foster research collaboration and boost the return on investment of research and development.

There were four global subsidiaries under the Dow Consumer Solutions, namely Consumer Care, Dow Automotive Systems, Dow Electronic Materials and Consumer Solutions – Silicones (Kumar,

B.R., 2019). Dow Electronic Materials was the largest among the four in terms of sale volume. It contributed approximately one-third of the sales of the Dow Consumer Solutions segment. The subsidiary provided advanced technology and unique chemistries for specialty applications including semiconductors and organic light-emitting diodes. As a whole, Dow Consumer Solutions served the market needs of adhesives and performance solutions for transportation industries; electronics and entertainment technologies; innovative pharmaceutical formulations; nutrition and food solutions; sustainable solvents for innovative cleaning solutions; and silicone components for personal and home care goods. This business segment was making sales to nearly 110 countries, half of which were in Asia Pacific area (The Dow Chemical Company, 2016).

The Infrastructure Solutions of Dow consisted of five businesses, namely Dow Building & Construction, Dow Coating Materials, Energy & Water Solutions, Performance Monomers, and infrastructure Solutions – Silicones. Nearly half of the sales activities were in North America. Each of the Asia Pacific and the Europe – Middle East – Africa – India "EMEI" markets contributed a quarter of the total sales. The segment made sales in nearly 150 countries world-wide. This segment offered the construction market with foam insulation, weatherisation, roof finishing, cement-based adhesives, acrylic binders, industrial coatings, paper, opacifiers, surfactants, super absorbents, detergents, inks and paints, moulding compounds, textiles, glass, glazing, microbial protection and many other infrastructures related advanced materials. It also provided industry-specific solutions for the oil and gas industry, water treatment industry, and food and beverage industry (The Dow Chemical Company, 2016).

The Performance Materials & Chemicals segment covered businesses of Chlor-Alkali and Vinyl, Industrial Solutions and Polyurethanes (Kumar, B.R., 2019). Chlor-Alkali and Vinyl business contributed over half of the sales of this segment in 2016. It manufactured and sold cost-advantaged chlorine and caustic soda, which is a valuable co-product of the chlor-alkali manufacturing process. Polyurethanes was the world's leading producer of propylene oxide, propylene glycol, polyether polyols and aromatic isocyanates in 2016. The Industrial Solutions business offered edge-cutting solutions for friction and heat eliminations in mechanical processes, oil and water interface treatment, dissolvability enhancement, and chemical technology advancement. The three technology-driven business of the Performance Materials & Chemicals segment had a reach of about 140 countries, where the EMEI and North America were the major geographical market in 2016 (The Dow Chemical Company, 2016).

The Performance Plastics segment ran the largest plastics franchise among the global market in 2016. Its portfolio was comprised of five major businesses: Dow Elastomers, Dow Electrical and

Telecommunications, Dow Packaging and Specialty Plastics, and Dow Hydrocarbons and Energy (Kumar, B.R., 2019). The Dow Packaging and Specialty Plastics contributed the largest portion of sales performance in this segment, which was over half of the 2016 sales by business. Dow Elastomers, Dow Electrical and Telecommunications, Dow Packaging and Specialty Plastics were serving high-growth, high-value markets with innovative solutions for reducing food waste, advancement of broadband and LTE telecommunications networks, electrical transmission networks and renewable energy systems. Dow Hydrocarbons was the global leading supplier and producer of ethylene and propylene. Apart from sales in the market, these chemical goods were also important internal feedstock for various segments within Dow. The Energy business of Dow was with unparalleled scale, purchasing power and global reach. It was the world's biggest energy producer for industrial applications and knowledge hub of world energy markets (The Dow Chemical Company, 2016). The Union Carbide Corporation was a wholly-owned subsidiary of Dow (Kumar, B.R., 2019). EMEAI and North America, which together contributed about 70% of the segment's sales in 2016, were the two major geographic markets of the Performance Plastics segment (The Dow Chemical Company, 2016).

3.1.2 Dow Chemical Company – Divestiture and Restructuring

A divestiture, which breaks up a corporate into autonomous entities that compete independently in the market or are sold to a third party inside or outside the original industry, can increase the incentive and possibility of a merger (Qiu, D. L., & Zhou, W., 2010). It is a common practice that merging firms will divest a package of assets that includes some of each of the two merging firms' assets (Loertscher, S., & Marx, L. M., 2019). When the merging firms are at a specific size and maturity or when the growth potential of the overall industry segment diminishes, companies may become tempted by diversification to reduce the risks for investors and the merging sides (Andres Nielsen *et al.*, 2012).

Dow carried out a series of divestitures before the merger with DuPont. The Performance Materials and Chemicals segment recorded three divestitures. On 30th January 2015, Dow sold its global Sodium Borohydride business to the Vertellus Specialty Materials LLC, a major speciality chemicals provider with the corporate headquarters in Indiana, USA. On 2nd February 2015, Dow sold the ANGUS Chemical Company to the Golden Gate Capital, which was a San Francisco-based private equity investment firm. On 5th October 2015, the Company divested its U.S. Gulf Coast Chlor-Alkali and Vinyl, Global Chlorinated Organics and Global Epoxy businesses to the Olin Corporation, which was a bleach and bullets manufacturer and key buyer of Dow's caustic soda (Olin Corporation, 2021), as a split-off in a tax-efficient Reverse Morris Trust transaction (The Dow Chemical Company, 2016).

Moreover, there were more divestitures in other segments of Dow. On 31st July 2015, the company's Agricultural Sciences segment sold its AgroFresh business to the organic chemical manufacturer in USA, AgroFresh Solutions, Inc. On 31st December 2016, the Consumer Solutions segment divested its SAFECHEM™ business (The Dow Chemical Company, 2016). In early 2017, Dow came up an agreement with the S.K. Global Chemical Co., which was the chemical manufacturing arm of South Korea's S.K. Group, on selling the global ethylene acrylic acid copolymer and ionomer business, as a part of the regulatory approval process for the merger transaction (Kumar, B.R., 2019).

After the approval of the Dow's board of directors in the second quarter of 2016 (Kumar, B.R., 2019), Dow Corning Corporation, which was formerly a 50:50 joint venture with Corning Incorporated, became a wholly-owned subsidiary of Dow on 1st June 2016 (The Dow Chemical Company, 2016). This ownership restructure, which was known as the "DCC Transaction", resulted in a reduction of manpower in a size of 2,500 staff globally (Kumar, B.R., 2019). The board of directors in Dow had carried out the repurchase of the Dow's common stock from the stock market in 2013-2015. The scale of the buyback programme was increased from US\$1.5 billion in 2013 to US\$3 billion in 2014 and eventually US\$5 billion by the end of 2014. The total authorised amount for a move of share repurchase reached US\$9.5 billion.

3.2 DuPont

The E.I. du Pont de Nemours & Company, better known as DuPont, was an American chemical company founded in 1802 and was incorporated in Delaware in 1915. DuPont developed from a family business of gunpowder manufacturing to the second-largest chemical company in the world by market capitalisation (Riggs, T. ed., 2015; Kte'pi, B., 2010). By the time of the merger with Dow, DuPont was a multinational corporation with business operation in about 90 countries and with 60% net sales outside the USA, employed 46,000 people, and was involved in the production of petroleum, natural gas, chemicals, synthetic fibres, and polymers, among other products (Riggs, T. ed., 2015; DuPont, 2016). When entering the 21st century, the company shifted its positioning from a chemical company to a science- and technology-based company providing science products and services (Kte'pi, B., 2010; DuPont 2016). It set up over 300 operation sites over the Americas, Europe and Asia. The annual budget for innovation and technology research and development was over US\$1 billion (Kte'pi, B., 2010). DuPont launched nearly 1,600 new products in 2016 (DuPont, 2016).

3.2.1 DuPont – Business before the Merger

As reported in the Annual Report 2016 (DuPont, 2016), DuPont consisted of seven business segments aggregated into size reportable segments. The seven business segments were Agriculture, Electronics & Communications, Industrial Biosciences, Nutrition & Health, Performance Materials and Protection Solutions. Some other businesses were pre-commercial programs, nonaligned businesses and pharmaceuticals in Other.

DuPont's Agriculture segment consisted of DuPont Pioneer and DuPont Crop Protection to serve the food supply and production agriculture industry. It served the global market that 51% of the segment's total sales were outside the USA in 2016. The product lines covered seed products, insecticides, fungicides and herbicides. The Agriculture segment was active in developing new technology to enhance their products, and its research and development cost accounted for 57% of the entire corporate in 2016; 55% in 2015. The segment's research and development focused on high yielding germplasm, hybrid corn, and soybean seed. The seed sales accounted for 27 per cent of DuPont's total net sales in 2014-2016. The segment filed patents to protect their inventions' intellectual properties. They formed licensing and collaboration partnerships with environment and service expertise to co-develop new innovations and bring products to markets. Crop Protection provided crop protection products for a broad range of core agricultural crops. DuPontTM Rynaxypyr[®] was the signature product (Kumar, B.R., 2019; DuPont 2016).

DuPont's Electronics & Communications segment supported the fabrication of semiconductors, packaging materials and components for consumer electronics and photovoltaics displays with raw materials, commodities and chemicals. It was a leading innovator of metallisation pastes and back sheet materials for solar panels and solar power systems. Its pigmented inks were also widely used in the digital printing industry. On the consumer electronics side, Electronics & Communications solution process technology was adapted in the manufacturing of active-matrix organic light-emitting diode display screens panels. Geographically, the DuPont Electronics & Communications segment mainly served the global market the USA market accounted for only 21 per cent of the total sales in 2016 (DuPont, 2016).

The Industrial Biosciences segment of DuPont made 59% of the net sales in the global market. It served the global market with a wide range of bio-based products. One of the signature product lines is the functional enzymes. The products were adopted in the aspects of animal nutrition, detergents, food manufacturing and ethanol production. The segment was also known for its sustainability incentives. It made the DuPontTM Sorona[®] PTT renewably sourced polymer for carpet and apparel fabrication. The Biosciences also offered clean technologies for sulfur emission treatment and wasted liquid management (DuPont, 2016).

Sustainable bio-based ingredients and advanced molecular diagnostic solutions were the notable products of the Nutrition & Health segment of DuPont (Kumar, B.R., 2019). In 2016, 66% of the segment's net sales were outside the USA. Many food manufacturers over the world were using the food ingredients of Nutrition & Health, for instance, cultures, probiotics, emulsifiers, texturants, natural sweeteners under DuPontTM Danisco[®], Xivia[®] and Supro[®] soy-based food ingredients (DuPont, 2016).

DuPont Performance Materials segment was the integration of DuPont Performance Polymer and DuPont Packaging and Industrial Polymers (Kumar, B.R., 2019). This segment of business provided polymer science solutions to automotive and transportation, packaging for food and beverages, electronics, healthcare, construction and aerospace industries. Over 70% of the Performance Materials segment's business was outside the USA in terms of net sales value in the merger period (DuPont, 2016).

The Protection Solution segments shared a similar market segment with Performance Materials, but provided market-driven scientific solutions to enhance life safety. The products include secure life solutions in military, construction, energy, transportation and aerospace industries and edge-cutting solutions for temperature-sensitive food and pharmaceutical products. In 2016, the USA and global market's net sales value ratio was half-half (DuPont, 2016).

DuPont held a large pool of patents and trademarks, which protect the foundation of their products and revenue sources via licensing. On 31st December 2016, over 16,500 active patents were granted under DuPont. Six thousand five hundred of which were U.S. patents, 10,000 were filed in other countries or regions. 55% of the U.S. patent and 30% of the non-US patent were related to the Agriculture segment. There were over 8,300 other patent applications being filed. In parallel, DuPont made protection of and revenue from their intellectual properties through trade secrets (DuPont, 2016).

3.2.2 DuPont – Divestiture and Restructuring

DuPont underwent divestiture and restructuring activities during the years-long merger period. In late 2013, DuPont announced the agreement to sell the Glass Laminating Solutions under the Packaging and Industrial Polymer business to Kuraray Co, a speciality chemicals manufacturer in Japan. The transaction and merger were approved by the European Commission on 29th April 2014 (European Commission, 2014). On 1st July 2015, DuPont announced the completion of the spin-off of its Performance Chemicals segment, which was The Chemours Company (DuPont, 2016). The Chemours Company had 9,100 employees and a sales value of US\$6.9 billion (A. H. Tullo, 2015). In December 2016, DuPont agreed to divest its global food safety diagnostic business to Hygiena

LLC (DuPont, 2016), which specialised in rapid food safety and environmental sanitation testing. The divestiture included all the business assets, salesforce, research and development teams, manufacturing and production capabilities (M.P. Bailey, 2016).

In the first quarter of 2015, DuPont announced its stock repurchase for a buyback of US\$4 billion from the common stock market. Most of the funding was from the divestiture of The Chemours Company. The buyback was initially scheduled to take two years. In an accelerated share repurchase agreement dated August 2015, DuPont retired 35 million shares at an average unit price of US\$57.16 (Kumar, B.R., 2019).

Before the Dow-DuPont merger, DuPont conducted productivity and cost-saving initiatives involving worldwide structural actions across for business consolidations and staff function alignments. The restructuring plan was intended initially to save US\$730 million operational costs in 2016 and reached a reduction of US\$1 billion by the end of the year. Eventually, DuPont reported a pre-tax charge to earnings of US\$798 million in the fourth quarter of 2015, comprised of US\$656 million of severance and retirement benefits and US\$33 million of contract termination costs (DuPont, 2016).

4. Merger of DowDuPont

On 11th December 2015, Dow and DuPont announced their boards of directors entry into an Agreement and Plan of Merger, under which the companies would combine in an all-stock merger of equals strategic combination. The combined company would be called DowDuPont (DuPont, 2016; The Dow Chemical Company, 2016).

4.1 Major Milestones of the Merger

9th December 2015	Dow Merger Sub and DuPont Merger Sub were two Delaware corporations formed as wholly-owned subsidiaries of DowDuPont Inc., a company jointly owned by Dow and DuPont. Dow Merger and DuPont Merger Sub would be merged into Dow and DuPont, respectively and survive as a subsidiary of the resulting DowDuPont company. Eventually, Dow, DuPont and the respective subsidiaries would be under the umbrella of DowDuPont. The Agreement and Plan of Merger stated that existing Dow stockholders and DuPont stockholders would receive DowDuPont common stock (DuPont, 2016).
23rd May 2016	Dow and DuPont announced the senior leadership team of the DowDuPont (Dow Corporate, 2016). The board of directors consisted of 16 members,

	with eight directors from the former Dow's board and the other eight from the former DuPont's board.
20th July 2016	Dow stockholders and DuPont stockholders voted to agree on all the stockholder proposals which were necessary to complete the merger. Both companies also approved to pursue the separation of DowDuPont into agriculture business, speciality products business and materials science business (DuPont, 2016).
30th December 2016	Four million issued and outstanding shares of Dow's cumulative convertible perpetual preferred stock series A were converted into 96.8 million shares of Dow common stock (Kumar, B.R., 2019).
27th March 2017	The E.U. Commission announced the approval of the merger between Dow and DuPont subject to conditions (European Commission DG Competition, 2017).
3rd May 2017	The Ministry of Commerce of the People's Republic of China decided to conditionally approve the concentration of undertakings on the merger of Dow and DuPont (MOFCOM, 2017).
16th June 2017	It was reported the Dow-DuPont merger proposal won the U.S. anti-trust approval with conditional regulatory clearance (Diane Bartz, 2017).
4th August 2017	Dow and DuPont announced that both corporates had satisfied all the conditions to close the merger as required by the authorisation bodies, both sides' boards of directors completed the merger details, and all required regulatory approvals and clearances have been received. The announcement confirmed the merger of equals among the two giants would be in effect after the market closes on 31st August 2017 (Dow Corporate, 2017).
1st September 2017	The trading of DowDuPont stock (DWDP) began on the New York Stock Exchange (Alexander HT, 2017).

4.2 Strategic Integration

Dow and DuPont had lots of complementarities. Most of the companies' operations, products, services and innovations were in similar areas, but they were playing different roles along the value chain or in other applications of the chemical and agriculture industries. The DowDuPont were believed to be highly value-creating and intended to born a new emperor of the industry by integrating the highly complementary portfolios of the two giants.

"At the time before the merge, Dow AgroSciences's business was 80 per cent in crop protection and 20 per cent in seeds and traits. DuPont was almost the opposite that they were 80 per cent in seeds and traits, only 20 per cent in crop-related chemistry. It was a natural fit.", Howard Ungerleider, CFO of Dow, stated in a Podcast interview of McKinsey in 2021 (Ungerleider, H. and Warner, J., 2021)

The merger aimed to eliminate the competition between Dow and DuPont and realise cost synergies and sustainable growth. The Dow-DuPont merger came with a subsequent action of splitting DowDuPont into three separate companies within 18 months to create three new leaders in the industry (Alexander HT, 2017) through a tax-free spin-off. Instead of creating one and spin into three, the restructuring was undertaken as going from two companies (Dow and DuPont) to three divisions (Agriculture division – Corteva Agriscience, Material Science division – Dow, and Specialty Products division – DuPont), with a thin holding company structure on top, which was the DowDuPont (Ungerleider, H. and Warner, J., 2021; DowDuPont Inc., 2018). DowDuPont had only eight top management officers but no employees. After the restructuring, each division was operating independently with its own systematic processes, manpower, licenses and assets. Dow Material Science was the largest division with approximately US\$45 billion in terms of market sales (Kumar, B.R., 2019).

5 People Management Issues of the Dow-DuPont Merger

Culture matters in eventual merger and acquisition success, and people management substantially influences culture management in mergers and acquisitions (Marks, M.L. and Mirvis, P.H. 2011). Culture in an organisation encompasses the way things get done, which represents the shared values, responsibilities, roles, business practices, ideologies and, more and more importantly, innovations (Marks, M.L. and Mirvis, P.H. 2011; Villaluz, V. C., & Hechanova, M. R. M. 2019; Ahmetoglu, G., *et al.* 2018). There were people management issues in the new structure of Dow-DuPont and its three divisions which influenced the innovation performance and internal conflicts of the new giant.

5.1 Corporate Leadership and Decision on Research and Innovations

"We continued the historical DuPont value of investing in the future. In 2016, we launched nearly 1,600 new products, which contributed significantly to market sales. We would make the ongoing investment on research and development and product innovation to strengthen our position in the marketplace..." claimed in the Annual Report 2016 by Edward D. Breen, Chair of the Board and CEO of DuPont (DuPont, 2016).

Dow stated in its annual report 2016 that its strategy was to invest in a market-driven portfolio of advantaged and technology-enabled businesses that create value for our shareholders and customers (The Dow Chemical Company, 2016).

After the merger, the DowDuPont Annual Report 2017 described the three divisions under the new business structure are highly productive innovation engine, robust technology provider and world-class product and application innovator (DowDuPont Inc., 2018).

These statements reflect the legacy Dow, legacy DuPont, and DowDuPont all position themselves as sales leaders and innovation pioneers in the market. To share this value along the corporate hierarchy of the corporate, the organisational leader should plan, organise, and direct their subordinates to increase their motivation to achieve the organisation's shared value, position, and goal while creating a supportive environment (House, R. J. 1971). Innovation requires the presence of organisational systems, resources, and commitments to enhance innovation projects and decrease development costs. Senior management has to set up communication strategies, employee engagement climate, support system and structure, training and development, and evaluation and rewards to establish the innovation culture within the organisation (Villaluz, V. C., & Hechanova, M. R. M. 2019).

However, the management of DowDuPont was going the opposite way practically. At least, this claim is supported by numerous publicly available information. As part of the preparation for the merger, DuPont slashed the investment in research and development. Economists discussed that the move signalled the market and even the general public the death of research and development in the country (Matthews, C., 2016). It was reported in early Jan 2016 that there was memo dated 17th December 2015 laid out the company's plan to shut down the DuPont Central Research & Development, which was the most prestigious and accomplished research organisation in the chemistry world. DuPont Science & Technologies and DuPont Engineering were combined into a single unit called Science & Engineering. "As part of this integration, Central Research & Development will be substantially redesigned to become 'Science & Innovation,'" states the memo, attributed to DuPont Chief Science & Technology Officer Doug Muzyka. This structuring reform resulted in 1,700 layoffs from the legacy DuPont Central Research & Development. This was part of DuPont's program in cutting research and development costs and staffing by US\$700 million and 10% workforce world-wide, respectively, to prepare for the Dow-DuPont merger (Alex Tullo).

After the merger, DowDuPont continued to slash down its investment and resources for invention. Their cost synergies were achieved through a combination of workforce consolidation and savings from actions such as harmonising energy contracts at large sites, optimising warehouse and logistics

footprints, implementing materials and maintenance best practices, combining information technology service structures and leveraging existing research and development knowledge management systems (DowDuPont Inc., 2017). To satisfy the official authorisation's conditional approval of the merger, DowDuPont planned the trade of part of the pesticide business and a Newark, Del., research centre to Philadelphia-based FMC Corp. The Union Carbide research centre in South Charleston in West Virginia was also closed (Joseph N. DiStefano, 2017). It was recorded a statement of Edward D. Breen, CEO of DowDuPont, that the company has ended its most ambitious research and development projects because they are expensive, require years of work, and sometimes have poor prospects for investment returns (Jack Kaskey, 2018).

The E.U. Commission also questioned the negative impact of the merger on research and development. The case recorded 915 pages decision, with an extensive and comprehensive part on analysing the impact on innovations (European Commission DG Competition, 2017). In Amsterdam's European Competition and Consumer Day on 18th April 2016, an E.U. commissioner commented that corporates innovate and invent because they need to. The promotion of competition within the industry is one of the most effective ways to promote innovation and technology development (Margrethe Vestager, 2016). She queried that the merger of the two giants would reduce the competition and incentive on invention and development because corporate innovates the most straightforward defence against rivals' innovation to buy them up (Kerber, W. and Vezzoso, S., 2019).

The E.U. Commission assessed and commented on the merger of Dow and DuPont based on two theories of harm. Firstly, the merger would reduce the innovation competition because it would result in likely discontinuation, deferment or redirection of competing lines of research and development activities and the invention of early pipeline products. Secondly, the merger would cause a substantial reduction in the industry's competition in terms of innovation and technological advancement. Subsequently, it would result in the shutting down or scaling down of incentives and capabilities to achieve the same level of research and development as the original two competing parties in the market. The situation was so significant as Dow and DuPont were two of the rare global integrated corporates conducting research and developing in chemical and agriculture products and innovating in certain speciality aspects (Kerber, W. and Vezzoso, S., 2019; Wilson, M. 2019). Scholars consolidated that the Dow and DuPont were owning patents in 33 overlapping areas, which covered over 8,300 patents by the time of the merger (Wilson, M. 2019).

Moreover, original chief officers of research and development in Dow and DuPont were absent from the board of directors in the DowDuPont (DowDuPont Inc., 2017). The composition failed to

reinforce the new corporate's commitment to invention and technology innovation to the market and public and, more importantly, to the internal hierarchy's talents.

5.2 Proposed People Management Strategies to Enhance Employee Engagement in Research and Innovation

The new DowDuPont corporate was created with people from two competing companies. The merger of overlapping units and talents also caused conflict and misunderstanding. As a result, the level of difficulty for management to deliver the shared value and goals to all employees was high. Mitchell Lee Marks *et al.* (2011) illustrated a framework in people and culture management in a comprehensive manner for successful mergers and acquisitions. The framework pointed out four strategic areas to address – Leadership Actions, Day-to-day Actions of Individual Managers and Supervisors, Structures, Processes, Systems and Procedures, and Individual Employee Engagement.

Leadership Actions – To reinforce the positioning of DowDuPont and its three divisions as the innovators and technologic pioneers in the market, the board of directors and upper management have to be synchronised in delivering messages and advancing the research and development. They can invite and involve research and development representatives to join upper management meetings to let research talents understand their importance in corporate decisions. Senior officers can also give speeches in technology and innovation conferences to show the corporate's gesture of committing to innovations.

Day-to-day Actions of Individual Managers and Supervisors – Immediate managers and supervisors usually demonstrate a more decisive influence on individual employees' behaviours than upper management. Managers and supervisors also play the role of manipulating the corporate's value and culture to the subordinates. They are at the frontier of managing the fusion of employees from the two original companies from the other angle. They should be given tools to reward the integration of research and development projects of Dow and DuPont, review and report the probable collaboration among talents, and measure the sub-unit's performance in encouraging innovation development.

Structures, Process, Systems and Procedures – A merged corporate's organisational structures, reporting systems, business procedures, and resource allocation would demonstrate the management direction and foster employees in achieving the shared goals. After streamlining the research and development centre during the merger process, DowDuPont should establish a new setting to encourage innovation development. It can raise the position of research and development units in the corporate hierarchy to emphasise the corporate focus on providing novel products and technologies

to benefit the market. Apart from in-house talent and capability, DowDuPont can develop a collaboration program with external research institutions and universities to leverage external resources. There are public subsidised research and development programs for institute-corporate collaboration around the world. This can maintain a high level of innovation for DowDuPont's business, showing the market its commitment to supporting research and development. DowDuPont can also collaborate with research centres established by former researchers of Dow and DuPont, who left the corporate during the merger period.

Individual Employee Engagement – Individual employees' daily actions show how they receive the shared value and goals of the corporate on research and development. It should build up the culture and spirit that all employees, not only scientists and engineers, can participate in innovation development. DowDuPont can set up internal systems for employees to propose their own initiations in product development, not only as costly research but as an individual business. The corporate would allocate dedicated resources for employees to carry out these bottom-up technology development proposals. Successful projects would have the opportunity to be spin-off companies of DowDuPont which both the corporate and participating employees would own equity.

6. Conclusions

The merger of Dow and DuPont was impactful to the market, whether the focus is on stock value or science and innovation. Both Dow and DuPont were the most prominent players in the agricultural chemicals and materials science industries. Authorities were concerned that the loss in market competition would subsequently reduce the incentive of innovations. This is particularly critical in the agriculture industry that growers and farmers rely heavily on new crop protection products and seeds to tackle the climate change and biologically evolution of pests to maintain the global production of foods (Kerber, W. and Vezzoso, S., 2019; Wilson, M. 2019; Lofaro, A., Lewis, S. and Abecasis, P., 2017). Ironically, Dow and DuPont were "forced" to cut the research and development arms to fulfil the authorities' conditional approval of the merger (Wilson, M. 2019; European Commission DG Competition, 2017). The pressure from activist funds and investors, who focus on short term stock value rather than long term return on innovation, put another hand to push DowDuPont towards cutting research and development budgets (Ungerleider, H. And Warner, J., 2021; Chang, J., 2015). However, DowDuPont is in the science-based industry providing technology-based products and relying on innovation to grow the business. By applying the management framework of Mitchell Lee Marks et al. 2011, the article advises people management strategies to

reinforce DowDuPont's positioning as the industry's innovators and encourage and magnify the corporate's potential research and development capability.

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