Ingredion

2019 SPRING CONFERENCE

Innovative starch based solutions in dairy & dairy free applications

CORINNA FAUSTMANN

EMEA DAIRY APPLICATION INNOVATION MANAGER

MAY 10TH, 2019

Dairy market worth USD 223 billion in EMEA

Highest growth expected in Middle East & Africa

Western Europe
2017 = **USD 128 bn**
CAGR 2018-2022 = **2.4%**

Eastern Europe
2017 = **USD 45 bn €**
CAGR 2018-2022 = **5.1 %**

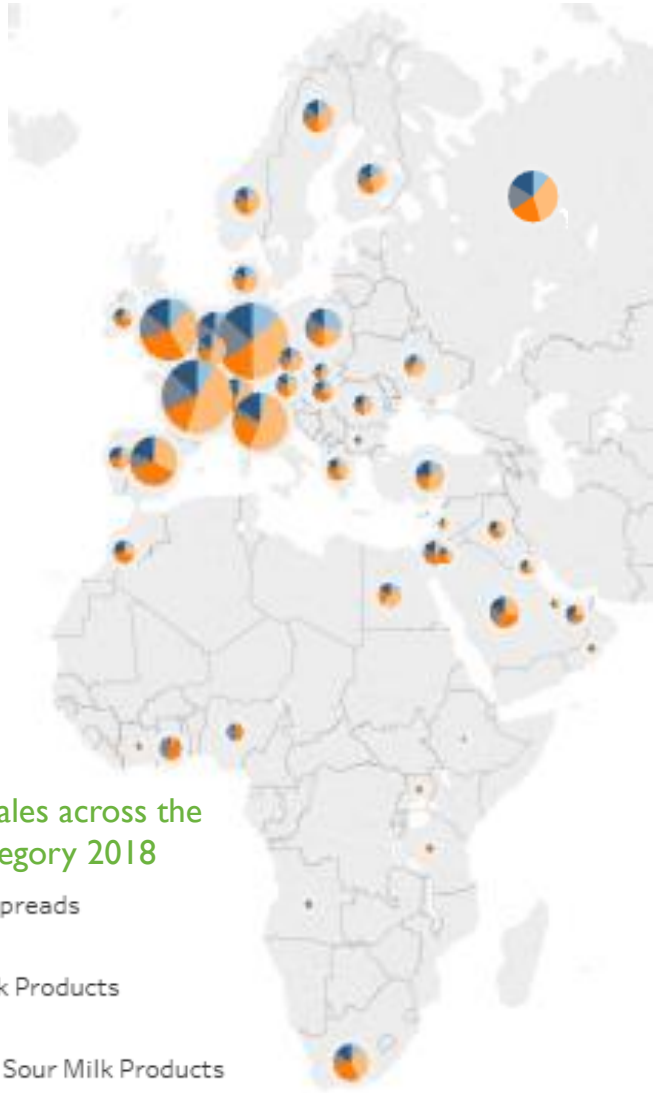
Middle East & Africa
2017= **USD 50 bn**
CAGR 2018-2022 = **7.9%**

EMEA
2017 = **USD 223 bn**
CAGR 2018-2022 = **4.3 %**

Ingredion

Source: Euromonitor, Dairy, & Ice-cream, March 2018

Innovation in dairy needs to be mindful of regional differences



Dairy Retail Sales across the World by Category 2018

- While **dairy sales are strong** almost everywhere in the world, **different categories** are driving revenue in different markets
- **Cheese** is driving the bulk of **revenues in Europe** while **drinking milk** is the key contributor to sales in the **Middle East and Afr**ica.
- **Dairy desserts** and **fromage frais** see an upward trend in **Western Europe**, while **chilled snacks** is a big revenue booster in **Russia**.

Ingredion

Source: 9 Dairy Trends for 2019, Euromonitor Passport

Top 3 trends in Europe

(1) 'Clean' is the new supreme

- Clean & simple product offerings

(2) Plant based 2.0 - 'Go Green'

- Vegan (Dairy alternatives) recipe development

(3) Indulgent health

- Good for you but yummy

Ingredion

‘Clean’ is the new supreme

Transparency

Desserts with “no nasties”

Recognizable

Ancient grains

- Consumers care about transparency and **younger consumers care the most**. A majority of consumers still does not understand most on-pack symbols and claims.
- The **“free range”** claim is expected to continue growing strongly in EMEA as it reassures consumers about the quality of eggs and milk.
- **Organic** and **No additives/preservatives** among the fastest growing claims in EMEA

Organic stirred yogurt with 5grains (quinoa, millet, linseed, sunflower and squash) and honey, France

Kaufland, low fat organic quark, Germany

Ingredion

Source: Clean label, Plant Based and Sugar reduction, Innova Market Insights, 2018

Plant Based 2.0 – 'Go Green'

New alternative ingredients

Probiotics meets dairy free

Oats everywhere

Matching dairy's taste and texture

- **Veganism** is now claimed to be the **biggest lifestyle movement** of the 21st century.
- Plant-based ingredients expand beyond almond to include **walnut and macadamia nuts**.
- Popularised by coffee shops, the **popularity of oats** extends beyond Nordic countries, and in an attempt to highlight gut health, probiotic claims now feature alongside **plant-based/vegan claims**.

Cacaolat Veggie drink with oatmeal and gluten-free cocoa, Spain

Tnuva soy-based yoghurt matching flavour, texture and packaging, Israel

Ingredion

Source: 9 Dairy Trends for 2019, Euromonitor Passport

Indulgent health

- Low fat
- Cake-inspired products
- Confectionery meets milk
- Fermented desserts

- Dairy is chosen first and foremost on its health credentials but **taste is rising fast** up the ranking.
- There is an increasing emphasis on marketing dairy on its taste credentials, with **playful packaging**, quirkier fonts and **indulgent flavours** products that are primarily (though not exclusively) aimed at **children and trying**
- Pairing between health and indulgence favouring **low fat** products

Muller Italian inspired, fat free, smooth hazelnut yoghurt, UK

Danone two trays of tiramisu flavoured Greek yogurt dessert, Czech Republic

Source: 9 Dairy Trends for 2019, Euromonitor Passport

Example: From milk substitutes to organic, indulgent, low fat beverages

Many dairy brands try to tap into one or more of the trends that are mentioned playing in different spaces at the same time

100% Vegan

Organic

FSC Certified

Netto Chocolate flavoured organic oat drink. Germany

Indulgent

Low fat

Convenient

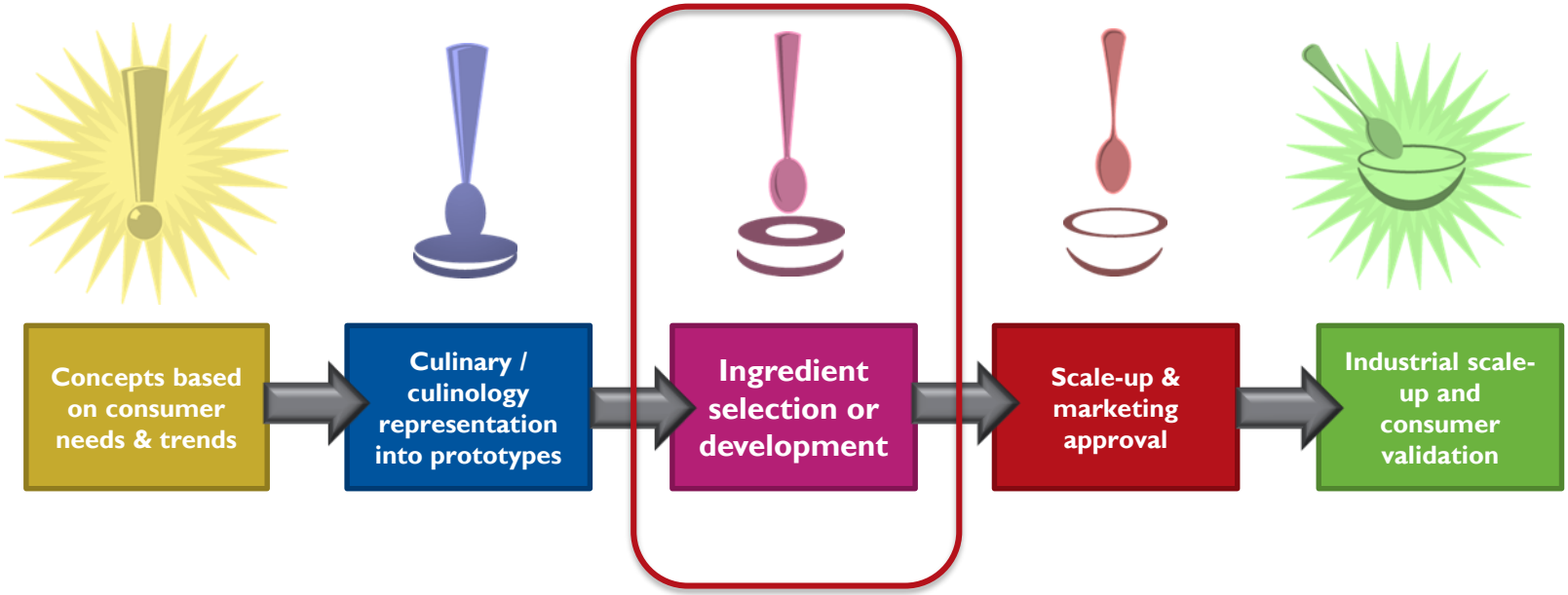
Ingredion

Source: NPL Innova Market Insights, 2019

Ingredion

New product development at Ingredion

Product & Concept development



Gluten-free bread

Authentic & free from additives

Clean label Greek-style yoghurt

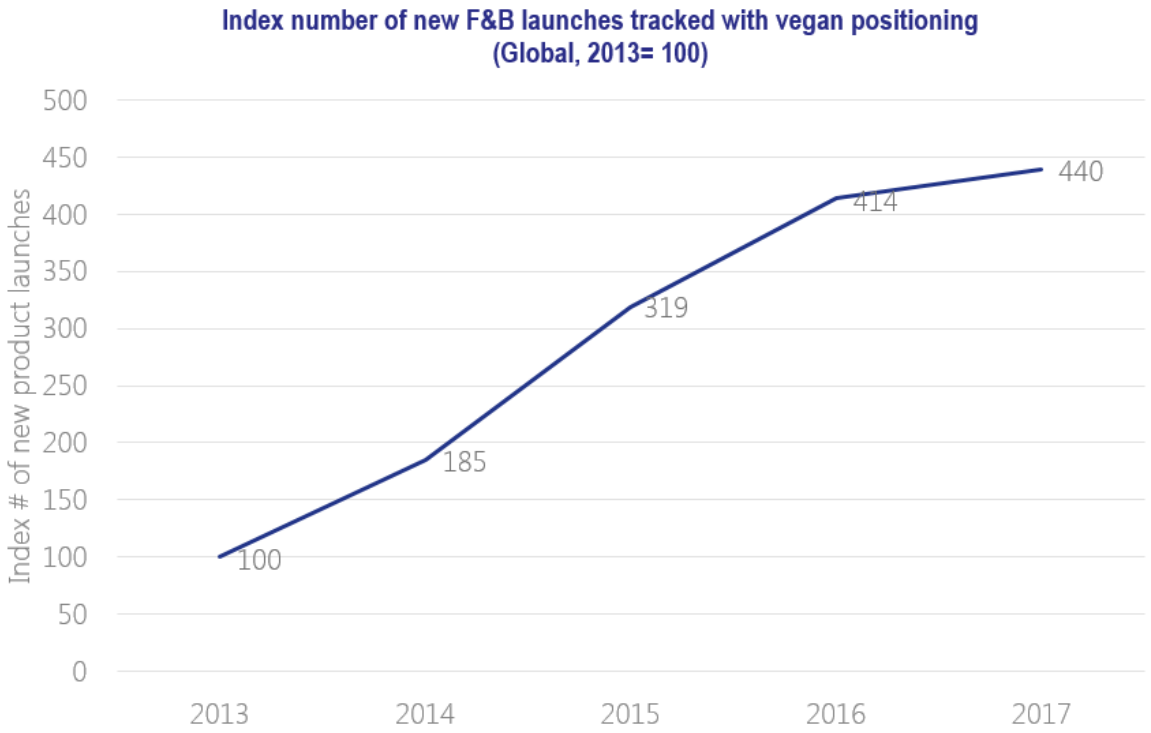
Ingredion

Ingredion

Example:
Vegan cheese product

Vegan positioning continues to grow

Growth of vegan positioning launches



Annual growth rate

+44.8% Average annual growth of F&B launches tracked with vegan positioning (CAGR, 2013-2017).

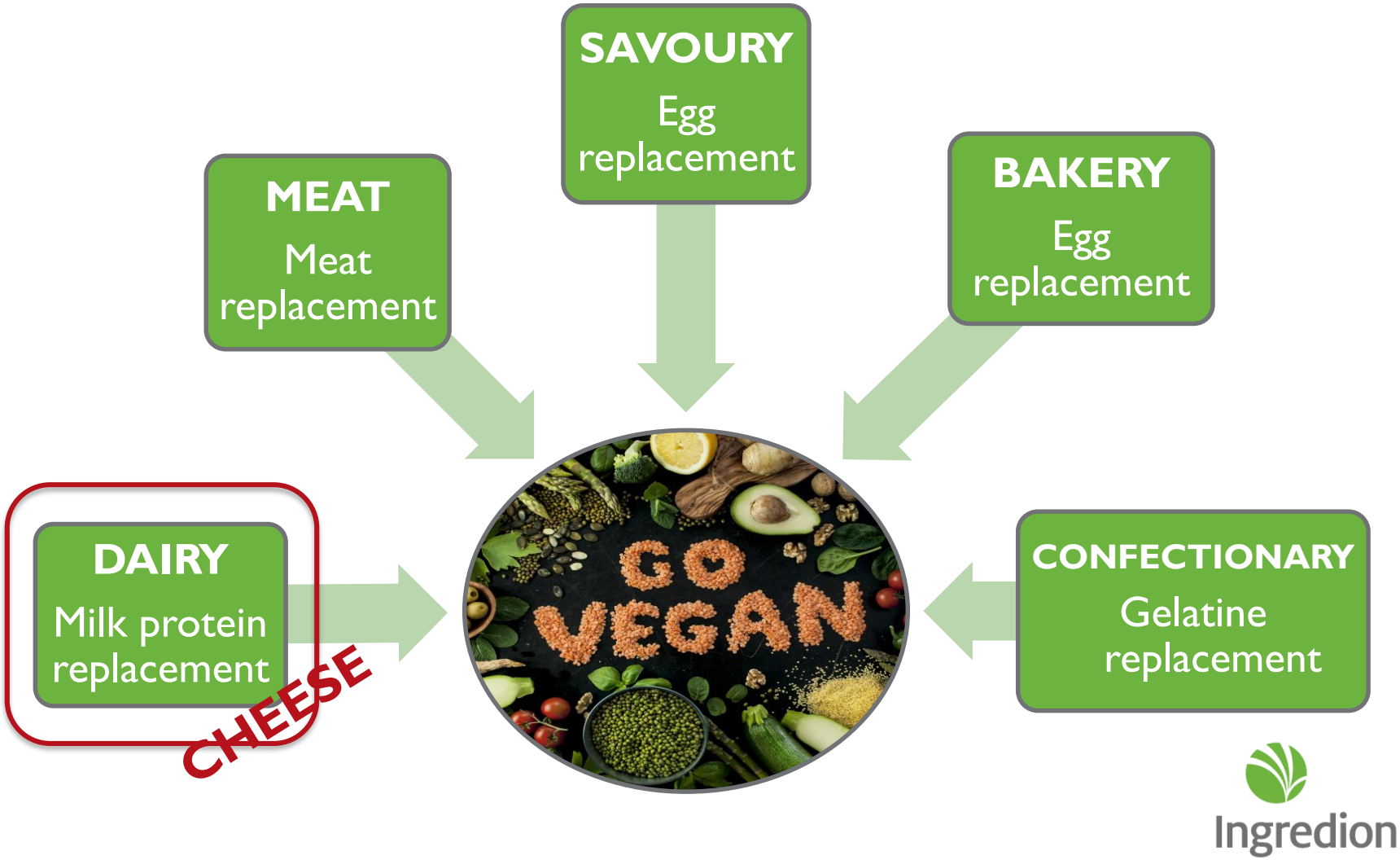
Synnove Go Vegan Cheese Slices

Norway, Nov 2017

Ingredion

Source: Innova market insights, March 2018

INGREDION: Vegan product application areas



Ingredion

Milk protein replacement: Dairy analogue (vegan cheese)

with PRECISA 655S to improve elasticity for pizza melt

Ingredients	Ingredion Solution
Water	43.78
Vegetable Fat	25
GEL'N'MELT	**10**
PRECISA 655S	**9**
FLOJEL 60	**6**
N-CREAMER 2111	**1.5**
National M2	2
Salt	1.7
Cheddar flavour *(Givaudan)*	0.8
Potassium sorbate	0.1
Titanium dioxide	0.1
Beta carotene 1.3% emulsion	0.023
TOTAL	**100**
% protein	**0**
% fat	**25**
% fat in DM	**47.5**
% moisture in fat free basis	**63.1**

Vegan®

Preparation (Stephan Cutter):

- Premelt fat
- Put water, melted fat & dry ingredients in the Stephan cutter
- Heat to around 50° C and mix at 1500 RPM for 2 min
- Check for lumps, heat up to 90° C at 1500 RPM
- Once at 90° C, hold 5 minutes at 1500 RPM
- Fill hot into containers
- Blast cool to T above 0° C
- Store at 4° C

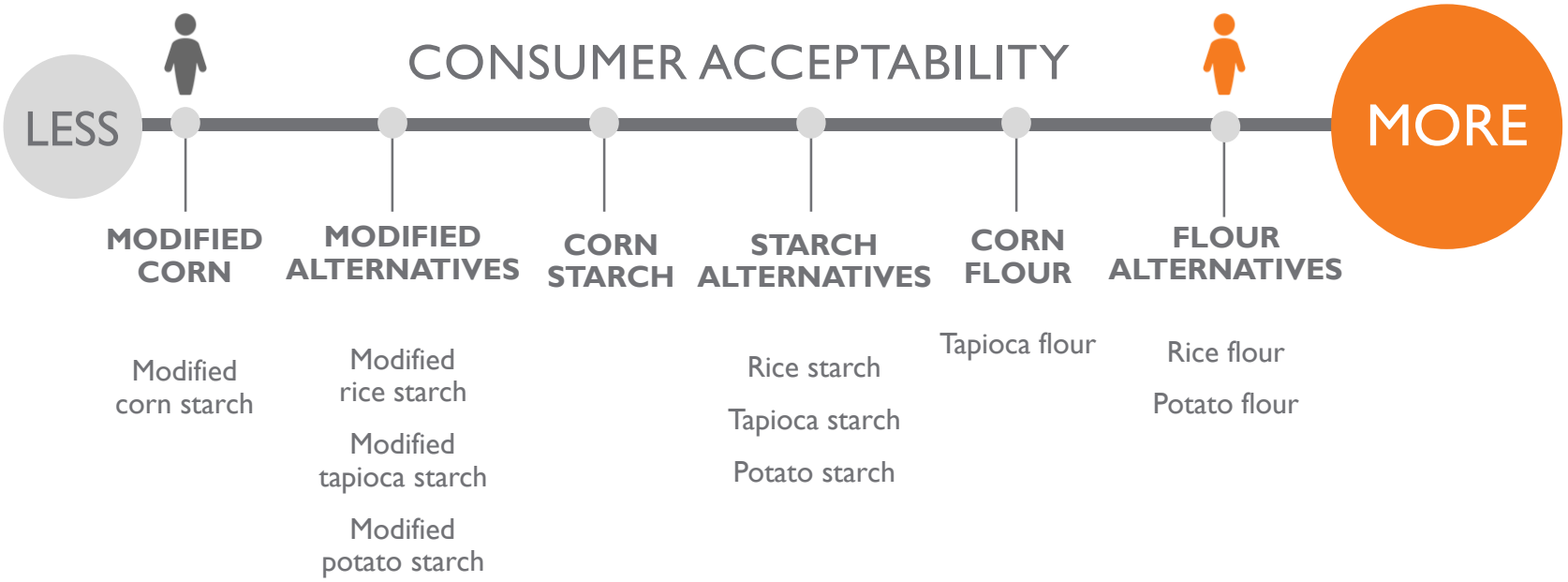
Ingredion

Ingredion

Novation® products Functional performance in any process

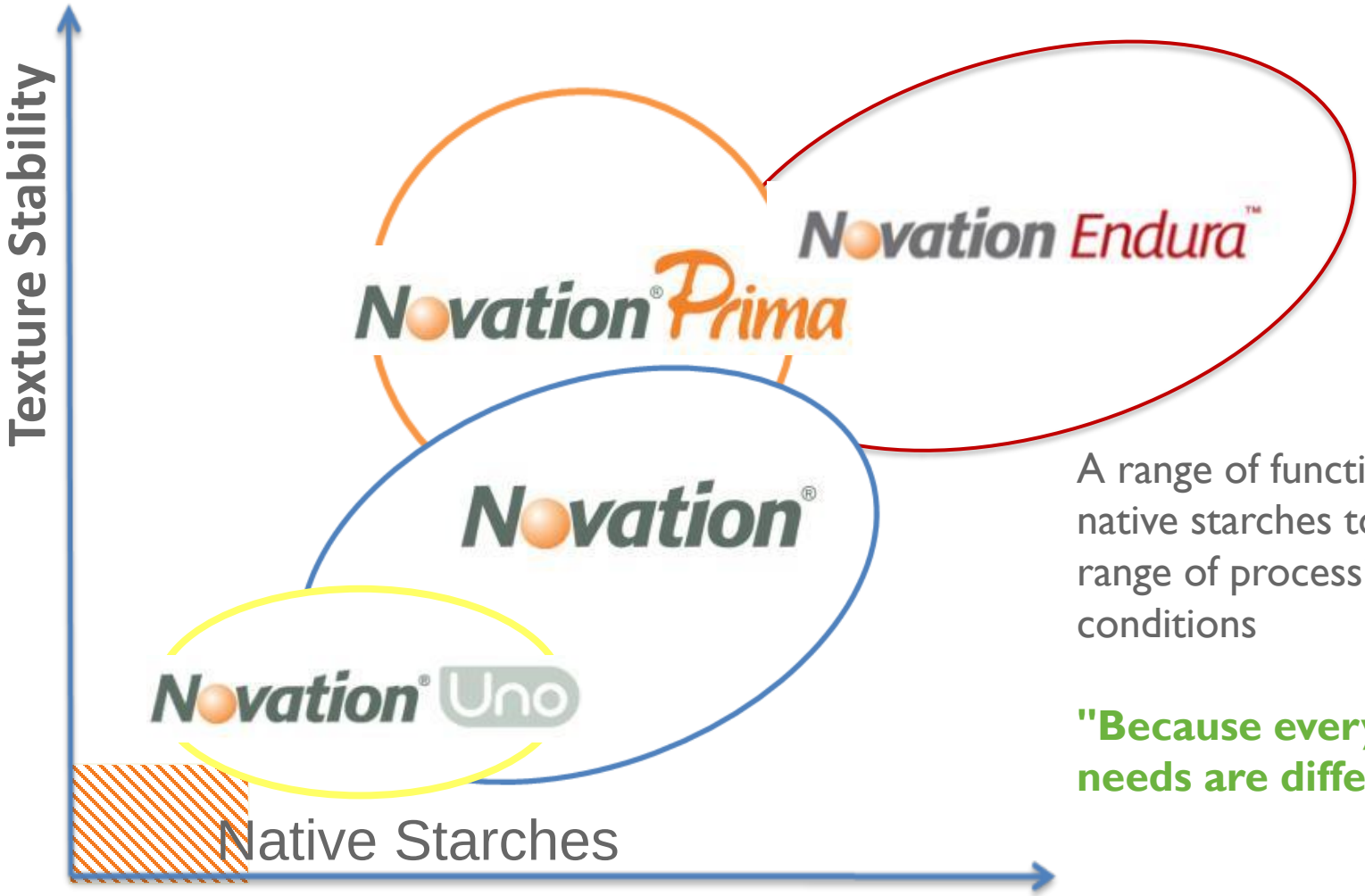
Clean label trend in Food

Label acceptance



Ingredion

NOVATION® for Functional Performance



A range of functional native starches to meet a range of processing conditions

"Because everyone's needs are different"

NOVATION® Indulge - *Co-texturizer for fat mimetic*

Ingredion

Dairy focus segments of Ingredion

Yoghurt
Stirred & Set

Dairy Desserts

Cheese
Processed & Analogue

Fruit Preparation

Dairy Drinks
Fermented, Milk, Milk/Juice

Dairy alternatives
Yoghurt, Cheese, Beverages

Ice Cream

Ingredion

Key value propositions in Dairy

Cost Optimisation

- **Protein Replacement**
  in fermented products, dessert & cheese
- **Fat Replacement**
  in fermented products, dessert & beverages
- Yield improvement
  in cheese products

Clean Label

- **Modified Starch Replacement**
- Partial Hydrocolloid Replacement e.g. gelatine & carrageenan in fermented products & desserts

Passive Nutrition

- **Fat Replacement**
  in fermented products, dessert & beverages
- Sugar Replacement
  in fruit preparation

Texture Improvement

- Enhanced Creaminess
- Texture Differentiation
  e.g. gelling, melting
- Syneresis prevention

Ingredion

Functionality of Starch as Milk Protein Replacer

In e.g. yoghurt, cheese and desserts

Functionality of milk protein

Milk protein binds water & increases total solids which leads to …

- increase in body and viscosity
- reduction of syneresis
- increase of hardness/gratability
- increase of meltability
- improved sensorial characteristics

… and it acts as emulsifier.

Functionality of speciality starch

Depending on the modification and source starch can lead to …

- higher viscosity
- enhanced creaminess
- less water separation
- emulsification
- improved gratability/cutability through gelling
- better meltability
- optimized spreadability

Ingredion

Example: Product portfolio for yoghurt

Recipe cost reduction in yoghurt by replacing milk protein and milk fat

PURITY 87™
N-CREAMER® 221
THERMFLO™
THERMTEX™
Viscosity & mouthfeel

NOVATION™ PRIMA 303
NOVATION™ Endura 0100
NOVATION™ 8300
Viscosity & mouthfeel (clean label)

N-DULGE™ C1
N-DULGE™ C2
N-DULGE™ SA1
NOVATIONTM INDULGE 3920
NOVATION™ INDULGE 1720
Creaminess & mouthfeel

ELASTIGEL™ 1000 J
Gelling – soft set

Ingredion

Recipe: Clean label protein replacement in stirred yoghurt (e.g. Greek style)

Ingredients	Control	Ingredion Solution
Fresh skimmed milk	70	83.20
Cream 40% fat	18	13
SMP	12	1
NOVATION® Endura 0100	-	1.80
NOVATION® Indulge 3920	-	1
TOTAL	**100.00**	**100.00**
% protein	**7.09**	**5.1**
% fat	**7.05**	**3.5**

Preparation:

- Blend dry components and incorporate into the milk
- Preheat to 65° C
- Homogenize (2nd/1st stage) @ 30/100 bar
- Pasteurize @ 95° C for 6min
- Cool to 43° C and inoculate with standard culture
- At pH 4.75 cool down to 20° C
- Static smoothing and fill the yoghurt into cups
- Store at 4° C

Ingredion

Recipe: Mouthfeel improvement in fruited yoghurt

with Novation® Indulge 1720 in the fruit prep

Ingredients	Ingredion solution
Sugar	40
Frozen strawberries	36
Water	21.2
Novation Prima 600	**2.3**
Novation Indulge 1720	**0.5**
TOTAL	**100.00**

Preparation (Stephan cutter):

- Mix dry powders
- Add dry powders into the mashed strawberry and mix properly
- Heat to 90° C
- Hold for 5 - 10 min (check starch microscopy)
- Cool to 20° C under agitation
- Fill into beakers
- Store at 4° C

Ingredion

Recipe: Clean Label UHT Crème Dessert

Ingredients	Modified starch	Starch
Skimmed Milk	71.37	71.07
Cream 32% Fat	10.8	10.8
SMP	2.5	2.5
Sugar	**10**	**10**
PURITY MAC	5	-
NOVATION PRIMA 303	-	5.3
Vanilla flavour (Symrise)	0.08	0.08
Colour (GNT)	0.15	0.15
Sodium citrate	0.1	0.1
TOTAL	**100**	**100**
% protein	**3.5**	**3.5**
% fat	**3.6**	**3.6**

Preparation:

- Pre- blend dry ingredients
- Add to milk with high speed/shear mixer
- Hydrate for 1h
- In-line processing heat exchanger (ASEPTO, tube set up)
- Preheating: 60° C
- Homogenization @ 100/30bar
- Sterilization process: 60sec. @ 130° C
- Cool down to 4° C
- Filling into beakers
- Refrigeration temperature 4° C

Ingredion

Recipe: Vegan coconut vanilla Crème Dessert

Ingredients		20% sugar reduction
Coconut milk 19% fat	85.27	86.77
Sugar	10	8
NOVATION PRIMA 303	**4.5**	**4.5**
NOVATION INDULGE 3920	**-**	**0.5**
Vanilla flavour (Symrise)	0.08	0.08
Colour (GNT)	0.15	0.15
TOTAL	**100**	**100**

Preparation:

- Pre- blend dry ingredients
- Add to milk with high speed/shear mixer
- In-line processing heat exchanger (ASEPTO, tube set up)
- Preheating: 60° C
- Homogenization @ 100/30bar
- Sterilization process: 60sec. @ 130° C
- Cool down to 4° C
- Filling into beakers
- Refrigeration temperature 4° C

Ingredion

Ingredion

Innovation in cheese products

Processed & Analogue/vegan "cheese"

BLOCK

SPREADABLE

MELTABLE

NOT MELTABLE

Pizza Gratin

Burger slice

Sandwich slice

Semi-Hard

Portions

Sausages

Tubs/Jars

Squeeze tubes

Ingredion

Key value propositions in processed, analogue & cream cheese

Cost Optimisation

- **Protein Reduction**
- Fat Reduction
- Cheese Reduction
- Yield improvement

Texture Improvement

- Improved Gratability/Cutability
- Better Meltability
- Optimized Spreadability
- Enhanced Creaminess
- Texture Differentiation

Passive Nutrition

- Fat Reduction

Ingredion

Product portfolio for Processed cheese

Recipe cost reduction in meltable block processed cheese by replacing casein

GEL'N'MELT™
Meltability
Soft gel

N-CREAMER® 2111
Emulsification

PURITY 87™
N-CREAMER® 221
NATIONAL FRIGEX™
Viscosity & mouthfeel

PRECISA® 655S
Flexibility and bendability
Shelf-life stability

FLOJEL® 60
ELASTIGEL™ 1000 J
Firmness/ gratability
Strong gelling @ high temp.

PRECISA® GEL 04
Strong gelling @ lower temp.

Maize/waxy maize
Tapioca
Sago

Ingredion

Protein reduction: 6% protein analogue pizza cheese

with Gel'N'Melt, Precisa 655S & Precisa Gel 04

Ingredients	T3
Water	44.18
Palm / coconut fat	22
GEL'N'MELT	**10**
PRECISA 655S	**5**
PRECISA GEL 04	**4**
Rennet Casein	5.1
Skimmed Milk Powder	5
Emmenthaler flavour *(Givaudan)*	1.8
Salt	1.5
Melting salt *(BK Giulini)*	1
Potassium sorbate	0.2
Citric acid monohydrate	0.2
Beta carotene 1.3% emulsion	0.0154
TOTAL	**100.00**
% protein	**6**
% fat	**22**
% fat in DM	**42.3**
% moisture in fat free basis	**61.3**

Preparation (Stephan Cutter):

- Premelt fat
- Add cold water into bowl, add rennet casein, emulsifying salt & salt – mix for 3 min at 900 RPM
- Add all other ingredients except fat – mix for 3 min at 900 RPM
- Check for lumps, mix for 30 sec at 900 RPM to remove lumps
- Add premelted fat – mix for 1 min at 600 RPM
- Heat up to 88°C at 900 rpm; heating up time should take at least 5 min
- Hold at 88°C for 3 min
- Hot filling into containers
- Blast cooling to T above 0°C
- Store products at 4°C

Ingredion

Milk protein replacement: Dairy analogue (vegan cheese)

with PRECISA 655S to improve elasticity for pizza melt

Ingredients	Ingredion Solution
Water	43.78
Vegetable Fat	25
GEL'N'MELT	**10**
PRECISA 655S	**9**
FLOJEL 60	**6**
N-CREAMER 2111	**1.5**
National M2	2
Salt	1.7
Cheddar flavour *(Givaudan)*	0.8
Potassium sorbate	0.1
Titanium dioxide	0.1
Beta carotene 1.3% emulsion	0.023
TOTAL	**100**
% protein	**0**
% fat	**25**
% fat in DM	**47.5**
% moisture in fat free basis	**63.1**

Vegan®

Preparation (Stephan Cutter):

- Premelt fat
- Put water, melted fat & dry ingredients in the Stephan cutter
- Heat to around 50° C and mix at 1500 RPM for 2 min
- Check for lumps, heat up to 90° C at 1500 RPM
- Once at 90° C, hold 5 minutes at 1500 RPM
- Fill hot into containers
- Blast cool to T above 0° C
- Store at 4° C

Ingredion

Segment products for Cheese products ('natural' cheese)

Recipe cost reduction through yield improvement by replacing protein with starch DM

PRECISA™ 680

Yield improvement in natural cheese & quark

Ingredion

Ingredion

Questions?