Henkel: A Digital Transformation Journey

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Competing With a Digitally Enabled Supply Chain

In his Amsterdam office, Dirk Holbach was having a one-to-one discussion with Wolfgang Weber to assess new technological opportunities for Henkel's digitally enabled supply chain. He had just received the latest ideas from their teams on 5G, blockchain and AI-enabled supply demand planning.

Dr. Dirk Holbach was the corporate senior vice president of supply chain at Henkel Laundry & Home Care and had been the initiator, mastermind and sponsor of the digital transformation journey since it began in 2011. Wolfgang Weber was the global head of digital supply chain transformation, reporting to Holbach.

Wolfgang Weber was summarizing the situation to Holbach:

> Since we started our industrial digitalization we have rapidly increased the number of devices connected in plants, with an exponential growth of data transmitted in real time. We will soon have a scalability challenge to guarantee the capacity, speed and security of our communications. I mean ultra-reliable, high-speed, low-latency, power-efficient and high-density wireless connectivity.

> 5G's strong focus is on machine-type communication and the Internet of Things, extending far beyond mobile broadband with ever-increasing data rates or proprietary networks as we currently use in our premises. In particular, 5G supports communication with unprecedented reliability and very low latencies, as well as massive IoT connectivity.

> It has the potential to provide (wireless) connectivity for a wide range of different use cases and applications in the industry thanks to the concept of 5G slicing, which allows the creation of virtual sub-networks tailored to serve multiple use cases. In the long-term, it may actually lead to convergence of the many different communication technologies that are in use today, thus significantly reducing the number of relevant industrial connectivity solutions.

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Just as there is an ongoing trend towards Time-Sensitive Networking (TSN) for established (wired) Industrial Ethernet solutions, 5G is likely to become the standard wireless technology of choice, as it may for the first time enable direct and seamless wireless communication from the field level to the cloud. Our facilities operate with a mix of wired and wireless technologies, but we are adopting new equipment to transform our business that will not work with wires.

Holbach listened carefully. He knew that the impact of this new technology on industrial processes and supply chain would be significant.

Weber continued:

On the other hand, beyond the production environment, our supply chain is getting more complex and I believe we could test the Blockchain technology to enable a more transparent, efficient and agile end-to-end digital supply chain. Blockchain can act as a common ledger for various parties involved in the supply chain. Using blockchain technology will allow faster and more accurate tracking of products and transportation details, permit the ownership of goods in transit to change hands throughout the supply chain lifecycle, and facilitate the use of 'smart contracts', which can enable more automation in the execution of financial transactions that are coupled with the physical flow of goods. Smart contracts in a supply chain can integrate commercial transactions and agreements automatically and transparently. They also reduce the need for intermediaries by enforcing the obligations of all parties in a contract without the added expense of an intermediary.

All this paves the way for the company's I4R journey to significantly improve the flexibility, versatility, usability and efficiency of future smart factories and supply chains. Connectivity, transparency and visibility are key components of Industry 4.0 and will support ongoing developments by providing powerful and pervasive connectivity among machines, people and objects.

Holbach was thinking of the complexity of ensuring that all supply chain players provide data for visibility and control. He could see how blockchain could help overcome those obstacles.

"But," replied Weber,

we should not forget the core engine of the supply chain management excellence: supply and demand planning. Supply chain planning tools and processes are radically changing with artificial intelligence. Over time, we have been enhancing our planning capabilities based on SAP and Oracle platforms together with other smart tools in demand sensing for predictive analytics. We have followed a hybrid approach, with some tools coming from advanced and small third party providers and others being developed internally.

New players in the market are approaching us with Integrated Demand Management solutions that are not just helping organizations forecast demand better but also helping them sense, analyze, plan and shape it to optimize sales & margin performance. Those companies look at planning very differently, and they take seasonality, promotional activities, media spent, economics and many other elements into consideration through AI. We need agility to handle different channels, customer and product variations while assessing risk and opportunities with the support of advanced collaboration, planning and execution tools.

Our digital enabled supply chain can create a game-changing value for Henkel by using innovative technologies beyond where we are today.

The Henkel Story

In 1876, Fritz Henkel and two partners founded the company Henkel & Cie in Aachen and marketed the first product, a universal detergent based on silicate. Contrary to all similar products, which at that time were sold loose, this heavy-duty detergent was marketed in handy packets (see **Exhibit 1**).

In the years that followed, this German family of entrepreneurs and thousands of their employees built Henkel into a global company organized into three business units: Laundry & Home Care, Adhesives Technologies and Beauty Care (see **Exhibit 2**).

By the time Holbach and Weber were speaking, Henkel's agenda reflected its commitment to sustainably continue Henkel's long-term success. Carsten Knobel, CEO of Henkel, explained:

As a first step, we have defined the aspiration for our company: to win the 20s through purposeful growth. This aspiration goes well beyond financials:

- We aim to outgrow our markets through superior customer and consumer value.

- We will differentiate ourselves through positive impact on society and the planet as leaders in sustainability.

- And we want to enable our people to grow with a sense of belonging.

<div align="right">Carsten Knobel, CEO</div>

Henkel's strategic framework (see **Exhibit 3**) embraced six focus areas to drive performance and deliver on their aspiration of purposeful growth, both short and long term.

The operating models and the digital supply chain strategy improved the gross profit margin of Laundry and Home Care and strengthened the Henkel brand's positioning in mature and emerging markets.

> Through advanced fourth industrial revolution (4IR) technologies and end-to-end supply chain connectivity we reduce processing costs and re-invest in innovations and marketing initiatives.
>
> <div align="right">Bruno Piacenza, Executive Vice President, Laundry and Home Care</div>

> Our digital supply chain is customer centric. Digital initiatives transform and impact all the jobs in the value chain: end-to-end planning and delivery, procurement, suppliers, manufacturing, engineering, safety, health, environment, customer service, sales. People get access to data that was hidden in legacy systems before and that unlocks significant incremental value.
>
> <div align="right">Dirk Holbach, Corporate Senior Vice President Supply Chain, Laundry & Home Care</div>

Henkel Laundry & Home Care's digital backbone was empowered by the 5th generation cloud computing (the so-called Henkel Data Foundation [see **Exhibit 4**]), a highly integrated data management, processing and analytics platform based on fully elastic cloud technologies. This platform processed millions of data assets from along the entire Henkel value chain, BI systems, IoT, consumer facing apps and external data. It had become the place to be for almost all data- and AI-driven use cases and business models at Henkel. It enabled such exemplary cases as:

1. Digitally integrated next generation end-to-end demand sensing

   Data Foundation enabled end-to-end real-time synchronous planning. Customer demands with big data such as point of sales, social media and economic indicators, which were identified and translated to create a real-time e2e supply plan, taking into account real-time machine data within the entire SC network.

2. Digital twin of sustainability on machine-granularity

   Real-time sustainability actions. Connected and benchmarked each of the >30 factories and technology in energy, water and waste. Every employee accessed real-time data and benchmarks and is empowered to reduce CO_2 footprint.

3. Digital e2e dispatching and tracking

   Right-time delivery to customers. Data Foundation predicted and communicated ETA deviations to customers based on real-time production output, warehouse throughput, real-time GPS signals, traffic and weather, closing the end-to-end synchronous loop.

4. Digitally enabled real time global overall equipment effectiveness (OEE) platform

   Access to data and insights at all levels revolutionized. Each operator on the shop floor had access to real-time efficiency and loss analysis of their own manufacturing line, as well as its benchmark against >250 lines around the globe to find improvement potential.

5. Seamlessly connected digitally-steered lights-out warehouse

   Data Foundation enabled touch and seamless supply. It operated a 200,000-pallet-warehouse in full automatic mode, including in-/outbound, as well as synchronization with manufacturing and OEE performance.

The transformation of Digital into a customer & consumer value creator was a strategic priority for the company, so Henkel implemented a range of targeted initiatives to further deepen relationships with customers and consumers worldwide, strengthen its leading brands and technologies, develop exciting innovations and services, and capture new sources of growth.

The Digital Transformation Program

While Weber shared his ideas for the future, Holbach mentally reviewed the history of the entire Henkel digital transformation journey since its inception and the lessons learned over the years. Overall it was a success story, but there had been roadblocks and surprises along the way.

Only very recently, the World Economic Forum had recognized Henkel as a frontrunner of the 4th industrial revolution[1]. In January 2020, Henkel became a member of the WEF's "Global Lighthouse Network" with other leaders of advanced manufacturers, ranked 1 out of 14 end-to-end lighthouses globally, and 1 out of 2 end-to-end lighthouses in the Fast Moving Consumer Goods industry on global level.

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[1] https://www.weforum.org/our-impact/advanced-manufacturing-factories-light-the-way-as-learning-beacons.

This was thanks to the systematic approach taken in recent years, a state-of-the-art Laundry & Home Care digital factory in Düsseldorf, Germany, and the efforts of many colleagues driving the digital transformation over almost a decade.

Building the Foundation – the First Digital Data Backbone

Back in 2011, the Laundry Supply Chain division of Henkel was pioneering the ISO 50.001 "Energy Management" certification process achieved in 2012 for all the 28 global production sites at that point in time. Thanks to the certification process and in line with the Henkel CEO's sustainability goals, the supply chain leadership team had the vision to start measuring and benchmarking its main energy consumption entities globally and in real time.

> Since we cannot improve what we don't measure, we decided to implementa project for real-time control of energy and water consumption.
>
> Dirk Holbach, Corporate Senior Vice President Supply Chain, Laundry & Home Care

The project was supposed to last 12 months, but stretched to two years. The initial idea was to build an open system, which meant providing information not only to the management team, but also to the workforce in the plants. The goal was to let teams use the tool to improve energy consumption efficiency by providing access to information such as energy consumption per meter and the main energy consumers (assets) in the factory.

This transparency in energy consumption allowed Henkel to identify patterns such as the energy consumption of each plant when not producing, plants with the highest energy consumption and in-depth analysis of the root cause of consumption. After identifying patterns, the team could take action.

This was the start of the digital data backbone. A scalable global platform was installed with all the factories and warehouses connected in real time. Eight years later, there were more than 3,500 sensors to measure sustainability data on individual process levels. (See **Exhibit 5**)

The final IT solution selected was based on Wonderware[2] technology, which was later acquired by Schneider Electric. Wonderware was chosen mainly because it had local teams of consolidators supporting the plants during implementation, aggregating the information centrally across plants and providing customized solutions. This implementation approach increased the speed of global deployment and eliminated the need for people to travel to the plants.

The network very quickly delivered tangible financial returns, in addition to sustainability benefits. Without realizing it, the team had created a significant digital asset, which it would leverage during the following years through manifold applications. The project work, as well as the ramp up, was steered by the global engineering team.

The lean manufacturing team created a tool internally called "best operating practices" (see **Exhibit 6**), which consisted of checklists explaining how to optimize energy consumption, water consumption and waste generation. This tool helped to leverage the newly acquired visibility of consumption data broken down on key assets in all relevant production processes.

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[2] Wonderware HMI (Human Machine Interface) software enables operational excellence across industries, providing deep operational insights as the basis of real-time performance management.

The Expansion of the Digital Backbone

> Aware of the value of the digital backbone, the team was gradually able to enhance the digital backbone functionality to product & process quality during 2013. After some years of experimentation with high-speed image-processing devices supervising the labeling process, the goal was set to meet 100% quality level of labelled detergent bottles for global volumes of more than 2 billion bottles manufactured per year. To achieve this, the decision was made in 2014 to roll the technology out globally, and at the same time connect devices and process capability data to the digital backbone. The technology was tested in high-speed production lines to check if it worked as expected. After a successful pilot validation, that technology was included in the digital backbone. Every product bottle is real-time checked whether it has the right label correctly positioned, whether that label is wrinkled, and so on. The technology helps fine-tune and adjust machine parameters to get the perfect quality result. (See **Exhibit 7**).
>
> Wolfgang Weber, Global Head of Digital Supply Chain Transformation

The number of devices was quickly increased to more than 70 in pursuit of a fast global rollout (within 12-18 months) to maximize business benefits. In addition, the vision was to control 100% of all products leaving the factories in terms of aesthetics, and drive continuous improvement based on large data sets. The second level of meter granularity was designed in 2016 and the number of connected devices climbed to more than 2000.

In addition to the labels, Henkel also determined the quality of a bottle's contents by measuring the single components. Ingredients were mixed in tanks holding up to eighty tons to check if the dose of each ingredient in each bottle was correct. A quality control technology, called a AquaSpec[3] analyzer, was used to inspect a sample extracted from the box and compare it with a perfect example product. MIRA was initially installed in two pilot factories (Düsseldorf and Lomazzo). At first, it seemed to be a promising innovation, but it turned out to be expensive and the process for getting the information from the sample took too long. Consequently, the pilot factories were not able to generate sufficient return on investment, and Henkel decided not to roll out the technology for its original purpose, but instead to use it to verify the quality of raw materials prior to production.

The digital backbone was helpful for trying out new technologies at early stages, evaluating results and making quick adoption decisions. The international engineering resources coordinated these types of projects. They searched for new applications in order to increase the OEE (Overall Equipment Effectiveness), which meant reducing the number of production lines while producing the same amount of products. As a result, they identified a more complex application, an online efficiency system, also based on Wonderware technology. The goal was to measure the OEE (see **Exhibit 8**) of Henkel's filling lines. The first pilot began in late 2015 in Lomazzo, Italy. After some initial hiccups, the system was working well by 2016 and the rollout to all filling lines in the European plants was completed in 2017, followed by Asia-Pacific, Latin America and the US in 2018, and Middle East Africa in 2019, reaching more than 250 fully equipped and connected lines by 2020.

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[3] The AquaSpec® analyzer is a high-performance spectrometers for rapid, non-destructive analysis of chemical and pharmaceutical samples, be they liquid or solid.

The Digital Supply Chain: Expanding the Digital Backbone Further

In 2016, Henkel reshaped its thoughts around digital in supply chain. The team defined five key technology areas it believed had significant business benefits for its concrete Fast Moving Consumer Goods (FMCG) business – the strategic frame for all upcoming activities:

1. Sensorics
2. Robotics
3. Analytics
4. Visualization
5. End-to-end application and data integration

Stefan Kozielski, plant manager at the Düsseldorf facility in Germany, reflected:

> We faced a rapid expansion of our pilots' scale-up trials, and rolled-out applications during the following years. However, the digital transformation was leveraging the legacy systems and not building an on-top extra platform.

In the meantime, total meters connected to the digital backbone had increased to more than 3,500, while the online OEE system was rolled out globally to more than 250 complex filling lines. The company added formula fingerprinting capabilities in 2016, leveraging machine-learning algorithms and real-time enzyme measuring in 2018. It also standardized its machine-to-machine language with suppliers to PackML, leading to the first fully connected filling lines supporting future self-optimizing systems.

By 2017, the company had carried out its first trials with drones and latest generation Automated Guided Vehicles (AGV's). While there was some doubt about the benefits of drones, AGVs were adopted by several sites and proved to be very efficient.

AGV usage was expected to improve with the introduction of 5G technology, allowing a centralized guidance algorithm instead of a separate AGV implementation approach. During a period of time, factory workers had to cope with a combination of manual and automated guided vehicles, so training and adaptation to the new technologies became a priority.

In 2018, the Holthausen plant moved further into Industry 4.0 by launching a pilot project in collaboration with the in-house Heidelberg 3D printing competence center. It allowed the plant to replace more than 20 complex and expensive spare parts with others produced by a 3D printer. Some of the parts were so expensive that the adoption of 3D printing technology delivered a savings of 200,000€. The 3D printing journey was just starting at Henkel.

> I use a Top 10 list of principles to manage the plant. The first one is communication and training. We must take away fear and engage people in the use of new technologies. Engagement is one of the major success factors in my plant.
>
> Stefan Kozielski, Plant Director Holthausen

Recognizing the increasing complexity and number of digital activities in the supply chain, a separate group for Digital Transformation was created in 2016. This group reported directly to the CSVP Supply Chain connected to the plant engineering teams, together with the first regional hubs (Spain and Singapore) working on data analytics. Other hubs were created in Amsterdam, Stamford (US) and Dubai (UAE).

In 2017, the company established a global network of on-site experts (SPOCS – single point of contact) following a bottom-up/top-down approach (i.e. good ideas were leveraged if they fit with the global frame of the technology areas). The SPOC was a combined role in the factory, eager to carry out the company's digital transformation. They coordinated digital projects in the factories and participated in a new monthly meeting called "Digital SPOCS," where digital initiatives were reviewed by the headquarters and factories. By 2020, there were more than 50 experts and the number was steadily growing.

In 2018, Henkel chose FourKites[4] as the single global provider for Track & Trace. They signed a short-term contract, since technology changed quickly and new solution providers regularly appeared on the market (See **Exhibit 9**).

The FourKites system used predictive ETA (Estimated time of arrival) to identify trucks' locations and, based on factors such as traffic and weather conditions, estimate possible delays so that customers could be proactively contacted by Henkel's operations teams to mitigate rejections and returns. FourKites worked with three different sources of information to connect with carriers: telematics, GPS and mobile. Since carriers were connected to the FourKites application, there were real-time status updates through FourKites system, which was integrated with Henkel's Transportation Management System (TMS[5]) and SAP platforms.

After full roll-out in the US during 2018, the track and trace implementation was being carried out in phases in Europe. By the end of 2019, The Netherlands, Belgium and Italy had almost been completed. The challenge for 2020 was to increase the coverage of FourKites to other EU countries and extend its adoption by carriers.

> It is fundamental to provide training to our internal logistics and customer service operations teams to not only use FourKites but also mainly to improve decisions and proactively engage to better serve customers in the delivery experience. Our next goal is to go further, provide the client with access to our track and trace system, but that is going to be another change management chapter for our organization and customers.
>
> Francisco García, Head of International Planning and Logistics

Pilot, Learn and Scale Up

Throughout Henkel's digital transformation journey, it had developed a unique "vertical/ horizontal/global" approach (**Exhibit 10**). It was vertical in the sense of testing concretely defined applications focusing on a defined area, with specific benefits (i.e. label quality control); horizontal in terms of adopting the applications to other areas and integrating continuously more of the data across the value chain; and global in terms of scaling up to multiple plants. A 2-3 step scale-up methodology was used:

1. Pilot in 1-3 sites (3-6 months)
2. Go/No-go decision based on a clear business case
3. Scale-up globally (12-18 months)

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[4] FourKites optimizes global supply chains for industry-leading brands. It combines powerful machine learning with the world's largest data network to provide real-time visibility and data-driven insights.

[5] A Transportation Management System (TMS) is a logistics platform that uses technology to help businesses plan, execute, and optimize the physical movement of goods, both incoming and outgoing, and making sure the shipment is compliant, proper documentation is available. This kind of system is often part of a larger supply chain management (SCM) system.

I think we succeeded with this methodology because it is a smart combination of a top-down and bottom-up approach, involving the key users and stakeholders early in the solution design process. That process is steered "application by application" through a focused and compact central team creating every day tangible user value. We had one global framework, one simple process leveraging our entire global organization.

<div align="right">Dirk Holbach, Corporate Senior Vice President Supply Chain, Laundry & Home Care</div>

Since not every initiative could be launched, the team employed a standardized "go/no-go" process to select one initiative at a time. First, a framework was defined from the top based on the technological areas being considered. Ideas were generated both centrally and decentrally and leveraged via the SPOC network. A small central "committee" was formed involving the global stakeholders in the supply chain, which met regularly to review bottom-up initiatives.

This systematic approach identified the optimal initiatives for development during the company's digital transformation journey. Corporate governance defined the direction, aligning all actions with the business lines, establishing the goals of each initiative and tracking results. A business case was built for each application. Business cases needed at least one of two elements: a specific ROI and a specific target that was easy to track (time reduction, materials, etc.) or long-term value being of strategic interest.

Some initiatives fell into the "no-go" category. For instance, an in-line "chemical fingerprinting" project became a no-go after the extended pilot project; 3D Printing (in the early stages) and the use of Google glasses were also rejected. Google glasses implementation for maintenance purposes was difficult, since people did not like to wear them. The team found different, easier and smarter solutions for maintenance. It was important to learn from the no-go projects. At the same time, it was thought that future technological developments might allow Henkel to implement past no-go concepts, and thus "parked" ideas were revisited regularly. One example was 3D-printing, which was eventually implemented successfully.

Big Data and Cloud-based Analytics Platforms

In 2017, Henkel started to unify all its information in a data lake, called the "Henkel Data Foundation." (See **Exhibit 11**).

Initially run on lab server based analytics platform Cloudera-Knime[6], Henkel decided to move to a Microsoft Azure cloud in 2019 environment and the company's single source of truth (SSOT) data platform. The central information technology group piloted different technologies with different companies before selecting Azure cloud. All system applications, such as SAP, Oracle TMS and all data coming from factory sensors, were connected to the data lake.

By mid-2017, leveraging Tableau[7] and PowerBI[8], Henkel built team capabilities and developed reports in the area of supply and demand planning, as well as logistics (see **Exhibit 12**). This platform grew between 2018 and 2020, to more than 2,500 users and 20,000 single report access requests by more than 450 different users per day on a global scale.

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[6] KNIME® Analytics Platform is an open solution for data-driven innovation, helping clients to discover the potential hidden in their data, mine for fresh insights, or predict new futures. It is fast to deploy, easy to scale and intuitive to learn.

[7] Tableau is a powerful and fastest growing data visualization tool used in the Business Intelligence Industry. It helps in simplifying raw data into the very easily understandable format.

[8] Microsoft Power BI is a business intelligence platform that provides nontechnical business users with tools for aggregating, analysing, visualizing and sharing data.

With one standard data lake and one analytics platform, Wolfgang Weber's global digital team started to perform data analytics in different domains. The first step was *descriptive* analytics, including diagnostics and root cause analysis. The next phase was to move into *predictive* analytics with applications to optimize service levels, inventory levels and demand forecasting. Since Henkel had been in a mature market for years, it had reached a limit in terms of forecasting accuracy with current technologies. Henkel therefore decided to launch a pilot project with the goal of improving forecasting accuracy by leveraging both big data and real-time information on one hand, and machine learning algorithms on the other hand.

> After deep research in 2017, we selected E2Open[9] supply chain software for our demand sensing. The tool picks our forecast, retailers POS, inventories, distribution center inventories and economic indicators and gives as an output and enriched forecast. The next 14-day forecast at SKU level is very good, short-term predictions are very accurate. It is a machine learning (autoML) forecasting engine tool with two years of data history considering seasonal patterns, cyclicity and external market data.
>
> Tarun Rana, International Digital Transformation Lead

Henkel's consumer goods businesses carried out a 3-month pilot project with the new technology in its Spanish business, starting in September 2018 and going live in January 2019. In 2019, they scaled up this solution in key markets in Europe and North America, achieving a forecast improvement over 20% at SKU level. The company continues the global rollout of this demand sensing technology in 2020, with the goal of decreasing working capital by almost 10%.

In 2019, the Düsseldorf plant wanted to launch a pilot project centered on predictive maintenance. The Global Digital Team contacted a Dutch start-up with a predictive maintenance tool recording data traffic between the engines and the PLCs behind them. Together with the Düsseldorf engineering team, they trained the machine-learning tool for three months and then switched into a monitoring mode to measure results. The tool could anticipate the time an engine would break with an accuracy of more than 91%. Thus, predictive maintenance contributed to improving the factory's OEE. While the global digital team supported the design, validation and implementation of the initiative, the initiative itself was a bottom-up proposal from the plant.

> For the first time in 2019, we installed learning algorithms that allow us to go beyond "visualization" and "diagnose": we "predict" future demands and we "prescribe" users actions such as delivery pattern optimization.
>
> Tarun Rana, International Digital Transformation Lead

In parallel with the predictive analytics pilots, Henkel also developed *prescriptive* analytics in several key areas of supply chain management and planning. Henkel began using big data prescriptive analytics for negotiation strategies with key customers (channel partners and retailers) around new promotions, new product launches, joint cost reduction programs, joint logistics efficiency initiatives, and the design of integrated distribution networks with customers. Prescriptive analytics insights emerge from a tool called "cost to serve," which was a six-month internal development at Henkel. The tool went live in 2019 for 17 countries and was used by customer operations and logistics teams in the regions.

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[9] E2open is a business-to-business provider of cloud-based, on-demand software for supply chain.

Amazon is not a traditional retailer; they are a new player in laundry detergent, and they don't want to order Henkel in full pallets. However, they order very frequently during the week at very low quantities. Logistics costs are tremendous to handle due to low pallet loads, mostly LTL, with multi-drop shipments from multi-distribution centers. Right now, we are working together with Amazon's supply chain team using our machine learning algorithms to negotiate an efficient joint distribution network, fulfillment center locations, logistics conditions, product price and discounts holistically.

<div align="right">Tarun Rana, International Digital Transformation Lead</div>

Preparing the Workforce for the Digital Transformation

The Connected Workforce

Initially, the digital backbone was used by a small number of people in the factories, such as plant managers, some controllers and cluster managers. However, it was quickly extended to a broader workforce, including shift leaders and sales managers, in order to oversee the efficiency of the filling lines.

New daily operating procedures on the shop floor started with a 20-minute morning meeting, which included the production manager, production engineer, head electrician, an internal logistics specialist and four sales managers. During this meeting, the biggest production line issues from the last three shifts, gathered in the digital backbone, were checked. Lean manufacturing and continuous process quality improvement mechanisms were implemented thanks to data coming from the digital backbone. Managers looked at the OEE number for one of the production lines and then probed deeper into the different machines in the production line to identify the biggest problem. After picking up the biggest production bottleneck of the last 24 hours, they drilled down into a root cause analysis, prioritization of causes and resolution.

Today, more than 250 complex filling lines are connected with machine data so that users can visualize, analyze, track and benchmark data in real time from any place in the world. In 2020, Henkel has launched two initiatives: "Digital gyms," (see **Exhibit 13**) focused on upskilling the frontline workers, and a fully integrated "Connected worker app platform" that piloted in 2020 and was rolled out 2021.

Digital Talent

The expansion of the digital backbone also represented a challenge for HR, as the company's shift to digitalization demanded entirely new skills. A combination of upskilling of current profiles in Henkel and bringing in new profiles from outside was required. Initially, the HR department focused on the engineering team in order to create a global digital group with the required specialization for its new tasks. The department began training some engineers within the company who had an affinity for IT-related topics and technologies. At the same time, it started to look for new profiles from outside the firm, which triggered a key problem.

> We were used to looking at engineer CVs that showed a linear development, meaning school, university, a master's degree and preferably a PhD in production technology, automation or robotics. Now, we focus on identifying IT and digital know-how instead of chemical or process or mechanical engineering.
>
> Armin Heck, Head of HR Business Unit Laundry and Home Care

> Now we look for people with knowledge in three pillars: supply chain, data analytics and visualization.
>
> Jorden Rasquin, International Planning and Logistics

At the same time, the company started creating new digital profiles itself. At the Düsseldorf plant in Germany, the company began developing "digital engineers;" trained in chemical engineering but also IT experts. Universities were still generating "silo" engineers, specialized in either chemical engineering or IT; they did not prepare the types of engineers needed by Henkel, who got around this by hiring silo engineers and giving them specific training to become digital engineers with the skills to run specific pilots in digitalization, automation and robotics.

Digital Upskilling

In 2017, Henkel started building up systematic online tutorials with a concrete focus on digital backbone applications and analytics for employees. These developed into an extensive library of online training sessions, which became the origin of the digital upskilling initiative. In March 2019, Henkel launched the global digital upskilling initiative for its 53,000 employees worldwide.

After performing anonymous employee online self-assessments, Henkel evaluated digital skills on general knowledge in a playful way, as well as expert levels, targeted to specific job roles for both management and frontline competencies. The results helped Henkel understand how digitally savvy employees were and what kind of tailored training recommendations were required.

Together with the Innovation Hub, Henkel created maize.PLUS[10], an innovative online learning experience designed to help professionals develop an innovation-driven mindset. The personalized assessment and learning embraced new technologies, consumer trends, new ways of working, and other relevant business topics.

For the experts, Henkel teamed up with Accenture and developed a digital capability framework for each "job family" (e.g. Marketing, Sales, IT or HR), which would serve as a future-oriented industry standard.

The specific training sessions on digital skills and knowledge were offered on a new learning platform launched to support all employees on their digital learning journey. This was developed together with Cornerstone[11], a leader in cloud-based Talent Management software. Employees benefitted from an intuitive platform, which offered engaging learning experiences and personalized content. It encouraged constant upskilling and learning on-demand, while responding to the users' individual needs.

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[10] Maize.PLUS is an e-learning platform dedicated to teaching digital transformation to over 50,000 employees from companies all over the world.

[11] Cornerstone OnDemand, Inc. is a cloud-based learning, talent management and talent experience software provider.

In this transformation process, our people are key. We want to ensure that they have the digital skills and knowledge that is needed – now and in the future. Driving such a change is a challenge, as we have a highly diverse global team of over 50,000 individuals with many different backgrounds and job profiles. This change will not happen overnight but is a journey that will last three to five years.

<div align="right">Sylvie Nicol, Corporate Senior Vice President Global Human Resources</div>

As part of a 2020 plan, Henkel aims to go further and provide all operators with access to the different learning tools.

Vision 2020+

Dirk Holbach was reviewing the future vision of the digital supply chain transformation journey. Definitively, this journey should contribute to achieving mid-term business and supply chain goals: reducing manufacturing and distribution costs by a double-digit MEUR p.a., reducing inventory by more than 20%, improving customer satisfaction via increased and differentiated service levels as well as on-time delivery, and improving throughput time and line efficiency by up to 30%.

> My organization had built a very good digital foundation but I wonder how to accelerate the digital transformation even further. I believe we can leverage the network of the 4IR lighthouses and therefore adopt faster a digital enabled supply chain. Change management is key, especially the 'human factor' which is usually the element that defines speed.

<div align="right">Dirk Holbach, Corporate Senior Vice President Supply Chain, Laundry & Home Care</div>

The business unit's plants now had access to more information, and plants were moving towards empowering employees so they could make decisions faster based on available data. In other words, the company was moving decision power to where the information was, for instance, onto employees' laptops and mobile devices.

Thinking ahead, Holbach realized that the company had to focus on attracting digital talent, especially younger generations who were keen on joining highly digital businesses rather than big corporates. In order to change that perception, Henkel had to communicate proactively and share its digital projects with universities and the digital community.

He believed that the company could only achieve supply chain competitiveness with digital innovation from production to end-to-end supply chain. Innovation starts with people who can make digital transformation and technology adoption a successful process. Investments in training the entire workforce are necessary to ensure new capabilities of the user. A connected workforce can only happen when new applications are user centric developed.After a few seconds of silence, Weber asked Holbach again:

> Dirk, what are your thoughts around 5G, blockchain and AI-enabled supply demand planning solutions? In those domains, we have received proposals from innovative startups and some other more mature companies willing to work with us. We should determine priorities of investment and what type of partners we should work with in these domains.

Holbach was not just thinking of these opportunities, but also of everything they might be leaving behind along the way. He did not want to miss opportunities in the digital transformation journey but at the same time, he wanted to ensure digital adoption was increasing in speed and effectiveness.

We enjoy a high degree of automation and have invested heavily in robotics during previous years however, I believes there is still room for improvement towards touchless factories. In spite of automation people will be always required in factories but with a more high value contribution. Actually, the recent COVID-19 crisis enabled the development of new digital automation solutions to control social distancing inside factories. He was convinced that more automation opportunities in material handling and production environments could be developed.

Another priority I have is the expansion of the end-to-end modeling of the supply chain, in other words developing a digital twin of their supply chain. So far we have built so many data models but now we aim to improve such a real time representation of our supply chain in two aspects: data density and frequency. Bottom line a digital twin of the end-to-end supply chain will enhance faster and better decisions which are required more than ever in the post-COVID scenario.

Concisely, the adoption of new technologies is critical to move forward our digital transformation journey but I wonder what I can do with new technologies if I am not successful in the change management of my organization and having my entire workforce prepared. I am afraid I cannot overload my organization with too many changes at the same time; there is a risk something gets broken down. I strongly believe I have to be very selective in my decisions with a limited number of initiatives per year. It is key how we explain, deploy and digest.

Exhibit 1
Henkel's First Branded Product, the Bleaching Soda
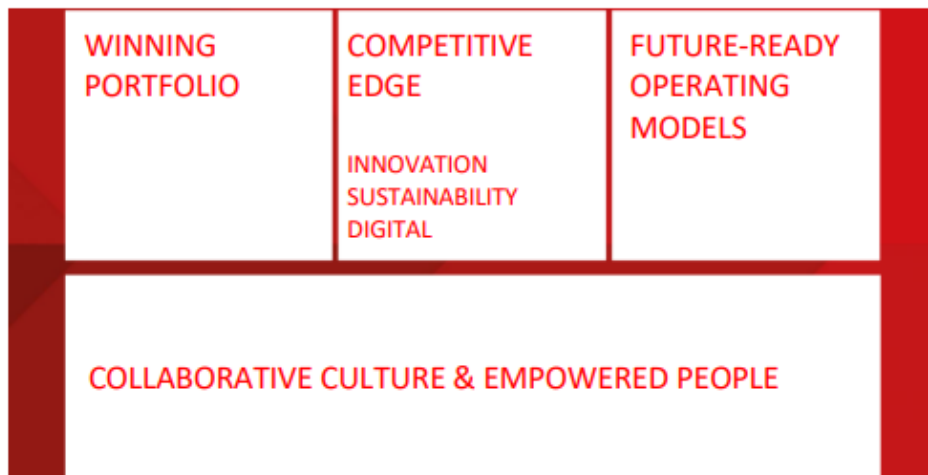

Source: Henkel. (n.d.). *History*. Home. https://www.henkel.com/company/milestones-and-achievements/history.

Exhibit 2
Henkel's Current Product Portfolio

Source: Stock Picks, Stock Market Investing | Seeking Alpha. https://seekingalpha.com/article/4187919-henkel-conservatively-financed-consumer-company-adhesives-business-attached.
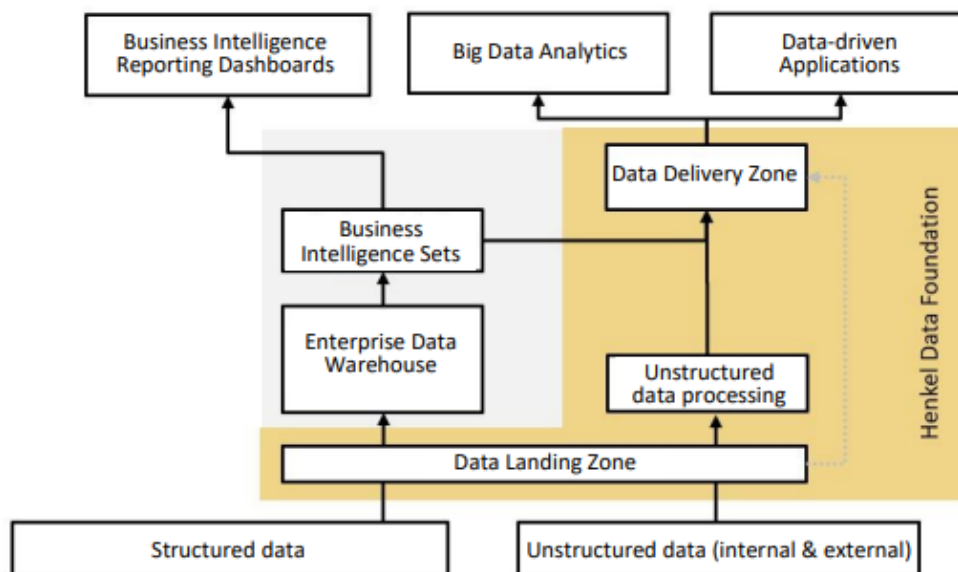
Exhibit 3
Henkel's Strategic Framework

WINNING PORTFOLIO	COMPETITIVE EDGE	FUTURE-READY OPERATING MODELS
	INNOVATION SUSTAINABILITY DIGITAL	
COLLABORATIVE CULTURE & EMPOWERED PEOPLE		

Source: Henkel. (n.d.). *Strategic framework*. Home. https://www.henkel.com/company/strategy.
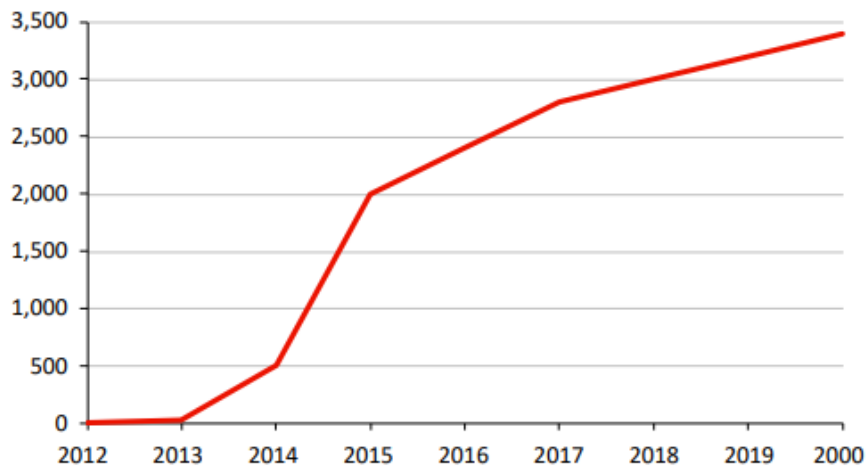
Exhibit 4
IT Infrastructure

Source: Document provided by the company.

Exhibit 5
Evolution of the Number of Sustainability Meters

Source: Document provided by the company.

Exhibit 6
Best Operating Practices – Sustainability Example

ENERGY				5%			? ←
#	Scope	Description	Status	ABC	Due Date	One Pager	Comment
1	Production	Is the pressure in compressed air supply system reduced to the minimum limit?	No	B			modified
2	General	Are the motion detectors installed for switch of illumination ON & OFF in the areas where personnel is present rarely?	In Progress				
3	General	Are the LED lamps installed for internal and external illumination?	Yes				
4	General	Are all electric motors over 10 kW which can be used with variable load equipped with frequency converters?	In Progress				
5	General	Are the pumps for circulation of liquid materials designed according to needed capacity?	In Progress				modified
6	General	Are all installed pumps have high efficiency (not less than 54%)?	In Progress				
7	General	Are thermal pumps used for water heating?	Yes				
8	General	Are inverters installed where it is possible?	No				
9	General	Are roof areas with translucent plates	Yes				modified
10	General	Are frequent checks of leakages in compressed air piping performed?	In Progress				modified

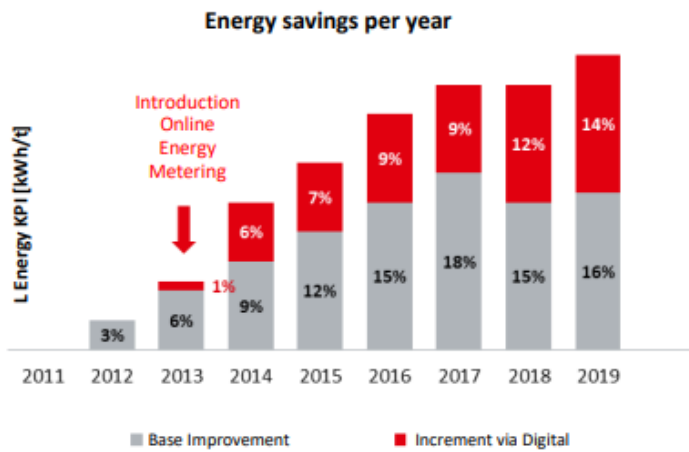Source: Document provided by the company.

Exhibit 7

Multimedia content

https://youtu.be/8z15EledMkQ

Source: YouTube, 2020. Intravis Henkel. YouTube.com. Accessed May 2020.

Source: Document provided by the company.
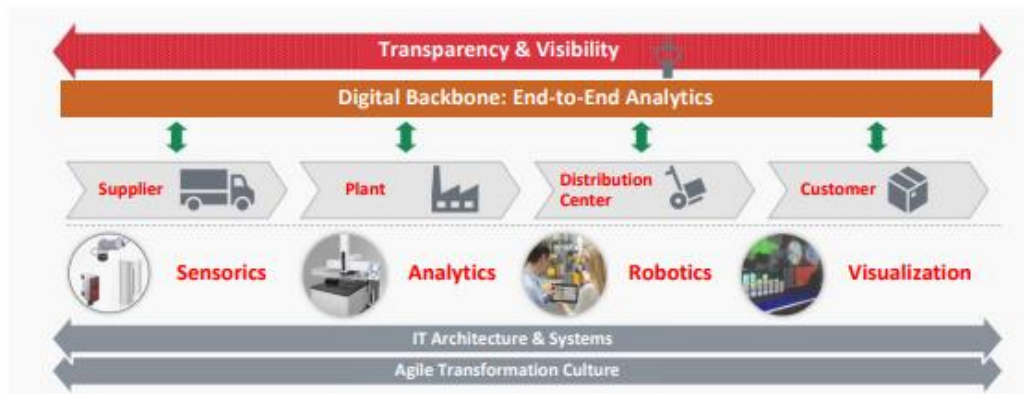
Exhibit 8
OEE Improvement in Terms of Energy Savings

Energy savings per year

Source: Document provided by the company.

Exhibit 9
Real-Time Track & Trace of Customer Shipments

Plants · DC · Customer

Source: Document provided by the company.

Exhibit 10
Horizontal + Vertical Approach

Transparency & Visibility

Digital Backbone: End-to-End Analytics

Supplier · Plant · Distribution Center · Customer

Sensorics · **Analytics** · **Robotics** · **Visualization**

IT Architecture & Systems

Agile Transformation Culture

Source: Document provided by the company.

Exhibit 11
Henkel Data Foundation Structure
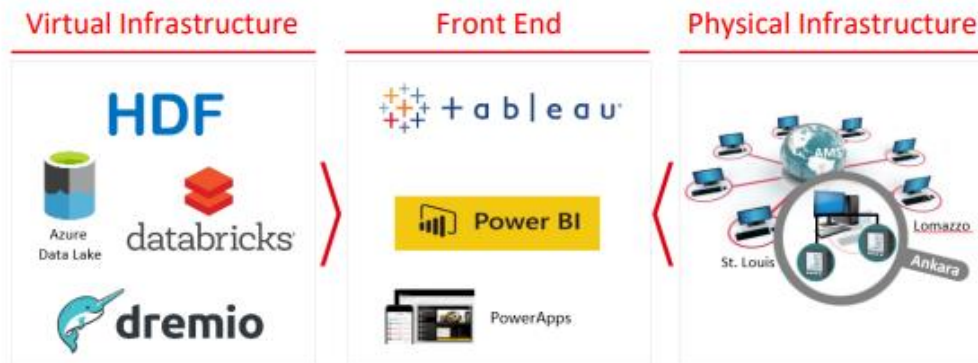
Source: Document provided by the company.

Exhibit 12
Line Efficiency Report Example

Source: Document provided by the company.

Exhibit 13
DigiGym Area Setup (Stationary Example)

Source: Document provided by the company.