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Innovation Center

DSM Innovation Center

x € million	2017	2016
Net sales	169	167
Organic sales growth (in %)	3	6
Adjusted EBITDA	9	1
Adjusted operating profit	(30)	(24)
Capital expenditure	43	32
Capital employed at 31 December	562	576
R&D expenditure	75	75
Workforce at 31 December (headcount)	685	619

The DSM Innovation Center has two functions. The first is to help develop new business, focusing on areas outside the current scope of the company's business groups. It identifies and invests in new and innovative growth options, initially through the DSM Business Incubator and then by developing and extracting value via the company's Emerging Business Areas (EBAs). The second function is accelerating the innovation power and speed of our core businesses. In this role, the Innovation Center supports all businesses through the Excellence in Innovation Program, DSM Venturing and the IP & Licensing department. In addition, the Chief Technology Officer, through the DSM Science & Technology Department, ensures the quality of the total R&D competence base and adds adjacent technologies for growth through DSM's Corporate Research Program.

The Innovation Center made good progress over the year, delivering on its Strategy 2018 goals to extract value from the Emerging Business Areas, the acceleration of large innovation projects, while simultaneously supporting the Nutrition and Materials business with their growth initiatives.

Full year 2017 sales in the main Emerging Business Area DSM Biomedical showed a strong underlying growth, largely offsetting the gradual discontinuation of a large contract during the year. DSM Advanced Solar delivered good growth in anti-reflective coatings and through the new backsheet activities for solar panels which were added in 2017 through the Sunshine acquisition.

Full year 2017 Adjusted EBITDA increase was largely driven by one-time positive effects from restructurings in DSM Advanced Solar, which had a positive EBITDA effect due to releases of liabilities, whereas the redundancy of certain assets related to these restructurings led to an impairment loss impacting the EBIT negatively.

Creating opportunities for future earnings growth through innovation

In 2017, innovation sales across DSM were 21%, above our aspiration of 20%. Through innovation, we are preparing for even more growth beyond 2018. We further focused our innovation program on a smaller number of bigger projects, providing interesting opportunities for 2019-2020 and onward. Examples include:

- The Clean Cow project for feed additives that reduce methane emissions in cattle
- The Green Ocean partnership with Evonik (now called Veramaris) for algae-based omega-3 for sustainable aquaculture
- The fermentative stevia sweetener platform
- Plant-based proteins for human nutrition
- Sustainable biological solutions for crop protection in agriculture
- Niaga[®] technology for fully recyclable carpets
- ForTii[®] high-performance plastics
- Dyneema[®] carbon composites

Enabling DSM's Bright Science

The ability to deliver innovative products and solutions is essential to DSM's business success and positive impact on society. The Innovation Center plays a central role in guiding, enabling and

accelerating innovation and R&D across the company.

R&D is instrumental to the realization of DSM's innovation strategy. Most of our expenditure in this area is directed toward business-focused programs that underpin our science-based, sustainable solutions.

R&D expenditure (including associated IP expenditure)

x € million	2017	2016
Nutrition	219	205
Materials	130	124
Innovation Center	75	75
Corporate Activities	20	22
Total	444	426
Total as % of net sales	5.1	5.4
Staff employed in R&D activities (total DSM)	1,920	2,055



Our innovation portfolio really reflects the choices we've made and defines the company we want to be. Today the overwhelming majority of our innovation pipeline is based on sustainability.

Rob van Leen, DSM Executive Committee

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Marcus Remmers joined DSM in April 2017 as Chief Technology Officer. A transformational leader and team-builder with a wide-ranging international background, Marcus has extensive experience in polymer and life sciences R&D, business operations, business development, strategy, and change management.

DSM has seven scientific competence areas. These are in analytical, biological, chemical, engineering, macromolecular, materials, and nutritional sciences. All seven are key to the company's continued success. The Science & Technology Department ensures that DSM has the right combination of skills, capabilities and partners to maintain and deliver on these competence areas.

Our internal science network consists of more than 1,900 people, including 25 professors and academic associates, who are spread across the globe. These employees co-operate extensively with external R&D institutions, both in academic collaborations and in broader public-private partnerships, such as the Bio-based Industries Consortium.

In line with this Open Innovation approach, DSM also regularly connects with its international Scientific Advisory Board. Acting under the supervision of the Chief Technology Officer, the Board provides valuable different perspectives and insights, challenges and reviews our scientific work and gives advice on trends and upcoming disruptive technologies. It comprises five internationally recognized experts in the fields of materials, biotechnology and nutrition from leading universities in the US and Europe.

Scientific Advisory Board

Member	Background
Chris Voigt (m)	Professor of Advanced Biotechnology in the Department of Biological Engineering
Wolfgang Marquardt (m)	Chairman of the Board of Forschungszentrum Jülich (Germany), Vice-President
Philip Calder (m)	Professor of Nutritional Immunology at the University of Southampton (UK). I
Frank Bates (m)	Regents Professor of Chemical Engineering and Materials Science at the Univ
Craig Hawker (m)	Director of the California Nanosystems Institute, Dow Materials Institute, Fac

DSM's new Materials Science Center in Sittard-Geleen (Netherlands) was established in 2017 to better service the current and future science needs of our Materials businesses. Joining forces across the Materials R&D organization will boost innovation and competitive positioning of businesses that draw on materials science.

April 2017 saw the grand opening of a new state-of-the-art biotechnology center at our site in Delft (Netherlands) to accelerate our biotechnology research and development capabilities for applications in food and nutrition, feed, fuel, pharma and bio-based materials. The facility has been named the Rosalind Franklin Biotechnology Center in honor of pioneering scientist Rosalind Franklin

(1920-1958), whose extraordinary work during a tragically short life and career significantly contributed to our understanding of the structure of DNA, effectively creating the basis for modern biotechnology. By honoring Rosalind Franklin, DSM pays tribute to all female heroes of science. The biotechnology center forms the heart of Biotech Campus Delft, an initiative of DSM Delft, Delft University of Technology, the City of Delft and the Province of South Holland to enhance the city's standing as a world-leading location for biotechnology development.

DSM Venturing

DSM Venturing invests in innovative companies in areas strategically relevant to DSM's current and future businesses. Our portfolio comprises 25 active investment companies. Each year, DSM Venturing reviews well over 500 new candidates.

In 2017, we entered into a number of new venturing investments and completed one significant financial exit. We also continued our involvement in the SunRISE TechBridge Challenge see [Innovation partnerships](#).

For more information on DSM Venturing, see the [company website](#).

IP & Licensing

IP & Licensing is a global group of qualified IP professionals who protect DSM innovations with patents and trademarks. This group also includes certified licensing professionals who offer expertise for intellectual property-intensive deals across all DSM businesses, including joint development agreements, technology acquisitions and sales, as well as in-, out- and cross-licensing deals.

In 2017, DSM filed 282 patents, somewhat below our long-term average. This reflects our changed business portfolio and a greater focus on fewer innovation projects with higher potential for business impact.

Emerging Business Areas

DSM's EBAs provide strong long-term growth platforms in promising end-markets that are based on the company's core competences. DSM has three EBAs:

- DSM Biomedical
- DSM Bio-based Products & Services
- DSM Advanced Solar

The EBAs delivered a total of €17 million in Adjusted EBITDA in 2017 (2016: €16 million).

DSM Biomedical

DSM Biomedical is a trusted partner to the global medical device industry, enhancing the quality and delivery of healthcare, and shaping the future of biomaterials and regenerative medical devices.

Every nine seconds, a patient somewhere in the world receives a medical device containing a DSM biomedical solution.

With global reach backed by a leading research and distribution network based in the US and the Netherlands, our product portfolio, technologies and expertise enable medical device companies to advance care across a wide range of medical specialties. These products address key global trends in medicine, from treating an aging global population to supporting more active lifestyles, while at the same time answering the need for safer, less invasive and more cost-effective procedures.

Through our investment in research and our state-of-the-art capabilities, we create, develop and produce innovative materials for our partners, as well as components, sub-assemblies and full medical devices. Our technology portfolio of high-quality advanced healing solutions includes biomedical polyurethanes and polyethylenes, resorbable polymers, bioceramics, collagens, extracellular matrices, device coatings, and cellular therapy platforms. These are used in applications in some of the world's most attractive high-growth markets, including orthopedics, soft tissue, cardiology, diabetes management, and general and reconstructive surgery.

Key trends shaping the global medical device industry in 2017 included:

- the shift toward value-based reimbursement with market success for products that have proven clinical and health economic outcomes;
- large-scale industry consolidation of medical device companies and attendant supply chain rationalization; and
- the quest for proven, largely de-risked products and concepts that can be developed into innovative, finished medical devices.

DSM Biomedical made good progress in 2017. Assisted by growth from product innovations in medical devices for selected therapeutic areas, DSM Biomedical outpaced its attainable market while capturing higher-value business.

DSM Bio-based Products & Services

As the world increasingly seeks alternatives to fossil resources and progresses toward a more sustainable, bio-renewable economy, significant commercial opportunities are presenting themselves in advanced biofuels and renewable chemical building blocks such as bio-based succinic acid.

DSM Bio-based Products & Services pioneers advances in biomass conversion and seeks to demonstrate the commercial viability of sustainable, renewable technologies in collaboration with strategic partners in the value chain. In particular, DSM has developed patented bioconversion technologies (yeast and enzymes) for various feedstocks and processes (including starch-based and cellulosic) in the biofuels industry. DSM's strategy is to deliver unique and differentiating technologies that enable biofuel plant operators to optimize their processes and maximize their yield and co-product creation. This helps make the production of biofuels even more sustainable.

Starch-based bio-ethanol

DSM developed a proprietary yeast which has demonstrated a significant ethanol yield increase. The product is under extensive market testing and evaluation. Full-scale commercial launch in the US ethanol market is planned in 2018.

Cellulosic bio-ethanol

The POET-DSM Advanced Biofuels joint venture operates a commercial-scale production facility for cellulosic bio-ethanol in Emmetsburg (Iowa, USA). This facility processes corn-crop residues through a bioconversion process that uses enzymatic hydrolysis followed by fermentation. DSM's biotechnology has demonstrated its unique proposition and performance. In the first quarter of 2017, significant improvements to the reliability of the process were made, including the redesign of the pre-treatment set-up, which resulted in improved performance. The delays in the start-up together with the pre-treatment re-design led to an impairment of €65 million in the third quarter of 2017. Since then, bio-ethanol production volumes have improved month on month, and POET-DSM is now shipping to customers on a weekly basis. As a result of the improved process reliability, POET-DSM is building an enzyme production plant at the Emmetsburg site that will be integrated into the process and forms a key component of the technology package.

Bio-succinic acid

The Reverdia joint venture between DSM and Roquette operates its Biosuccinium[®] plant in Cassano (Italy), where it produces high-quality bio-succinic acid. Reverdia had a successful operational year in 2017, which exceeded the original targets for its low-pH yeast fermentation technology. In April, Biosuccinium[®] S grade was approved as 100% natural by ECOCERT. In June, Bonderalia Italia launched a new natural and multifunctional emulsifier for use in the cosmetics industry based on Biosuccinium[®] S and organic pumpkin seed oil, while in July, VAUDE launched a range of high-end trekking footwear containing Biosuccinium[®]. Reverdia invested substantially in market and application development in 2017 and saw customers increase by 30% in the period from 2016-2017.

DSM Advanced Solar

Solar photovoltaic (PV) capacity is growing faster than any other fossil or renewable power source. DSM Advanced Solar aims to accelerate the uptake and effectiveness of solar energy by focusing on the development and commercialization of technologies and materials that increase the efficiency of solar modules. Increased efficiency reduces the cost of energy delivered.

Coatings are one area of expertise. Today more than 50 GW of solar modules have been produced using DSM coating technologies. In 2017, we expanded our anti-reflective coating market leadership position and launched a new product, DSM Anti-Soiling coating. Solar modules treated with this new coating soil less quickly, are easier to clean and maintain better power output.

We also developed a new Brighter Living Solution – innovative conductive backsheets for use with back-contact cells. Back-contact cell technology offers better efficiency and value for photovoltaics, and lowers the levelized cost of energy see [Explanation of some concepts and ratios](#). To complement our offering, we acquired and integrated Chinese-based company Suzhou Sunshine

New Materials Technology Co., Ltd. in 2017. Sunshine brings high-performance, innovative non-fluorinated backsheets with a proprietary technology base.

New solar energy projects in China, the US and India drove demand throughout the year. DSM's focus on being first to market for anti-reflective coating technology in India led to an especially strong position with leading manufacturers of solar PV modules. Furthermore, DSM is supporting the transition to improved and more sustainable backsheet technology with companies like Vikram Solar in India.

DSM Business Incubator

The DSM Business Incubator explores potential future business opportunities in areas with a close link to DSM's technologies and competence base. Platforms are created within the scope of securing society's food, health and energy requirements, in close collaboration with industry partners and existing and potential customers. DSM's Business Incubator feeds our new product pipeline with opportunities that address unmet customer needs.

In 2017, the DSM Business Incubator worked on three key ventures. In the Canola venture, we produce a high-quality plant protein for food & beverage applications from biomass derived from rapeseed, also known as canola.

A demonstration unit is now up and running, pre-marketing volumes are being developed for application development, and market interest in our CanolaPRO™ solution was very strong in 2017. In our energy storage project, meanwhile, a number of potential leads were explored, generating interest on the part of several battery/separator companies. The third venture is our partnership with Syngenta (see next section, 'Innovation partnerships').

Innovation partnerships

DSM's ongoing R&D partnership with Syngenta develops and commercializes biological solutions for agriculture. Our aim is to accelerate the delivery of a broad spectrum of products based on naturally occurring micro-organisms for pre- and post-harvest applications. The project has a long-term focus and high potential. Our cooperation made excellent progress in 2017 as we worked to accelerate the development of these solutions.

DSM has several other partnerships as well. For example, in 2017, we ran the SunRISE TechBridge II challenge together with Fraunhofer TechBridge and Greentown Labs, building on the success of the inaugural challenge in 2016. Once again it allowed us to evaluate opportunities for collaboration and investment that could accelerate innovation in our solar business. There were 56 applications and four early-stage companies were announced as winners in 2017.

Bright Minds Challenge

In 2017, DSM together with several partners from the public and private sector sparked a movement to help fast forward the 100% renewable energy revolution. The Bright Minds Challenge mobilized scientists, governments, businesses and civil society. We called on people from around the world to submit their projects and ideas for solar energy and energy storage. We received 55 submissions

from 22 countries across five continents. The three most promising solutions were awarded with expert support from DSM and partners to help them scale up as quickly as possible.

The first prize in the Bright Minds Challenge was won by Professor Ernesto Calvo (Argentina), who invented a new way of extracting lithium that is powered by solar energy and is quicker and cleaner

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