Getting ahead

Technology and Innovation

Applying the lead user process to identify and implement new F&F technologies

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Technology and innovation initiatives at flavor companies often are misunderstood or, worse, mismanaged because of poor understanding of the relationships between technology, innovation and the company's business engine. This article will attempt to shed some much-needed light on the connections between these three variables, as well as the challenges in reaching a harmonious balance among them.

Definition of Technology and Innovation

The Merriam-Webster Dictionary defines technology as the "practical application of knowledge, especially in a particular area." In business, technology manifests itself in the form of "tools" that are used to accomplish a task. Innovation, on the other hand, is best characterized as the application of a technology—or the culmination of several technologies—to create something that is new or novel. In *The Fifth Discipline*, MIT's Peter Senge asserts that an idea becomes an innovation only when it can be replicated reliably on a meaningful scale at practical costs. Although the result of advancement in technology is the creation of a new tool, device, process, method or knowledge, innovation results in something that is brought to the marketplace as a solution, benefit or economical improvement over an existing item. Although technology and innovation can exist independently of each other in rare cases, a linked relationship in which technology feeds innovation and innovation, in turn, drives new technology often results in the most significant breakthroughs.

One of the best-known examples of the subtle distinction and dependent relationship between technology and innovation is the evolution of commercial flight. In December 1903 at Kitty Hawk, NC, Wilber and Orville Wright proved that powered flight was possible. However, it would take more than 30 years to turn this technology into an innovation that would serve the general public. The true breakthrough innovation came in 1935, when McDonnell Douglas introduced the DC-3—the first plane to support itself economically, as well as aerodynamically. The DC-3 brought together five critical technology components that together formed the first safe and cost-effective plane. A competitive plane introduced just a year earlier that included only four of the critical technologies failed, while the DC-3 successfully ushered in the era of commercial flight.

The 30 years of development time between invention and innovation for commercial flight is typical of a "basic innovation"—one that creates a new industry or changes an existing one. Unfortunately, that time line is hardly practical in this era in which corporations strive for breakthroughs to happen each quarter, rather than each decade. Today, organizations often implement a technology and innovation initiative with the expectation of generating revenue or developing a competitive advantage within a very tight time frame. When selecting a model or paradigm to support your technology platform, it's important to consider your company's strategic goals, culture and business structures in order to ensure success.

At FONA International, a model for our technology and innovation platform was selected based on its

New technology report

Enhancement of Shelf Life and Flavor Profile for Encapsulated Orange Oil

A case study in microencapsulation processing technology developed using the lead user process

A new microencapsulation processing technology was found to increase protection against oxidation substantially while also exhibiting a significant increase in low-molecular-weight volatile organic compound retention. This patent-pending process (FONATech Clean Flavor Technology, or CFT), developed using the lead user process, is based loosely on contemporary spray-drying techniques. The objective of this research is to determine and verify the performance of this new process technology. The data represented herein details notable differences between a CFT microencapsulated orange oil versus a typical spray dry of the same oil and carrier system.

The analysis of the CFT and the traditional spray-dry microencapsulates encompassed a full array of analytical techniques (i.e., total oil determination, surface oil determination, moisture analysis, headspace analysis). This communication will outline the results of an accelerated shelf-life study regarding the presence of limonene oxides, L-carvone and carveols. The shelf-life study was conducted in the following manner. Samples of each encapsulate were stored in a container representative of the packaging material commonly used for warehousing microencapsulated products. Representative containers then were placed in an incubator regulated at 45°C for a time period to simulate six months of shelf life. The products then were pulled from storage and prepared for analytical evaluation.

The analysis consisted of determining the remaining levels of limonene alongside the generation of off-taste components (i.e., limonene epoxides, carvone). This was accomplished by solvent extraction preparation, followed by separation on a gas chromatograph. The quantitative determinations utilized both an internal standard and correction factors for detector response. The results are reported in T-1.

T-1 Concentration of limonene and off-taste components after six-month simulated shelf life

Component	CFT (mg/g)	Spray dry (mg/g)
limonene	382 ± 2	168 ± 1
cis-limonene oxide	0.8 ± 0.1	11.7 ± 0.1
trans-limonene oxide	0.9 ± 0.1	6.5 ± 0.1
L-carvone	1.16 ± 0.03	16.2 ± 0.2
trans-carveol	1.9 ± 0.2	18 ± 2
cis-carveol	0.9 ± 0.1	9.1 ± 0.2

The presented data firmly established the reduction of oxidation and off-flavor proliferation contributed by limonene degradation. Although the analytical data exhibited notable differences with concentrations of limonene and its oxidation products, these differences extended to the organoleptic evaluation of this material. FONA's sensory group conducted a difference test on the materials to see if there was a perceivable difference between the flavor profile of the CFT microencapsulation and non-CFT spray dry in a sweetened beverage. The results showed that there was a significant difference between the samples at the 99.9% confidence level. The group commented that CFT-processed materials had a cleaner organoleptic presence regarding the natural orange profile, including the retention of the brightness attributes of the orange oil. This contrasted with the non-CFT-processed flavor that exhibited an adulterated profile, lack of brightness and off-note lingering.

Current flavor families using the CFT technology include citrus, exotics, mints, fruits and certain savory applications. Future work for this technology includes examination of functional ingredients and thermally labile components that could benefit from this microencapsulation process.

ability to adapt to various business scenarios, such as academic or strategic partnerships, as well as its ability to grow with our business. For FONA, in order to plan for and properly evaluate the effectiveness of a technology and innovation initiative, first it was important to understand the dependent relationship that exists between the development process and the business engine. Only this understanding will provide the insight necessary to quickly identify and deal with barriers and bottlenecks in the technology and innovation process.

The Cycles

The model we employ is made up of two distinct, yet dependent elements: the business cycle and the technology development cycle (F-1). These two cycles are linked in such a way that they are able to positively or adversely affect each other. For example, a well-funded and appropriately staffed technology development cycle often leads to the timely and efficient release of new products into the marketplace. This, in turn, contributes to revenue, further funding the technology and innovation budget. In contrast, a poorly funded and staffed technology cycle may not result in marketable products or increased revenue. This deficit actually can slow down business momentum, in addition to draining that engine financially, which further depletes the technology and innovation budget of resources.

To complicate things, there are components to each cycle that are highly variable and capable of hindering the entire process. On the technology development side, variables include staff size, concept complexity and scope, available resources, time dedicated to concept development, incubation period, and, finally, market acceptance of the product that is developed. The most common challenge on the business side of the cycle is coping with the difference between the sometimes slow speed of technology development and the ever-increasing pace of business momentum. The difference between the paces of these two cycles often creates a barrier that can threaten to upset the delicate balance between them. The good news is that there is a variety of strategies or paradigms that can be used to manipulate the rates of these cycles in order to provide a better balance.

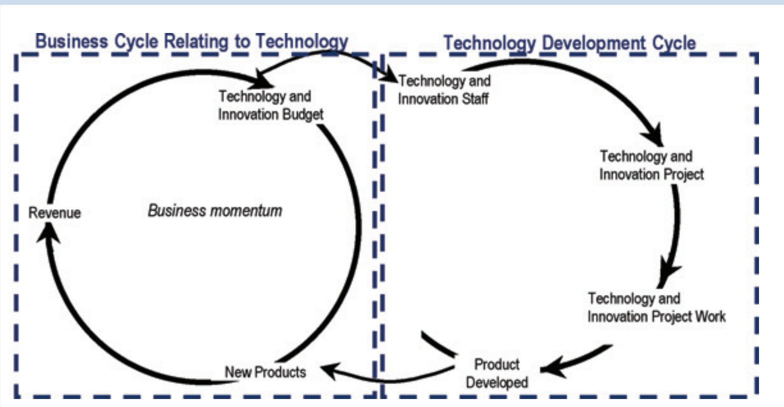
At FONA, we have elected to use the "lead user process" to identify new innovations at a faster rate than might be allowed by more traditional investigation and research models. Developed by Eric von Hippel at MIT and refined by 3M, the lead user process is an innovation model focusing on users that are on the leading edge of a company's target market, as well as leaders in related industries. These lead users typically face similar problems and need similar solutions to those of typical users, but in a more extreme form.

Consider an automobile manufacturer intending to design an innovative braking system. In a *Harvard Business Review on Innovation* article entitled "Creating Breakthroughs at 3M," von Hippel, Thomke and Sonnack explain that, if using the lead user process, the automaker would start by finding out whether any innovations had been developed by groups with a strong need for better brakes, such as racing teams. Next, it would look to a related but technologically advanced field in which people had an even greater need for better brakes, such as the aerospace industry, where very expensive vehicles and short runways have provided the perfect incentive to develop innovative elements, such as the antilock braking system.

The Lead User Process

Implementation of the lead user process officially starts with the formation of an interdisciplinary innovation team. Teams typically are made up of four to six people from marketing and technical departments, in addition to one member with strong project management and brainstorming skills who serves as project leader. Teams usually are expected to commit 12–15 h a week immersed in the project. Although the duration of each of the four phases will vary in length, participants should plan on four to six weeks for each phase, as well as four to six months for the entire project.

F-1



Phase one, laying the foundation: During phase one, the team identifies the markets it wants to target with the innovation, and defines the type and level of innovation desired by key stakeholders within the company. The team will need to be mindful of, and sensitive to, the development process and the resources that may be required to develop this innovation; this is an important step in justifying investment, developing ROI and ensuring stakeholder buy-in early in the process. Finally, a surface-level evaluation should be undertaken in order to determine whether the market displays a need for the innovation that you are considering offering.

Phase two, determining the trends: Phase two of the lead user process focuses on pinpointing the current trends in product use. The innovation team first will need to identify experts in the field they are exploring who have a broad view of emerging technologies and current product trends. This will enable the team to later recognize users that are ahead of that trend.

Phase three, identifying lead users: Then the team begins an extensive networking process in order to identify users at the leading edge of the target market and related markets. Through this networking, the team engages lead users in finding technologies that synergize as a potential source for innovative ideas and preliminary product formulations. The team begins to assess how these concepts fit with the company needs and expectations that were defined in phase one. Phase three is the phase with the most variable time line from project to project.

Phase four, developing the breakthroughs: In phase four, the innovation team focuses on moving preliminary concepts toward completion through an iterative process of idea incubation, evaluation and refinement. Often, this phase begins with an intensive group workshop that includes lead users and ultimately results in a presentation to senior management of a product that precisely fits the company's needs. Although the innovation team then may be disbanded, one member should be assigned to the team who will commercialize and release the product to the marketplace in order to ensure that the knowledge gained during the lead user process remains useful as the product or services are developed and marketed.

FONA's implementation of the lead user process to increase the rate at which we identify and release innovations to our target market has proven to be a valuable addition to our technology and innovation initiative. Producing innovations at a rate that meets the needs of our business cycle has enabled us to build a momentum that is crucial to growth during the first years of any initiative. In designing and evaluating your own technology and innovation process, you would do well to consider the unique characteristics of your business and technical engines, and to investigate the tools available to affect and manage the momentum of each.

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