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Developing a Long-Term R&D Strategy in an Increasingly Changing World

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OVERVIEW: The 2021 Holland Award article, "Long-Term R&D Strategy and Planning," showed that companies struggle to determine where to invest their R&D efforts in longer-term technology platforms and projects. The work resulted in the development of a Long-term Visioning Scorecard with key elements that support confidence and R&D investments in opportunities. This case study illustrates the application of the scorecard and best practices for long-term R&D strategy. It highlights efforts DSM used to grow its Dyneema business, including the adoption of new practices that enriched the insights gathered and tools used to formulate a growth strategy. The intent is to provide R&D leaders with an example of new approaches that will help them advance their practice for longer-term R&D.

KEYWORDS: Long-term planning, Insight, Opportunity, Ecosystem

Companies are facing significant challenges for growth. Startups, global competition, faster followers, and competition from new retail channels, such as Amazon-produced products, are making sustained differentiation more difficult. To grow, many companies invest in R&D-led innovation both for the near- and long-term. Creating roadmaps for R&D efforts in the short-term is relatively straightforward as the business units (BUs) can provide guidance concerning their customers' needs. However, planning for the long-term is another story. Young, Rosenstiel, and Henderson's (2020) article, which received the prestigious Holland Award awarded by Innovation Research Interchange (IRI), showed that there is a significant lack of satisfaction in meeting desired outcomes by companies when the timelines are further out. Several challenges emerge in planning for time frames beyond the typical development cycle—namely, knowing what customers will want in the future, understanding the right market and technology trends, exploring technology advancements farther out, and understanding the future of business models. Businesses must make decisions on where to commit resources, start projects, distribute funds, form partnerships, or make acquisitions in areas where they lack a complete picture of the product or market opportunities they are pursuing.

Young, Rosenstiel, and Henderson (2020) further explored the extent to which companies felt equipped to plan for the

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long-term. A shocking 87 percent of R&D leaders interviewed stated they did not have confidence in the insights and processes necessary to plan where to invest in periods beyond their core business development cycles. Also surprising was that some of these R&D leaders were able to secure the resources for investing in longer-term technology platforms, but they were not sure where to direct those resources. One output of their study was the creation of a Long-term Visioning Scorecard that showed how companies approached their planning processes and the elements of the processes used by those companies that were more confident (and more likely to secure resources).

Long-term Visioning Scorecard and Study

In 2017, IRI commissioned a Research-on-Research working group to explore the gap between *short-term business planning* cycles and *far-horizon planning*. The assumption was that short-term business planning involves well-developed processes that help companies determine where to invest resources. These include portfolio management, project management, and Stage-Gate tools and practices (Moore 2007). Far horizon planning enables companies to better prepare for future disruption by conducting scenario or contingency planning and incorporating insights from futurists and think tanks. Researchers and practitioners view both activities as critical to successful R&D organizations. However, the challenge lies between the two extremes, in what was defined as the *long-term planning cycle*, a time frame ranging from approximately three to eight years into the future—well beyond the annual strategic planning cycle but much shorter than the far-horizon planning timeframes.

The Long-Term Visioning Scorecard (Figure 1), leveraged a maturity model framework to help organizations evaluate their current performance and practices. Rows of the scorecard centered on key vectors of successful long-term planning, with each row articulating behaviors and practices across spectrums of success identified during the study.

In essence, the scorecard shows that more successful companies do the following:

- Have an expanded view of the role of R&D (Point of View);
- Look farther out in time and evaluate their plans more often (Timing + Cadence);
- Allocate more of their R&D budget to long-term platforms and more diverse opportunities (Funding);
- Use a broader range of market research, which leads to more successful processes (Insight Gathering);

	Limited	Moderate	High
Section 1: Timing + Cadence			
Horizon for Long-Term	0-4 years	5+ years	5+ years
Frequency of Planning	Ad Hoc	Annually	Annually with "revisits" as needed
Section 2: Point of View			
Perceived Purpose of R&D	• Driving growth in core markets	• Driving growth in core markets • Supporting the businesses • Exploring mid-term growth	• Driving growth in core markets • Supporting the businesses • Exploring mid-term growth • New / adjacent market expansion • Exploring long-term growth
Perceived Purpose of Long-Term Planning	• Achieving top line growth	• Achieving top line growth	• Driving breakthrough • Industry leading innovation • Achieving top line growth
Section 3: Funding			
Scope of R&D Program Funding	Able to secure funding for projects involving: • External partnerships	• External partnerships • Work in adjacent areas • New tech platforms	• External partnerships • Work in adjacent areas • New tech platforms • Long-term initiatives • New business models
Section 4: Insight Gathering			
Breadth of Research Inputs Utilized	• Technology trends • Market trends	• Technology trends • Market trends • Competitive Insights • Customer Insights	• Technology trends • Market trends • Competitive Insights • Customer Insights • Business Insights • New Business Models
Section 5: Engagement + Communication			
Penetration of Communications thru the Organization	R&D strategy shared with: • Leadership (Organization and / or BU) only	• Leadership (Organization and / or BU) only • R&D and Marketing	• Throughout the greater organization
Section 6: Opportunity Identification + Measurement			
Analysis Mechanisms in Place for Long-Term Planning	No/limited process for [1] Defining opportunity, [2] Sizing opportunity, [3] Long-term metrics, [4] Tying R&D strategy to business strategy, [5] integrating risk + decision making	Some / inconsistently used process for [1] Defining opportunity, [2] Sizing opportunity, [3] Long-term metrics, [4] Tying R&D strategy to business strategy, [5] integrating risk + decision making	Established process for [1] Defining opportunity, [2] Sizing opportunity, [3] Long-term metrics, [4] Tying R&D strategy to business strategy, [5] integrating risk + decision making

FIGURE 1. Long-term visioning scorecard (Young, Rosentiel, and Henderson 2020)

- Have greater engagement in terms of cross-functional participation, linkages to business strategies, and communication of vision and strategy (Engagement + Communication); and
- Have more sophisticated processes for opportunity definition and measurement, but few have any successful processes (Opportunity Identification + Measurement).

Case Study

In this case study, we highlight DSM (Dutch State Mining) and its efforts to grow its Dyneema business. We explore how Dyneema took a product that was used in mature applications with slow growth and reinvigorated its innovation pipeline through an exploration of long-term opportunities. The case clearly shows how DSM leveraged strong existing innovation practices and behaviors, while elevating its capabilities in key areas of the scorecard.

DSM

DSM was established in 1902, originally to mine coal reserves. Over the last 120 years the company has transformed itself through innovation. At its heart, DSM is a science company, having grown a portfolio of materials science and solutions in health and nutrition with a heavy focus on sustainability.

In 2007, DSM adopted the Opportunity Thinking Growth System approach to building long-term strategy (Henderson 2013). DSM internalized the Opportunity Thinking Growth System, calling it their Business Innovation Analysis (BINA) methodology (Corporate Innovation Online 2011) (see "DSM's BINA Methodology" on p. 43). DSM adopted BINA as part of a corporate strategy refresh and so it could systematically explore innovation opportunities. Once DSM adopted the BINA methodology, it provided training to its employees. Then DSM focused on applying the BINA methodology and related tools to specific businesses. DSM has used the BINA methodology for the past 10 years.

Dyneema's Dilemma

Dyneema was one of the first businesses to which DSM applied its BINA methodology. DSM invented Dyneema, an ultra-high molecular weight polyethylene material that is considered the strongest fiber in the world. It competes with Kevlar in markets such as bulletproof vests and fishing lines. Dyneema is extremely strong, lightweight, and expensive. The Dyneema team had been highly successful in its core applications, including fishing lines, nets, and bulletproof vests, but its growth had slowed after capturing significant shares of these markets.

DSM's leaders challenged Dyneema to identify new growth areas for the brand, and the business was seeking new opportunities through technology advancement and market application development. Dyneema found identifying growth areas particularly challenging because its leaders felt that few other applications could support the price point of the material.

DSM's BINA Methodology

DSM adapted the Opportunity Thinking Growth System (Henderson 2013) and created a Business Innovation Analysis (BINA) methodology to help the company explore innovation opportunities in a systematic way by exploring market needs, new value propositions, and external trends and conditions that create opportunity for innovation. The BINA methodology lays out six sources of innovation: brands and design; business model/monetization; market and application; business biotope; process/costs; and technology. The BINA methodology uses an Innovation Dataset that includes basic business elements: mega trends, business position, opportunity landscapes, and capabilities (Corporate Innovation Online 2011). The Innovation Dataset has internal and external inputs designed to organize the company's understanding of future trends, business position, opportunity landscapes, and capabilities (Corporate Innovation Online 2011). Part of the BINA methodology entails holding Business Innovation Dialogues (interactive workshops) in which participants engage to create strategy opportunities that map to the four basic business elements. The BINA methodology begins with a basic understanding that opportunities are fundamentally different from ideas and that companies often can confuse the two.

Current State of Maturity

We begin this case study by first assessing where DSM and Dyneema already exhibited best practices based on the Long-term Visioning Scorecard.

Strong Point of View on the Role of R&D

DSM performs well regarding how leaders and employees view the R&D function within the organization (Section 2 of the Long-term Visioning Scorecard). DSM has based its growth on innovation and corporate-level commitment to driving growth from R&D. DSM's purpose in adopting the BINA process was to provide longer-term planning of opportunities for R&D and innovation. The company performed well on this vector: it showed support for its businesses, consistently exploring mid- and long-term growth. DSM's willingness to consider new and adjacent market expansion meant that R&D had a seat at the strategy table both at a corporate innovation level and within its businesses, such as Dyneema. In addition, the Dyneema business was looking

Dyneema found identifying growth areas particularly challenging because its leaders felt that few other applications could support the price point of the material.

to R&D to help resolve to its growth challenges in both the short term and long term.

Strong Organizational Engagement

Part of the BINA methodology was to use the Six Sources of Opportunity (Henderson 2013), which covers multiple sources of growth, including market, technology, brand/design, business model, environment, and organization (Figure 2). These sources of new opportunities require that the businesses gain multiple perspectives on opportunities from across the organization. This creates broader engagement, aligning with Section 5 of the Long-term Visioning Scorecard. Dyneema had exhausted its efforts to derive growth from its core markets and needed help to stretch the business into new adjacencies. To do this, DSM created a cross-functional team comprised of technical, market, and commercial expertise to collaborate with NewEdge to apply the BINA process to the Dyneema brand at a business function level.

Good Alignment with Corporate Strategy

At an organizational level, the fact that DSM had prioritized its Dyneema business for long-term growth activities was due to its connection to DSM's overall corporate strategy, which had been developed and finalized during DSM's previous strategic planning cycle. This consistent focus of long-term initiatives demonstrated a strong alignment between DSM's priorities and those of Dyneema (Section 2 of the Long-term Visioning Scorecard).

Dedicated Funding

DSM demonstrated commitment to funding longer-term opportunities; however, the company was not clear on where to invest. The purpose of the new initiative was to identify the opportunities where long-term R&D would bring growth to the organization. Both DSM and the Dyneema business unit have a documented history of investing in longer-term technology platforms and applications.

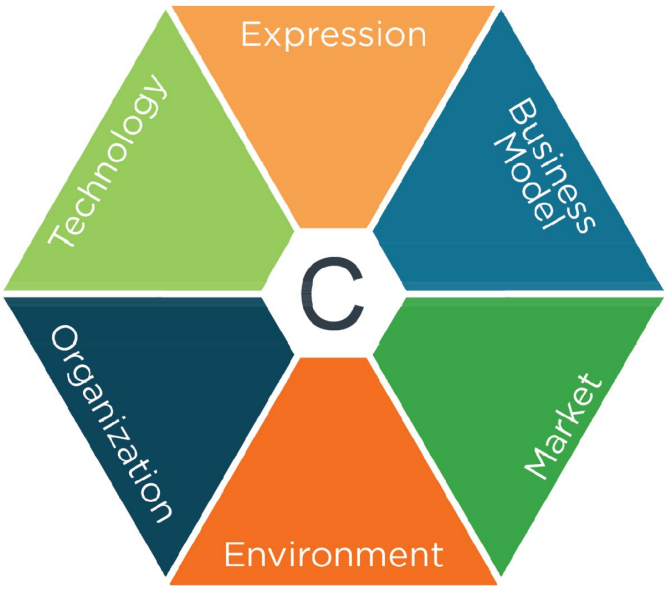

FIGURE 2. Six sources of opportunity (Henderson 2013)

Appropriate Timeframe of Evaluation

While looking beyond the current business cycle is a common challenge for many companies, the Dyneema business team had organizational support and understood the value of looking at long-term trends and disruption (Section 1 of the Long-term Visioning Scorecard). DSM had recently completed its own long-term strategic assessment and had identified a range of key trends that it believed would impact DSM as an organization over the next decade. This thinking carried over to the Dyneema business and laid the foundation for the work to come.

Driving Maturity to Drive Growth

While DSM showed signs of maturity in its overall strategic planning, the company still had room to improve. Applying the BINA process in concert with tools for exploring the Six Sources of Opportunity (Henderson 2013) provided them with an opportunity to build new capability.

New Approach to Defining Opportunities

A company or its competitors can pursue opportunities that exist outside of an organization. Ideas represent ways to execute on those opportunities. In a company's longer-term roadmap, tethering strategy to opportunity rather than to ideas creates greater stability, thereby enabling an organization to manage its pursuit of the longer-term opportunity rather than the near-term execution of an idea. The Dyneema business unit had plenty of near-term business opportunities to pursue with current customers—the real challenge was how to identify longer-term opportunities and platforms to build an enduring innovation pipeline, with meaningful output for years to come (Section 1 of the Long-term Visioning Scorecard).

Defining Opportunities, Distinct from Ideas—While the Dyneema team had plenty of ideas, it lacked an understanding of the bigger opportunities. The team needed guidance in how to elevate its ideas into bigger value propositions to focus on. For example, an *idea* might be line or rope for marine applications—such as fishing line—while the *opportunity* might be tethers for use in extreme environments. Framing the opportunity in this way elevates the discussion, stretching thinking to consider a range of potential applications rather than focusing on a single area. In doing so, opportunities get prioritized first, rather than trying to decide immediately what a company's ideas and projects could be or how they should be ranked.

Defining Opportunity More Robustly—Many companies struggle with how to define opportunities. Even within organizations, different functions might look at opportunities in different ways. Marketing may consider a sales opportunity or business platform, while R&D might frame opportunities in terms of technologies or new capabilities. DSM was no different, until it adopted the definition of opportunity used in Opportunity Thinking (Henderson 2013).

Opportunity comes from the Latin word *Ob Portu*, which means *into port*. The "opportunity" came about in the late 1300s when Spain and Portugal were exploring new trade routes and delivering goods into port. Marketing might consider the port the opportunity, a need in the market for new goods and services, and R&D might consider the opportunity to be the boat and goods onboard, a value proposition the boats were delivering. Neither definition was correct. The *Ob Portu* Spain and Portugal were referring to was the tide and the wind. The overall conditions that moved the boat the final mile into port. Without the right conditions, a boat would stall outside of port and all the goods would spoil.

Thus, the definition of opportunity brings together three elements: the *needs* in the market, a *value proposition* that can be delivered on, and the right *conditions* defining the right time to act. The BINA methodology elaborates on its definition of opportunity using the Six Sources of Opportunity (Henderson 2013), which expands the *needs* to include needs in the market, the environment, and the organization; and the *value propositions* to include value propositions created by technology, the brand expression, and the business model. Additionally, we look at how conditions (trends) are changing across all six sources to further understand how the business may be impacted. This broad definition of opportunities touches on another element of maturity—namely, that it drives looking for a broader array of opportunities.

Opportunity-driven Insight Gathering

Most corporations have a scouting function that gathers insights across all three aspects of opportunity. DSM Dyneema was no different: it developed an understanding of market needs through customer insights; identified new technologies through tech scouting and road mapping; and spotted trends through trends reports, scenario planning, and forecasting (Section 4 of the Long-term Visioning Scorecard).

While DSM Dyneema had these capabilities for its core business, DSM as an organization lacked a broader set of insights to provide line-of-sight into new adjacencies where it hadn't had operations or business in the past. Since Dyneema could potentially engage in brand new markets, including non-existent ones at the time, gathering insights proved a difficult challenge that needed new approaches and tools. Dyneema looked for insights across the elements of the opportunity (needs, value propositions, and conditions that are trends) and even more broadly across the Six Sources of Opportunity (technology, brand expression, business models, markets, and the environment within the organization, including IP that had been shelved and past projects that had not completed).

Trends and Conditions—In general, processes are better developed for looking at opportunities in the next 1–3 years or at opportunities much farther out (20+ years). The middle time frame is most challenging to make sense of and strategize against. Across all these time horizons, companies rely on basic tools to explore trends. For near-term understanding, companies purchase market reports that show business projects and forecasts. For extremely long-term horizons (20+ years), companies rely on futurists, prognosticators, and scenario planning, which stretch thinking but often fail to tether those insights to tangible and actionable strategies.

The middle time frame has the least well-developed processes, even though 3–10 years out may be of great interest to most companies for planning purposes. Companies must be able, with relatively high levels of certainty, to predict which trends will create disruption and opportunity so they can develop properly the capabilities, products, knowledge, and skills to respond effectively. To truly understand how their businesses will be impacted, companies need to take a very broad view of trends, looking beyond their industry and organization.

The Dyneema team looked at a range of trends, including how business models were changing, trends in transportation and shipping, agriculture and aquaculture, design (including fashion and furniture), textiles (including safety clothing and sports), leisure (especially extreme sports), anti-terrorism, manufacturing, sustainability, the evolution of cities and urbanization, and new materials. It even explored how innovation itself was evolving.

The team explored these and other trends in light of the attributes of their materials. The team posed questions regarding where the industries were pushing the performance of the materials, where materials were being taken into more extreme applications, where applications benefited from lighter weight or durability, and where applications required greater sustainability.

As the team went through this exercise, it identified the intersections of these trends. The team uncovered new areas where materials were being used in much more remote locations, extreme environments, and conditions; and where they were subject to greater corrosion, and more extreme temperatures. In these areas, materials were expected to have more features and benefits, and often customers were looking to replace a multi-material design with a single material solution. New markets and customers wanted greater sustainability, lower failure rates, improved durability, tear resistance, and lighter weight. Many of these customer requirements were well suited to Dyneema (see "Expanding Insight from Trends Through New Lenses" on p. 46).

Opportunity brings together three elements: the *needs* in the market, a *value proposition* that can be delivered on, and the right *conditions* defining the right time to act.

Expanding Insight from Trends Through new Lenses

One challenge organizations face is they are increasingly influenced by forces external to the markets they serve. They feel blindsided by these trends often because they are looking only at trends within their markets and not at trends from adjacent areas—not adjacent markets only, but also adjacent aspects of their business. The first category of trends they may miss is macro-influences, which include, for example, aging, the future of cities and urbanization, connectivity, electrification, and personal health and wellness trends. Companies often look at these trends as they impact their markets. Instead they should be looking at how these trends are influencing adjacent industries to see when and how they will impact their own industry. Other types of trends include changes in business functions such as new business models, the nature of manufacturing itself, sustainability, and even the way in which innovation will be done. DSM Dyneema was not accustomed to but benefited greatly from looking at adjacent markets *and* also at trends in macro-influences and in functions such as innovation, business models, manufacturing, workforce, and sustainability. The holistic look provided richer perspectives on opportunities and potential for differentiated approaches that addressed a wide range of change.

These insights led the Dyneema team to see more opportunities than originally thought. Significant trends existed in the use of materials, including their use in more complex and extreme conditions requiring lighter, stronger materials; and entirely new and previously unexplored applications such as inflatables, outdoor furniture, high-end sporting equipment, deep oil drilling, disaster relief, military, and anti-terrorism. The team began to identify the potential opportunity landscape of places to do business and laid the foundation for the next area of discovery—understanding the unique needs of these customers.

Understanding Needs Beyond Current Applications

When DSM looked at the range of potential applications, it realized that its existing Voice-of-the-Customer techniques would not provide the needed insights to meet the needs of the Dyneema business because it was exploring new areas and it served multiple markets. Furthermore, customers could not be expected to imagine entirely new applications. The solution was to adopt a Voice-of-the-Ecosystem approach, which DSM had adopted as part of its BINA methodology. The Voice of the Ecosystem consists of participants, influencers, and observers in industries that a company competes in or seeks to enter (Henderson 2013). Most companies focus primarily on engaging with participants—that is, direct customers, suppliers, or industry professionals focused on the markets they are in. Identifying the influencers and observers is often more challenging, but they are the ones who can often see further out in time and articulate upcoming industry shifts that otherwise go unnoticed.

The Voice-of-the-Ecosystem work for Dyneema included speaking with participants in the value chains of potential application areas the trends research had illuminated. The Dyneema team spoke with influencers, including the US Federal Emergency Management Agency (FEMA) to understand its activities with temporary structures. The team also engaged with trade associations and spoke with industry thought leaders such as athletes sponsored by companies like The North Face. Using this approach enables a faster uptake of industry knowledge. Finally, the Dyneema team spoke with observers, including people that are guides for extreme sports; with NGOs working in disaster areas; and with airline employees working with anti-terrorism products.

This phase added depth to each of the opportunity spaces initially identified in the trends research. Each opportunity space had a list of top needs for new materials. Dyneema's business leaders eliminated some market spaces that seemed appropriate for Dyneema materials but for which no unmet needs existed (see "Challenges with Understanding the Ecosystem" on p. 47).

Creating New Value Propositions—To truly understand how Dyneema could create new-to-the-world applications, the team needed to stretch its thinking about both material attributes and possible material forms. The Dyneema team used a dimensioning tool to explore the boundaries of what was possible, mapping all the primary, secondary, and tertiary benefits along one dimension, and the potential processing formats that could be leveraged along another dimension (Figure 3). The team first looked at material attributes of Dyneema. The attributes they had focused on up until that

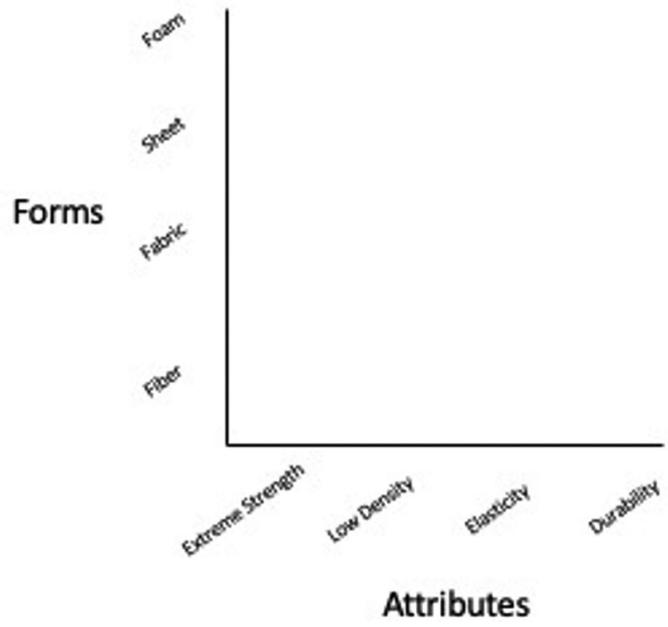

FIGURE 3. Materials map

Challenges with Understanding the Ecosystem

Moving from Voice of the Customer to Voice of the Ecosystem is a significant change for companies. Voice of the Customer not only provides insights needed for the core business, it holds the promise of potential sales. Voice of the Ecosystem requires several shifts for companies. It is all about truncating the learning cycle by going directly to people that have line-of-site to the new places to do business. A challenge is for team members to understand how to think creatively of the ecosystem as something more than a value chain. Participants in value chains are of interest, but influencers such as regulators, trade association presidents, thought leaders, NGOs, and even consumer advocacy groups are also of interest. Even more creative is thinking about who might observe behaviors of interest. For example, a food company developing healthy snacks for children had exhausted the insight from parents and children, retailers, and suppliers, but were still at an impasse. It turned to an observer—janitors in the school lunchroom—who saw the entire black market of school lunches, including everything that was traded or thrown away. They described trash cans of perfect apples, all of which had become projectiles. The insight was that the food company needed to not just make the food taste good but be enviable and trade worthy.

point centered around strength and light-weighting. However, through the attributes map the Dyneema team uncovered a range of additional as yet unleveraged attributes, pushing the team to consider new value propositions that could realistically be delivered to the market.

Historically, Dyneema had always focused on the fiber format for its material. Stretching across the dimension of form, the team explored whether Dyneema could look at sheeting, pellets for molding, or even foaming. As Dyneema combined these dimensions into a materials map, it was able to explore new applications inspired by interesting intersections of attributes and physical forms. This stretched Dyneema into non-obvious applications where it considered foaming the product in furniture for environments where temperature resistance was critical, and for sheets in motorsports for tear resistance.

The outcome of this phase was to further populate each opportunity space with the value propositions that might have potential. These longer-term platforms or ideas often required technical development and more advanced R&D projects, though some were current business opportunities focused mainly on application development.

Identification of Opportunities

With a foundation of insights across needs, value propositions, and conditions (trends), the Dyneema team took its knowledge into the Opportunity Landscaping and Identification phase, which consisted of a creative and iterative exercise over several weeks where the DSM Dyneema team and its partners pulled together their collective knowledge into potential opportunity spaces. As is the challenge with many landscaping exercises, DSM had a mix of opportunities that were comfortable places for it to work and others that stretched the company into new areas with some uncertainty. Organizations often gravitate towards prioritizing known opportunities—not because they have a bigger potential for growth, but due to their familiarity and perception of being less risky.

Dyneema recognized that strategic choices cannot depend on familiarity. Dyneema needed a mechanism to quickly validate the opportunities it had defined thus far by gaining an understanding of radically new areas in a short amount of time. To solve this, Dyneema once again leveraged its external ecosystem.

The team organized a week-long eco-immersion event in London, where a cross-functional group from DSM engaged with ecosystem participants, influencers, and observers relevant to each opportunity space. On behalf of DSM, NewEdge recruited ecosystem members and ran half-day sessions. The ecosystem grounded the team members in their perceptions of opportunities, while the Dyneema team shared materials, samples, and visualizations of *what might be*. The team then collaborated on creatively exploring *what could be*, performance requirements, price elasticity, and potential market size.

These activities allowed the DSM team to continue to refine its opportunity landscape, clarifying and prioritizing its spaces and platforms as more information was gathered. The DSM team eliminated opportunities such as outdoor furniture, postponed opportunities in other areas, and expanded opportunities in areas (clothing) originally considered unable to bear the added cost of Dyneema (see "Reducing Uncertainty Aversion" on p. 48).

Broader Organizational Engagement and Alignment

Organizational engagement both during and after the strategy work was a key success factor for Dyneema. Cross-functionality was a key tenant of the approach, which is embedded in the BINA methodology. That cross-functionality paid off when the Dyneema team engaged with the ecosystem. Previous research published in *Research-Technology*

Organizations often gravitate towards prioritizing known opportunities—not because they have a bigger potential for growth, but due to their familiarity and perception of being less risky.

Management (*RTM*) showed that organizations are more likely to get to breakthrough when they have both marketing and R&D engaged in gathering insights (Cotterman et al. 2009).

Once the Dyneema innovation strategy was completed, the Dyneema team spent significant time and resources summarizing the key learnings using communication tools that focused on the identified and prioritized opportunities. While many ideas were shared during the strategy development, the post-project messaging focused on the higher-level opportunity spaces and platforms. By focusing on this level, the team was able to freely engage in specific initiatives and projects without fear of failure. The commitment from DSM remained at the opportunity level, while it allowed specific projects and ideas to come and go.

Discussion

These efforts produced profound results. Dyneema launched R&D projects, application development projects, and commercial initiatives to build out new offers and positions in new markets, including protective armor, wearables, offshore wind energy, and aquaculture such as in ocean fish farms. Dyneema became one of the top performing businesses in DSM. Ten years after the implementation, DSM attributed over 75 percent of Dyneema's growth to the work described here. What was a 16-week effort to map the future of R&D fed the organization with growth opportunities for 10 years.

In addition, DSM continues to use the BINA methodology that lays the foundation for how R&D is best positioned in the organization and how to approach innovation in a cross-functional way using multiple sources of insight. By developing new applications, Dyneema has become a market creator in different markets whereas its competitors have followed suit.

Like DSM, most organizations will not ever operate at full maturity. From project to project, business to business, results will vary. Different stakeholders will hold conflicting opinions on their maturity in different areas of the Long-term Visioning Scorecard, and a company that shows high levels of maturity can lose ground with leadership change, reorganization, and impacts of culture.

Every project is unique, and the application of tools and processes that work in one situation may not work the same for the next. Some factors, like funding and resources, could be out of the individual team's control. The timing of an opportunity may not be right, or an ecosystem may be too nascent to fully engage. Focusing on opportunities and following the fundamental principles of the Long-term Visioning Scorecard will help each organization be more focused and more consistent.

Establishing an overall formal process was one of the most significant advances DSM made. The DSM leadership adopted the BINA methodology as its approach to building long-term growth through innovation. The BINA methodology forces more external thinking, greater cross-functionality, and a focus on opportunities robustly defined, before seeking to develop ideas. An organization would find it particularly challenging to rise to a level of maturity without having a process that ties critical steps of investigating and defining opportunities to a foundational set of principles and steps.

Yet even with a process there are creative elements that cannot be overlooked. Determining which trends to look at during the front end was a creative process that required thinking broadly about where Dyneema might play. The development of new value propositions was an inherently creative step. Blending the conditions and trends, with needs and possible value propositions, was also creative. Finally, working with the ecosystem was not simply an exchange of information. It was a creative process of imaging entirely new products and brand positions that would justify the cost of Dyneema.

While there needs to be a rigorous process that dictates what inputs to gather, there must also be the experience and creativity to use that process in a way that truly inspires the development of new opportunities and the organization to fund them.

Conclusion

Effective and efficient innovation is necessary for any company's long-term survival and growth. Companies in an industry must be prepared for paradigm shifts. Short of expensive acquisitions, waiting until the market shift is clearly evident before developing a solution is already too late to maintain competitiveness in one's industry. The market determines the timeline, not the company. To successfully compete and grow, a company needs to have a disciplined approach of ongoing development to be prepared when these shifts occur. Or as Wayne Gretzky put it, skate to where the puck is going to be.

While most companies are unlikely to operate at full maturity, the Long-term Visioning Scorecard is a useful tool to both help them define the performance of their current innovation structure and practices—with emphasis on R&D's role and alignment to the organization—and aid in the continuous improvement over time of that innovation infrastructure. This case study shows how companies can have an effective, disciplined procedure to create and execute

Reducing Uncertainty Aversion

One of the biggest challenges associated with driving new R&D platforms and investment is overcoming organizational resistance. Many attribute that resistance to risk aversion. We have found that *uncertainty aversion*, not risk aversion, holds organizations back. Uncertainty aversion occurs when the areas being investigated are new to the organization. The trick to reducing uncertainty aversion is to quickly ramp up the organization's familiarity with new areas, and the fastest way to do that is to help them engage directly with the ecosystem. An ecosystem working session allows the company to get to know new people working in new areas, which is different from a panel of experts. The goal is to really collaborate. This very human activity significantly reduces uncertainty by reducing unfamiliarity.

robust strategies to enhance their survival and growth through targeted long-term innovation.

References

Corporate Innovation Online. 2011. DSM—all out innovation. https://corporateinnovationonline.com/wordpress/wp-content/uploads/2010/06/DSM-Profile-Final1.pdf

Cotterman, R., Fusfeld, A., Henderson, P., Leder, J., Loweth, C., and Metoyer, A. 2009. Aligning marketing and technology to drive innovation. *Research-Technology Management* 52(5): 14–20. doi:10.1080/08956308.2009.11657585

Henderson, P. 2013. *You Can Kill An Idea, But You Can't Kill An Opportunity*. Hoboken, NJ: John Wiley and Sons.

Moore, G. 2007. To succeed in the long term, focus on the middle term. *Harvard Business Review*, July–August. https://hbr.org/2007/07/to-succeed-in-the-long-term-focus-onthe-middle-term

Young, K. M., Rosentiel, T. L., and Henderson, P. 2020. Long-term R&D strategy and planning. *Research-Technology Management* 63(2): 18–26. doi:10.1080/08956308.2020.1707002