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Digital Transformation Case Study: Novozymes

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“We could have chosen external consultants to drive our digital evolution journey, but they wouldn’t know how biochemists think. We needed our people to drive this because they understand the intricacies of our organization.”

– Lone Dybdal Nilsson
Vice President,
Agricultural & Industrial Biosolutions

Executive Summary

Digital transformation has the power to disrupt traditional ways of working and unlock new capabilities and opportunities in practically any industry sector. In this case study, we examine the digital transformation journey of Novozymes' research/product development flows in one of their R&D organizations.

Novozymes is the global market leader in biological solutions, producing a wide range of industrial enzymes and microorganisms. Solutions span a range of applications areas from improving the filtration and flavor of beer to reducing the costs of drug production.

Research and development (R&D) have been key enablers to Novozymes' success. Novozymes has two "layers" of R&D. The first layer—classical R&D—focuses on discovery and generation of biological diversity within enzymes and microorganisms. The second layer—application research—comprises industry-specific R&D teams working closely with Novozymes' customers to develop and deliver commercially viable biotech solutions.

This case study focuses on the digital transformation journey of Novozymes' Application Research (AR) organization within their Agriculture & Industrial Biosolutions (AIB) business unit.

This case study highlights several factors, many of which are still ongoing, that have contributed to Novozymes' digital transformation successes thus far:

- **Leadership-driven change management:** Novozymes empowered its managers and directors to institute change management initiatives that excited and encouraged employees to develop supplementary digital skills.
- **Aligning change management efforts to match the organizational culture:** AIB AR had to create a thoughtful, intentional approach to establish and scale digital adoption, one that would be effective in a culture designed around organizational autonomy.
- **Investment in culture/skills:** To be successful in their digital evolution, Novozymes AIB AR decided to invest in upskilling the existing team with digital skills. Their goal to augment researchers' biotechnology skills with digital skills, rather than replace the existing biotechnology talent with digital talent, is creating a workforce prepared for a digital future.

- This investment in people demonstrates that existing workforces can augment their core skills with digital capabilities.
- Investment in digital infrastructure: At Novozymes, prioritizing the digital transformation in data infrastructure tools improves the effectiveness of research, increases efficiency, and opens new innovation opportunities. It helps create new ways of working with customers, including sharing data with collaborators to arrive at new breakthrough solutions.

Acknowledgments: RTI greatly appreciates the time and insights provided by Novozymes R&D digitalization leadership. Many thanks to Mads Torry Smith, Lone Dybdal Nilsson, Søren Stenz Egestad, and Robert Osborne.

Context for the Reader

This case study is one of a series of case studies IRI is developing to examine successful digital transformation within legacy companies. To evaluate each digital transformation, RTI Innovation Advisors developed a set of perspectives, or “lenses,” to explore different aspects of the case study company in a systematic and comprehensive fashion. In our series of case studies we apply these lenses to understand how each company’s digital transformation manifested itself and how the company has changed as a result. Each case study is documented in the context of the following digital transformation lenses (Figure 1):

- **Strategy** - the corporate, product, and digital strategies and how they inform the business and how or if corporate vision and strategy have changed as an intentional part of the digital transformation
- **Structures** (organizational structures and hierarchies) - how structures, teams, and leadership have influenced the digital transformation work and how the purpose, design, governance, and activities of the organization and teams have evolved as part of the digital transformation
- **Resources** (people, time, funding, etc.) - how resources and their allocations are influenced by digital transformation initiatives and how these have changed digital investments, talent and expertise, and capabilities
- **Culture and Change Management** - how existing beliefs and norms influenced digital transformation and how culture, communication,

collaboration, incentives, and training changed in the face of digital transformation

- **Technology and Data** - how information technology, digital systems, and data environments are shaped and evolved as a result of digital transformation. As part of the digital transformation, what changes to technology infrastructure, systems integrations, data management (access, quality, etc.), capabilities, and new applications have occurred?
- **Opportunities and Offerings** - how existing business opportunities and business models influence digital transformation and how, in turn, business opportunities are changed or are introduced as digital transformation evolves. Customer-centricity is often a key aspect of new digital efforts and offerings and is considered in detail.

If digital transformation explores or affects some or all of these evaluative lenses, we include the learning from those changes in our analysis.

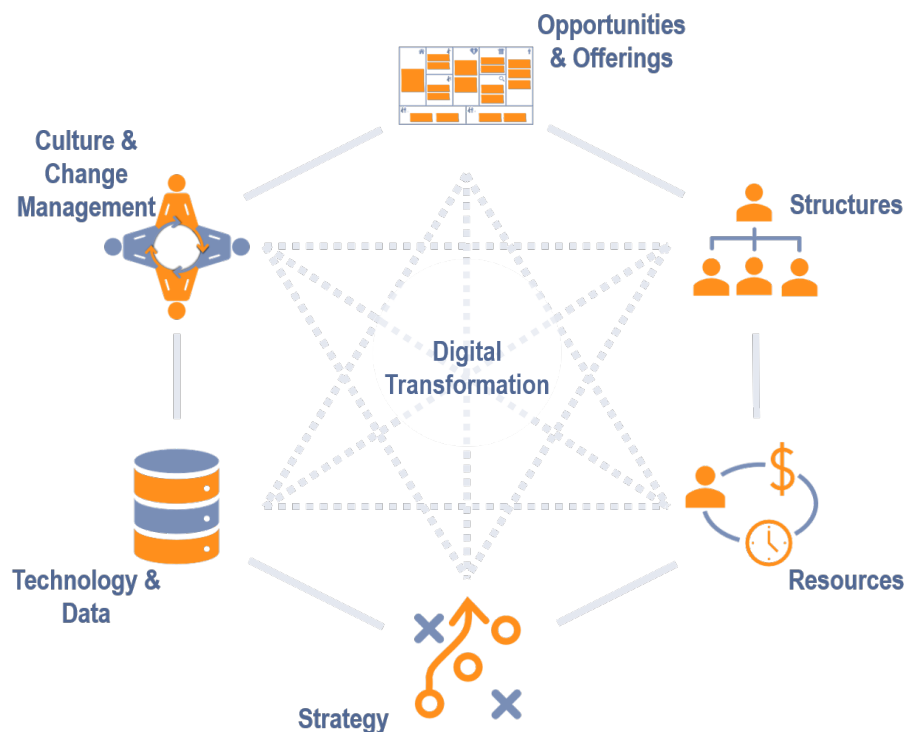


Figure 1 – Six Lenses of Digital Transformation

Each case study follows a basic organizational transformation construct, examining the following:

- **Impetus** - Change drivers that led a company to contemplate and pursue digital transformation
- **Preparation** - The specific initial steps taken to set the stage for and embark on the digital transformation
- **Action** - The kinds of actions taken across the key aspects or lenses as the company's digital transformation progressed
- **Maintenance** - Lessons learned and continuing actions to sustain the transformation

Company History and Digital Opportunity

Novozymes—The Company and Its History

Novozymes was founded in 2000 as a spinout from pharmaceutical company Novo Nordisk; however, Novozymes' roots date back to the 1920s. Today, Novozymes is a global leader in biological solutions, producing a wide range of industrial enzymes and microorganisms. Biosolutions span a range of application areas from improving the performance and sustainability of detergents to maximizing yields of industrial-scale grain processing. Headquartered in Bagsvaerd, Denmark, Novozymes has over 6,000 employees, operates in more than 30 countries, and serves customers in over 40 industries. The company's business consists of two segments: Agriculture & Industrial Biosolutions (AIB) and Consumer Biosolutions. In 2020, Novozymes posted sales of DKK 14 billion (USD 2.2 billion).

The Novozymes case study differs from others in the IRI Digital Transformation series in that we focus on the digital journey within a specific group in the company: the Application Research (AR) group within the AIB segment.

The Impetus for Digital Transformation

AIB's digitalization journey began in response to seeing competitors, mainly small biotech startups, leverage data to enhance operations.

The digital transformation journey began in January 2018 in the Biorefining and Feed (B&F) group, the predecessor to AIB AR. The journey began with an interdepartmental team spun out to drive automation and digital data

management for a new research effort within the bioenergy yeast area. Leadership within B&F recognized an opportunity to generate higher-throughput workflows in application research and to better simulate customer performance. Around the same time, a host of biotech startup companies operating in the same space were leveraging data in new ways, giving them a competitive advantage. In response, B&F invested in automation to increase the speed of learning loops and ultimately their own innovation. Through this process they realized a need for proper data infrastructure to support their ambitions.

In August 2019, a dedicated digitalization research team, DARE, was created within B&F. This team's defined ambition was to "leverage advanced analytics to enable data-driven business guidance, and to improve R&D innovation flows across the entire B&F organization." When B&F later merged with another unit to form AIB AR in October 2020, the digital transformation team was expanded.

What prompted AIB's digital transformation?

- An enzyme market crowded with new products and services, increasing market complexity and enhancing customer sophistication.
- A new appreciation for market data as a business asset.
- Democratization of synthetic biology tools led to explosion in access to diversity for both enzymes and microorganisms.
- A recognition that to stay ahead of competitors, biotechnology solutions require digital tools to enhance customer engagement.
- A belief that continued advancements in artificial intelligence and machine learning will expand opportunities in data mining and uncover new application insights.
- A realization that data capture is time consuming, taking away time that could otherwise be spent analyzing trends and generating insights.

The Preparation for Digital Transformation

The buildout of a robust data infrastructure helped the AIB AR team launch its digitalization journey.

DARE’s initial digital efforts were enabled by company-wide digital investments. These investments created a foundational data infrastructure and tools that the DARE team adopted and enabled. For example, Novozymes began to democratize data in 2017 with an ecosystem of tools centered around a central data repository, known internally as the Data Lake. The Data Lake was a foundational component to DARE’s digital journey and helped facilitate the easy ingestion of data from existing R&D systems, lab instruments, and analytics tools, such as Python (a programming language), JMP (a statistical software package), and Tableau (an interactive data visualization software package) (Figure 2). The Data Lake and subsequent investment in tools, including Riffyn Nexus (a cloud-based workflow and data capture tool), enabled DARE to demonstrate benefits early on for the yeast platform team by transforming data capture and analysis capabilities.

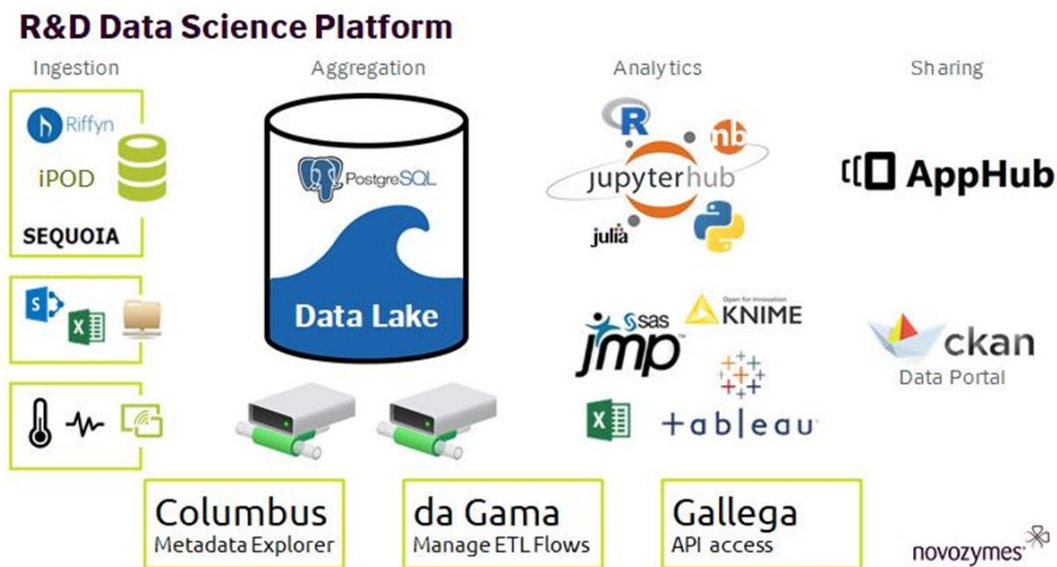


Figure 2 – Data Lake Architecture
Source: Novozymes

The Actions of Digital Transformation

A digital roadmap, leadership-driven change management, and company-wide data investments were key enablers of AIB AR's digital evolution.

With the robust Data Lake in place, Novozymes' R&D digitalization strategy began to take shape. Some overarching themes emerge from the story:

- Leadership-driven change management: Novozymes empowered managers and directors to institute change management initiatives that excited and encouraged employees to learn and adopt new digital skills.
- Aligning change management efforts to match organizational culture: AIB AR had to create a thoughtful, intentional approach to establish and scale digital adoption, one that would be effective in a culture designed around organizational autonomy.
- Investment in culture/skills: To be successful in its digital evolution, Novozymes AIB AR decided to invest in upskilling the existing team with digital skills.
- Tapping into company-wide digital investments: Investments made at the company level in digital tools helped catalyze AIB AR's evolution.

Reviewing AIB's digital journey through the six lenses highlights key aspects of AIB's actions and progress.

Strategy Lens



At the onset of the AIB AR digitalization journey, the organization developed a digital roadmap (Figure 3) to enable data-driven business guidance and to improve R&D innovation flows that more quickly provide tailored innovation to customers. The roadmap provides context and realistic targets for the digital journey ahead. The milestones along the roadmap are broken down into three timelines: now, next, and later. As part of the digital roadmap, AIB AR defined four focus areas for their digital strategy: internal data, external data, data skills, and business impact. Highlights of each strategy element are outlined below.

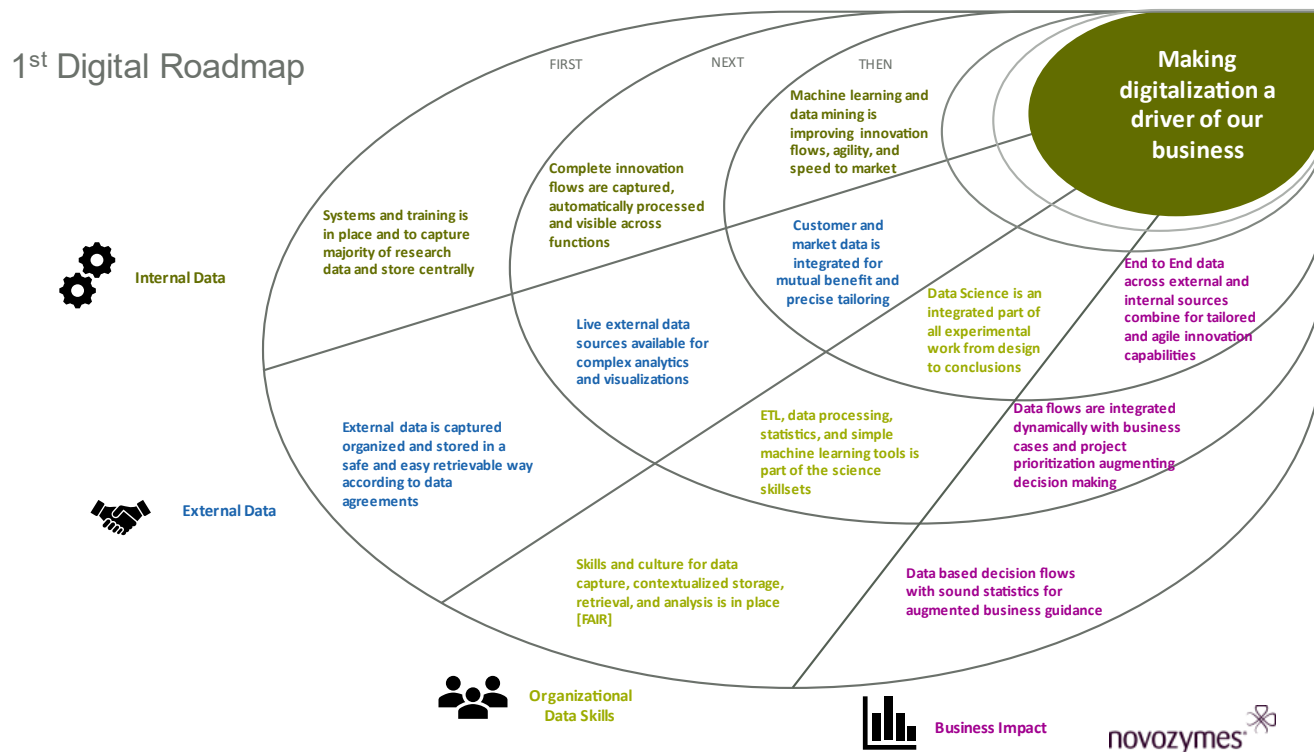


Figure 3 – AIB Digital Roadmap
 Source: AIB AR Digital Roadmap Presentation by Novozymes

1. Novozymes Data
 - a. Enable collaboration and decision-making cross-functionally
 - b. Augment decision-making for early-stage molecule designs and product composition selections
 - c. Develop the capability to securely consolidate datasets across geographies, functions, and innovation flows
2. External Data
 - a. Live access to market, public, and shared customer data for segmentation and value estimates.¹
 - b. High-resolution data access for joint trial data and assay quality learning loops

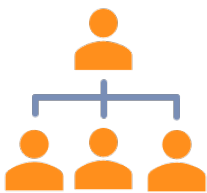
¹ Novozymes takes data privacy and confidentiality very seriously, and only accesses customer data that is agreed upon and permitted.

- c. Partnerships engage in digital collaboration for data capture, share, and joint analytics
- 3. Data Skills
 - a. Improved employee skill and tools for data capture, processing, and analysis via the Data Lake
 - b. Statistically driven experimental designs, assay validation, and data interpretation
 - c. Local experts in place to support digital infrastructure, data visualization, and automated processing
- 4. Business Impact
 - a. Data-driven decision making for smarter science and business guidance
 - b. Interactive dashboards and customer-tailored/involved product development
 - c. Supporting agile business cases and risk assessments with a dynamic live data foundation

“The winners in biotech will be companies that manage to deliver disruption from combining products and services. We are reshaping innovation through an agile approach to strategy, digitalized core processes, appreciation of data as a business asset, and an ever-evolving ecosystem of commercially robust digital capabilities.”

– Mads Torry Smith
Head of Digitalization,
Application Research

Structures Lens



The Digitalization Application Research (DARE) team was formed after initial experiments in bioenergy yeast proved successful. A team of five people with advanced data management skills were initially selected to build upon lessons learned in the yeast platform and create a roadmap to establish and grow AIB’s digital efforts. This team has grown over time and is still charged with driving and coordinating the digital journey within AIB AR.

The digital roadmap serves as the guiding document to DARE’s endeavors. In its first iteration, the digital roadmap was a collaborative effort between Novozymes’ digital champions, department managers, and the AIB leadership team. A digital champion is a person with the skills and enthusiasm to support

others needing help using digital technologies. This structure enabled local ownership of digital efforts. The DARE team is tasked with the following:

- Conducting sprints with local teams to help implement digital tools, automation, and data processing scripts
- Running larger digitalization projects across AIB functions
- Surveying, matching, and developing training materials around digitalization skillsets to disseminate across AIB
- Connecting the digitalization community within AIB to share best practices and tools between functions
- Serving as AIB's strategic interface to other groups within Novozymes

In DARE's first formal structure, each research area within AIB had a digital champion and a sponsor from the leadership team. Now the DARE team leverages digital ambassadors and digital managers throughout the organization to lead the digital evolution.

Digital Council

In 2020, Novozymes established a cross-functional digital council to streamline digitalization efforts within R&D. There was a realization that increased attention to high-level coordination of digital initiatives and investments across R&D and adjacencies was needed. For far-reaching, company-wide R&D digitalization to be successful, it needs to be led from the top down. Members of the Digital Council include representatives from AIB AR, core R&D, IT infrastructure, and the corporate digital group. They are tasked with facilitating the development of a unified strategy for digitalization in R&D.

Digital ambassadors are digital enthusiasts who become the point of contact for their department/business area on topics related to digital transformation. They are charged with incorporating tools and other digital advancements in their own workflows to help their groups and improve their projects. Digital ambassadors are not a resource diversion, meaning they are not funded by DARE or other digital AIB initiatives. Rather they use digital tools to boost their own research and support their colleagues to do the same.

Digital managers are dedicated representatives within AIB AR's functional management teams. They serve as the management-level digital ambassador in helping anchor, drive, and incorporate digital initiatives into relevant local strategies. These digital managers are also strategic representatives for their function in setting the overall digital direction in AIB AR, working closely together with DARE to help drive their functions' digital ambition and address change-management needs. The DARE team is organized around supporting

geographies where AIB AR is active (North America, the European Union, and China).

The DARE team is not alone in this journey. They were supported by several company-wide teams. The Scientific Data Management and Analytics (SDMA) team, which is linked to the company-wide digital transformation effort, served as a valuable resource for early digital initiatives taken on by DARE. SDMA helped DARE reinforce common data tools and served as trainers for upskilling AIB researchers in digital skills.

Resources Lens



The resources lens helps evaluate the digital transformation journey by examining the investments and resources that were important for its success. For AIB AR, early investments focused on digital tools. AIR AB chose to use commercially available and open-source tools, including Riffyn, Python, and SAS JMP, that were vetted and chosen by the company-wide SDMA team.

During the roll out of these new tools, the DARE team relied heavily on company-wide support groups, including the SDMA team. There was close collaboration in the initial setup for data capture and integration, marrying SDMA's development operations (DevOps) skills and knowledge in central systems with the AIB AR team's context expertise. In parallel, the team leaned on external consultants, including JMP and Riffyn trainers, to build and develop internal talent.

Culture and Change Management Lens



Fostering a digital culture is a core component of DARE's digital evolution and was a central tenet to the digital strategy. One of the tenets of Novozymes' company culture is organizational autonomy, enabling business units and research groups to operate with some latitude. While autonomy has many advantages, it can also create a challenge for any type of change management effort to be implemented and ultimately adopted. To increase the odds of widespread adoption, AIB leadership knew that technology and data

platforms alone would not suffice. To leverage these new tools and maximize their impact for the business, the tools needed to be embraced and used by researchers. Instead of bringing in new talent, leadership recognized the importance of upskilling existing R&D researchers to ensure they had a core competency in digitalization and software automation. The goal was to augment the researchers' biotechnology skills with digital skills, rather than replace the existing biotechnology talent with digital talent. This approach was taken to ensure a culture of purpose-driven digitalization.

To foster digitalization and software automation skills, DARE prioritized training and upskilling in the digital strategy. Through upskilling, DARE sought to create a pyramidal digitalization competency distribution to empower R&D researchers to leverage and incorporate software automation tools for digitalized workflows. R&D researchers can be categorized as operating in one of three categories based on their digital skillset (Figure 4):

1. **Intermediate** (Level 1: 70% of R&D workforce) - Working knowledge of digital tools for improved workflows (e.g., extracts data from the Data Lake and uses JMP for statistical analysis or experiments).
2. **Advanced** (Level 2: 20% of R&D workforce) - Advanced digital skillset for leveraging and expanding the digital toolbox (e.g., designs processes, experiments, and captures data using Riffyn; this is the desired skill level for data ambassadors).
3. **Expert** (Level 3: 10% of R&D workforce) - Dedicated data scientists fully focused on expert-level digital tool development and implementation (e.g., trains Riffyn users at the project level).

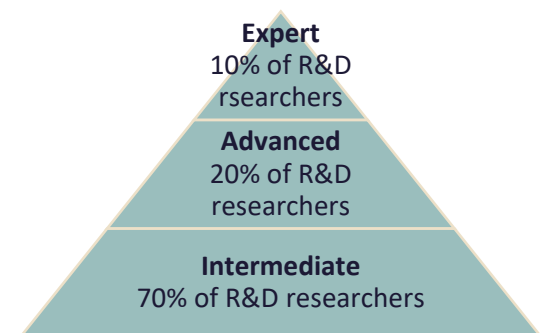


Figure 4 – AIB's Pyramidal Structure for Digital Upskilling

It is important to note that the base of the pyramid starts with intermediate, not beginner. This is intentional. Similar to the permafrost reference mentioned in the Michelin digital transformation case study, AIB leadership recognized that some staff would be resistant to change and could not be converted (or “melt”). The pace of change and need for digital tools is growing exponentially. Digital skills are becoming a prerequisite for new hires. Both DARE and AIB leadership recognize that eventually the pace of change will overtake those resistant to learning digital skills, thereby creating a minimum digital skillset level.

In the early stages of the journey, DARE used a digital champion model to upskill and grow the base of the pyramid. This model focused on developing skillsets for a select group of digital champions (the middle layer of the pyramid). With enough support, the digital champions are able to inspire and teach the next generation of digital champions, offering a sustainable and self-perpetuating framework for fostering digital skills.

Now DARE conducts an annual employee survey for digitalization skillsets, where employees are asked to self-identify skill levels. Results are funneled back to employees and managers for action taking and goals setting. The dedication of resources—both time and money—to upskill employees was seen as a crucial investment to carrying out the digital strategy. Digital skillset improvements are now a core element in employee annual goal setting and individual development plans.

Technology and Data Lens



AIB AR were first movers in Novozymes' R&D to embark on a digital journey and thus needed to lay the foundation with robust data capture tools before leveraging advanced analytics capabilities such as artificial intelligence and machine learning. DARE wanted to move away from traditional, siloed databases, like Lotus Notes, to interactive databases. Early technology and data investments focused on digital tools that were being supported by company-wide digital teams. DARE was able to tap into these company-wide investments and leverage them internally to improve data capture and analysis. Examples included Riffyn, Python, and JMP, which supported and enabled the underlying data infrastructure for AIB.

Like other companies profiled in these case studies, AIB AR's digital portfolio includes self-built, single-purpose digital tools, known as microservices in Novozymes' terminology. The head of the digitalization team within AIB AR noted three important roles that microservices play:

1. Microservices offer customization to the AIB AR infrastructure that can align to pipeline systems like Riffyn or JMP.
2. Microservices can be used for easier data capture in both the lab and in the field.
3. Microservices can be used as early proof of concepts to test operational efficiency and ease of use before investing to develop a robust offering.

The extent of Novozymes' investment in data tools and platforms facilitated great success in enhancing R&D efficiency and operational excellence, but the journey has not been without its challenges. Like most companies that are on a digitalization journey, DARE struggled in the early days gaining buy-in. They spent a lot of time and resources trying to prove themselves, resulting in some earlier initiatives being less successful.

Opportunities and Offerings Lens



Yeast Platform: Early digitalization efforts in AIB focused on Novozymes' yeast platform. Novozymes wanted to develop a superior yeast for optimized ethanol production, which required rapidly generating and testing thousands of strains in small-scale assays and necessitated a robust data infrastructure. The yeast platform was able to leverage new data capture and analysis tools to transform operations, including:

- Increasing the speed of design, build, test, learn (DBTL) cycles - The digital evolution has empowered the yeast team to identify bottlenecks earlier and faster.
- Increasing speed to market - Typical project timelines ranged from 3 to 5 years for enzymes. With the help of digital tools, the yeast application R&D team has reduced time to market significantly, in some cases to less than a year.
- Identifying crossover opportunities in other verticals - The use of historical data has enabled the yeast team to troubleshoot and identify useful patterns across sectors. This was difficult to do in Novozymes' prior siloed data structure.

In just three years Novozymes has gone from zero to ~40% market share of ethanol produced in North America by Novozymes yeast solutions, thanks in part to the expanded capabilities realized during their digital evolution. Success in the yeast platform is underscored by several tools and platforms, including the following:

- **Riffyn:** Riffyn Nexus is a scientific data system that offered AIB a process-centric approach to capturing both experimental execution details and a high level of meta (data), which result in data primed for

advanced analytics and machine learning directly into the Data Lake through a seamless API. The use of Riffyn by AIB researchers is a contributing factor to reducing product development time by up to 50%.

- **Engageovation:** AIB AR is at a point in their journey where they are beginning to connect their internal data with customers' data to personalize their biotechnology solutions. Engageovation is designed to be a digital customer engagement and data aggregation platform that has the potential to unlock new business and collaboration models. Engageovation enables AIB to innovate with their customer by incorporating customer needs and data into the development pipeline earlier in the innovation process, resulting in the delivery of more relevant information to the market in less time. The platform has led to up to 4x time savings for piloting new products.
- **Mission Control:** DARE developed a machine learning-reinforced data "shopping" platform, known internally as Mission Control. Mission Control allows R&D researchers to interrogate any type of data that has been generated throughout the yeast innovation pipeline, essentially replacing hundreds of siloed spreadsheet files.

The Maintenance of Digital Transformation

The AIB AR digitalization journey has been a growth driver for the segment and served as inspiration for a company-wide digitalization effort.

Timeline



Novozymes' AIB AR started its digital evolution approximately three years ago, driven, in part, by external competition. AIB recognized the need and dedicated a team of five to focus on building digital and data capture tools. The success of the yeast platform led to the creation of a dedicated digitalization team, known as DARE, for B&F in August 2019. The creation of DARE formalized digitalization efforts and catalyzed the creation of a digital roadmap. In October 2020, Novozymes went through a corporate reorganization to consolidate three research areas into two, transforming B&F into AIB. DARE now operates within AIB.

DARE likes to refer to AIB's journey as a digital evolution, opposed to a digital transformation. Transformation implies a beginning and an end, while an

evolution speaks to the perpetual disruption that necessitates continued innovation. The journey will continue to evolve over time as new capabilities and technologies emerge.

The initial focus of AIB AR's digital journey was to develop a robust data infrastructure and upskill researchers with the necessary skills to be able to operate in the emerging digital environment. With data capture capabilities in place and a strong pipeline of digital talent eager to learn, DARE foresees the following next steps in their digital journey:

- Internal
 - o Expand digital skillsets through continued change management efforts to further increase (meta)data capture
 - o Democratize data science through programming free data science platforms
 - o Expand the use of tools more broadly across AIB
- External
 - o Connect to more data sources external to AIB AR, such as customer data streams and downstream Novozymes units, including finance, supply chain, production, marketing, and sales
 - o Drive transformation from design, build, test, learn (DBLT) cycles along the product pipeline

Measures and Metrics

The DARE team looks to replicate successes from the yeast platform to other areas of AIB.

This case study highlights several examples of the impact of digital activities on Novozymes' AIB AR activities:

- Yeast platform:
 - o Reduced time to market for product development
- Engageovation
 - o Led to cases for 4x time savings for piloting new product concepts
- Riffyn
 - o Reduced product development time by 50% using half the personnel

Novozymes' digital evolution within AIB AR is still in its early stages. They gauge progress by mapping their success against the AIB digital roadmap. The digital roadmap is set up in a way that enables leadership to track both short-term and long-term milestones.

Because they are still in the early stages of their digitalization journey, the DARE team is still exploring the best ways to measure success. Success early on for the yeast platform focused on time savings for scientists, reduced time to market, and faster assay throughput. As the DARE team continues forward on the digital journey, they will look to replicate the successes from the yeast platform to other areas within AIB.

Learnings and Lessons

When asked to share the top success factors that influenced their digital transformation journey, AIB leaders provided the following insights from their experiences:

- **Start with culture:** It takes more than technology alone to embark on a digital transformation journey. A digital culture encourages people to take risks, fail fast, and learn. AIB AR has successfully incorporated and scaled digital adoption in their research organization, a remarkable achievement in a company culture where organizational autonomy is the norm. Finding the right way to align digital transformation efforts to the company or organizational culture is a critical yet challenging aspect of change management.
- **Determine the right type of change agent for digital:** Instead of making data scientists (subject matter experts) responsible for convincing biotech scientists to adopt digital tools, AIB intentionally selected change agents who came from R&D, knew the business, spoke the language, and were passionate about digital. These change agents were able to overcome cultural challenges and increase adoption of digital tools.
- **Garner support from leadership:** Leaders are key multipliers in developing and enabling a digital culture. Having buy-in early in the journey helps to ensure sustainability. AIB AR leadership provided the necessary support and created a dedicated team (DARE) that was empowered to bring digital into the organization in the right way.
- **Focus on short-term wins and long-term vision:** both are necessary for implementation of digital change.

- Be bold and take risks: Disruption is natural. It is about being uncomfortable with disruption and bouncing back.
- Keep your foot on the gas pedal: The journey is long and requires significant commitment—in both time and money.
- Do not create a company digital strategy: instead, create a company business strategy, and enable digital as a lever to achieve the business strategy.

Conclusions

This case study highlights several factors that have contributed to AIB AR's digital transformation successes thus far:

- Designing an approach that aligns to the culture - AIB AR had to introduce significant change in an organization designed to make decisions autonomously. Corporate mandates would have backfired, so a more creative and nuanced approach was required. That approach included:
 - Recognition to upskill biotechnology researchers in digital skills instead of replacing biotechnology researchers with digital talent.
 - Creation of a small core “engine” of digital change agents, with a deep understanding of biotechnology, to drive the transition.
 - Leveraging company-wide digital tools and DevOps skillsets to spur the initial digital journey and lay the foundation for a robust data infrastructure.
- Acknowledgment from AIB leadership that investment now in digitalization will drive future growth.
- Commitment from managers and directors to invest—both time and money—in the upskilling of R&D researchers.

These factors can also help other organizations that are earlier in their digital journey.