The Next Frontier of Flavor Innovation

From Molecule to Market

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Driftwell's failure shows that speed without cross-stage integration — from flavor design to validation — can derail even well-designed innovations.

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Agenda

01 | Rethinking the flavor innovation workflow

02 | Enabling technologies for flavor innovation

03 | Opportunities and outlook for the next era of flavor innovation

1. Rethinking the flavor innovation workflow

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> "It's hard to stay ahead of fast-changing flavor trends and quickly identify the fruit and juice flavors consumers truly want."

A leading beverage brand

> "We're constantly seeking new ways to enhance cooling or tingling sensations while reducing harshness beyond traditional flavor systems."
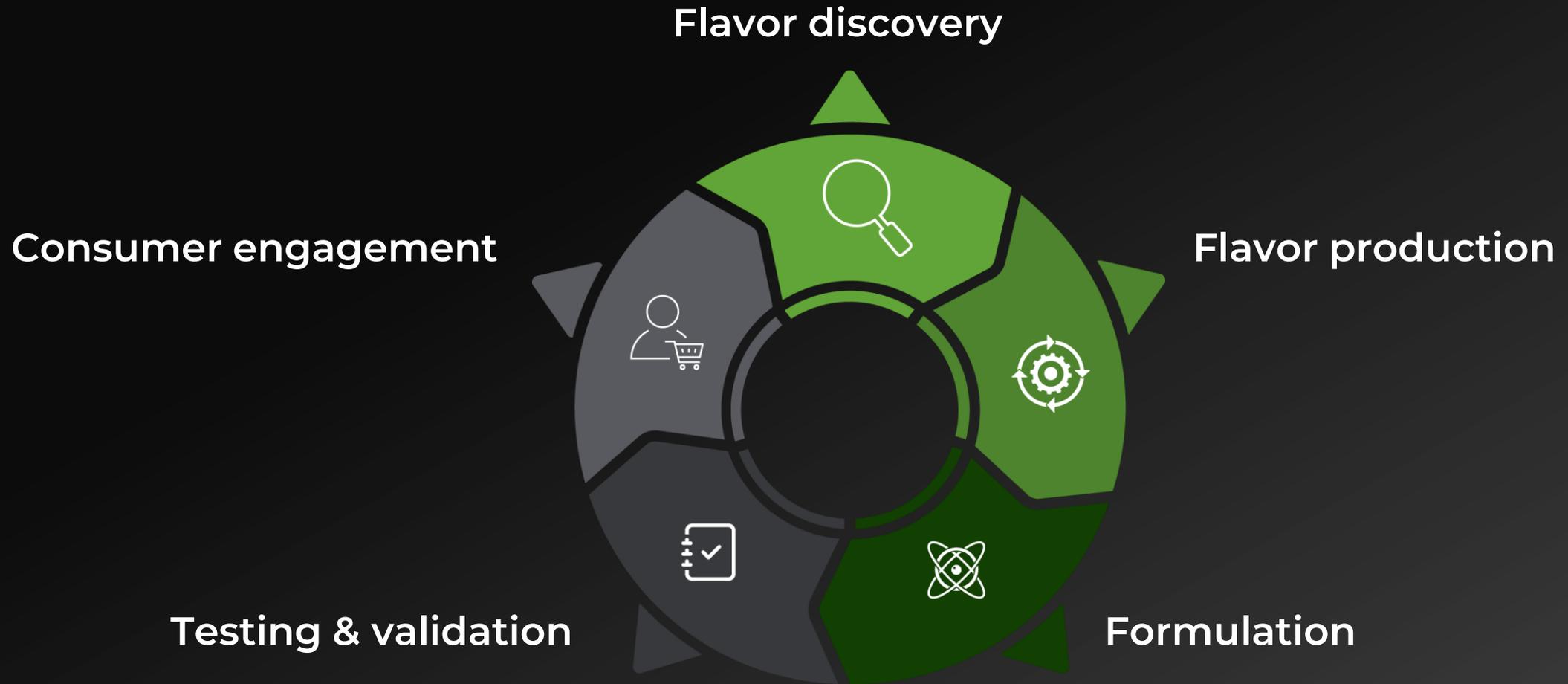
A leading tobacco company

> "We're always looking for ways to mask cacao bitterness with minimal additives, but cost and sustainability remain major challenges for natural flavor sources in the EU."

A prominent chocolate and cocoa manufacturer

Flavor innovation stages

Flavor discovery

Flavor production

Consumer engagement

Formulation

Testing & validation

Evolving trend in flavor innovation

Givaudan recently partnered with biotech firm Nuritas to leverage AI-based peptide discovery for novel flavor ingredients.

NIQ acquires Gastrograph AI to strengthen predictive flavor intelligence through advanced sensory modeling.

Spray Tek unveils plant-based encapsulation breakthrough to boost flavor release and stability.

| February 2024 | January 2025 | April 2025 | April 2025 | May 2025 |

Lallemand Brewing partners with EvodiaBio for its yeast-based aroma ingredient.

Lay's "Do Us A Flavor" contest showcases consumer-created flavors with 700,000 submissions.

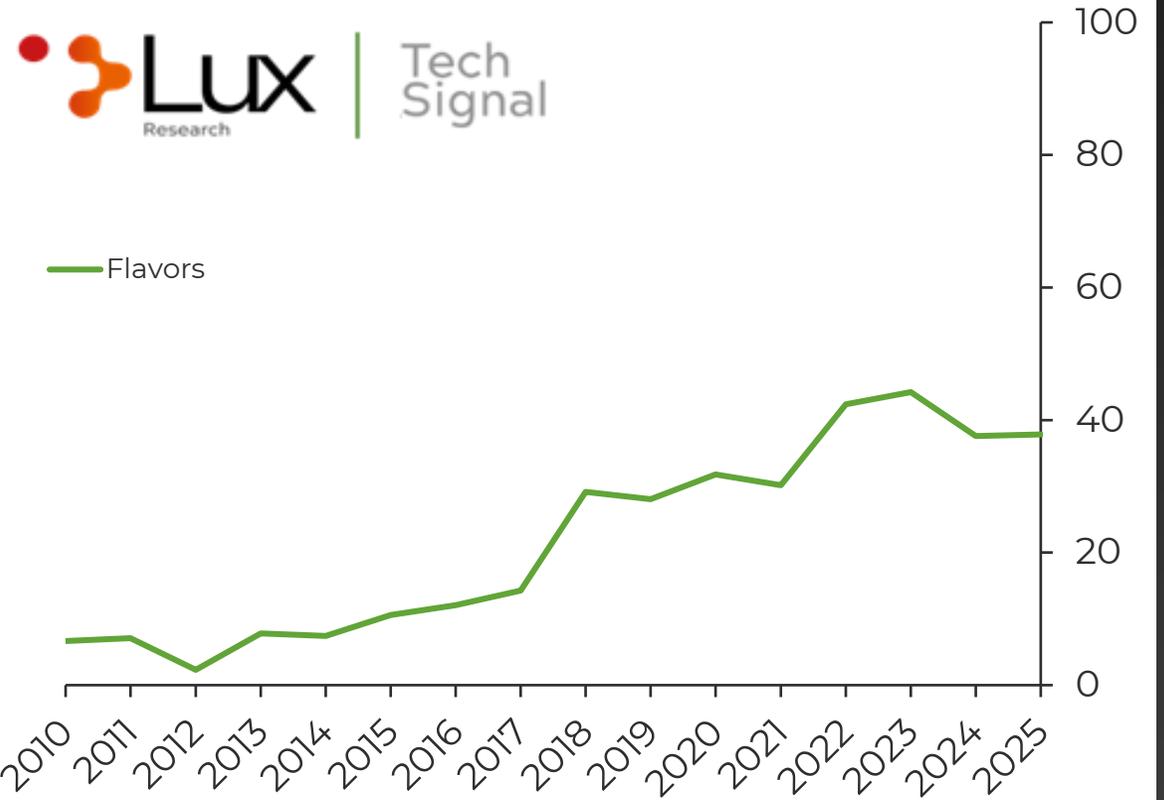# Where does flavor innovation truly happen in your workflow?

2. Enabling technologies for flavor innovation

Signals shaping flavor innovation

Flavor becomes a systems science

Predictive and personalized flavor intelligence

Biomanufacturing of natural flavors

— Flavors

Food flavors

- Corporates drive innovation, with startups gaining momentum.

- Synthetic and legacy food flavors offered by leading corporates like Givaudan and International Flavors & Fragrances (IFF) still take the front seat, with growing diversification into natural flavors.

Flavor innovation stages and their relevant technology categories

Flavor discovery
- AI-driven flavor-design platforms
- Molecular & receptor-based taste discovery
- Advanced analytical & metabolomic flavor mapping

Consumer engagement
- Consumer cocreation platforms
- AI & data platforms

Flavor production
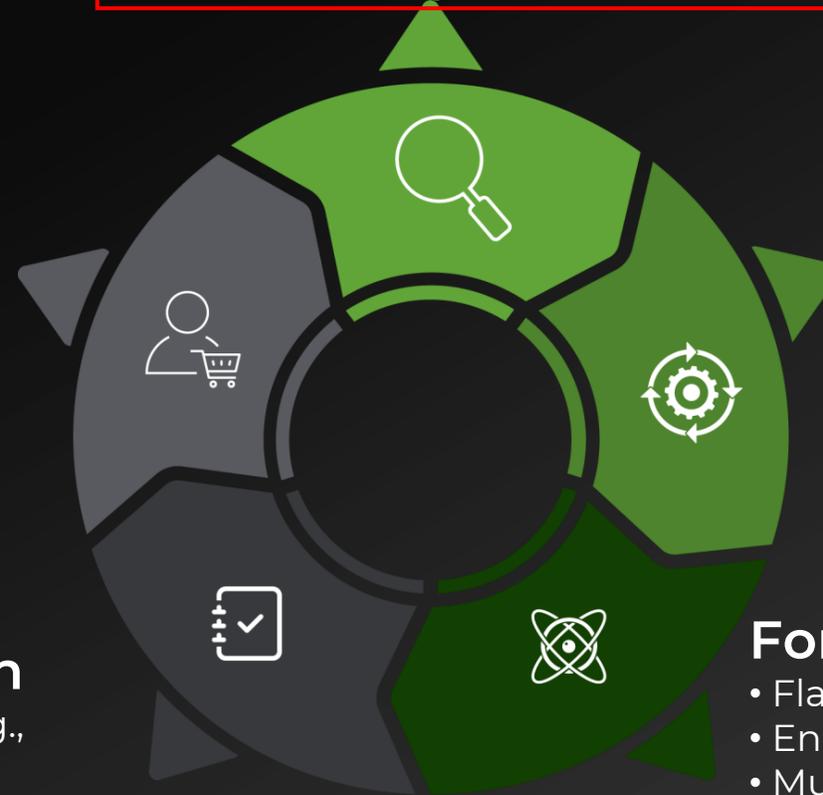- Precision fermentation and synbio platforms
- Enzymatic biotransformation systems
- Solvent-free/advanced extraction systems

Testing & validation
- Digital sensory devices (e.g., e-tongue, e-nose)
- AI & data platforms

Formulation
- Flavor modulation
- Encapsulation and carrier systems
- Multisensory and trigeminal actives
- AI-led formulation

Case study

OFI resorts to AI to capture the booming global cacao flavor trends

- AI analyzes recipes, menus, and e-commerce data to predict emerging cacao flavor trends.

- AI analysis revealed an "East meets West" trend: Western consumers adopt Asian flavors (dragon fruit, sesame), while Eastern markets explore Western notes (salted caramel, marshmallow).

LUX TAKE

While AI helps uncover new trends for flavor innovation, companies should remain cognizant of the quality of the data sources and short-term unsustained consumer shifts.

ofi
make it real

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Case study

Chi Botanic's USDA-funded vanilla 2.0 aims to replace synthetic vanillin

- It is developing *Vanilla planifolia* plant cell cultures to produce vanillin and related phenylpropanoid compounds.

- The project received a USD 175,000 USDA SBIR* Phase I grant to assess scalable domestic vanilla production.

LUX TAKE

Synbio and fermentation are progressing in natural flavor production, but plant cell culture remains early-stage, with scaling and cost hurdles.

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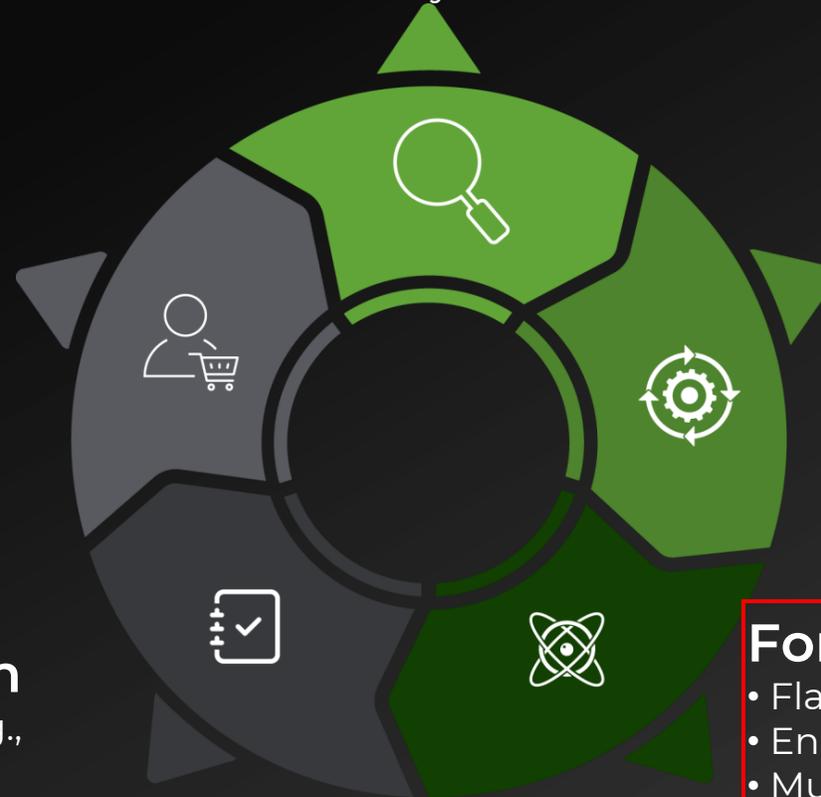- Precision fermentation and synbio platforms
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Case study

Multisensate system for trigeminal flavor effects

- Takasago developed a multisensate blend combining cooling (menthol type), warming (vanillyl butyl ether), and tingling (spilanthol/jambu) agents for immediate and prolonged sensations.

- The system improves onset intensity and cross-sensate synergy while balancing harshness cooling across food, oral care, and personal care applications.

LUX TAKE

The system highlights the importance of trigeminal modulation as a route to dynamic and layered flavor experiences, advancing beyond taste chemistry to full multisensory design.

TAKASAGO

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Case study

E-nose and sensory integration for flavor profiling

- FlavorActiV and Alpha MOS partnered to integrate e-nose analytical technology with human sensory training, enabling automated detection and interpretation of aroma and flavor.

- The e-nose uses flash gas chromatography for volatile analysis, while FlavorActiV provides trained sensory panels, calibration kits, and data interpretation through its FlavorForensics platform.

LUX TAKE

E-nose systems mark a key move toward AI-driven sensory evaluation, offering an objective aroma profiling, though hardware sensitivity and data consistency remain hurdles.

3. Opportunities and outlook for the next era of flavor innovation

Translating technology positioning into flavor innovation strategy

Foundational enablers

- Flavor modulation
- AI-led formulation

Frontier enablers

- Precision fermentation
- Receptor-based discovery
- AI-driven discovery

Supporting tools

- Metabolomic mapping
- Enzymatic biotransformation
- Encapsulation systems
- Multisensory actives
- AI sensory analytics
- Advanced extraction

Low strategic fit

- Digital sensory devices

INNOVATION LEVERAGE

INTEGRATION FRICTION

Key takeaways

1
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Flavor innovation is evolving from a linear process to a connected ecosystem.

Biotechnology, data science, and sensory design are linking together to drive faster, more predictive product development.

2
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Biotechnology and precision fermentation enable consistent lab-based production of natural ingredients.

This improves supply reliability, though scale-up cost and complexity remain challenges.

3
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AI-powered sensory analytics and predictive modeling are transforming how brands understand taste perception.

This enables more tailored, data-driven flavor experiences across markets.

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