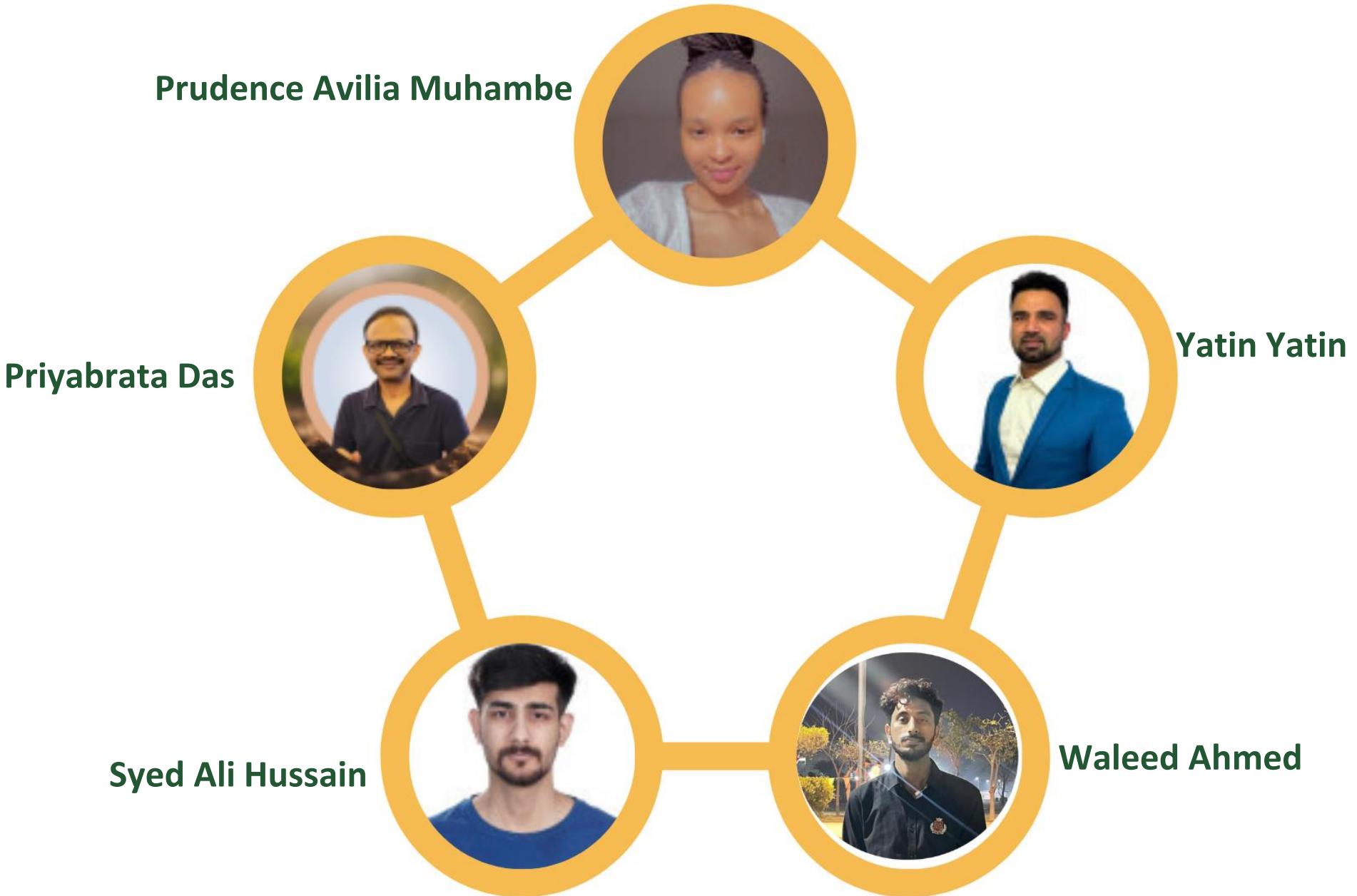




# **Smart and Sustainable Dairy Production in Bavaria**

**version 1.0  
19.11.2025**

# Team Group 6





# Historical Overview of Milk Farms in Germany

# Historical Background (1960-1980)

Milk production in Germany began to modernize in the 1960s, transitioning from traditional methods to more mechanized systems. By the late 1970s, the introduction of artificial insemination significantly increased milk yields per cow, changing the landscape of dairy farming.



# Industry Changes and Policies (2000-2020)

From 2000 to 2020, EU regulations impacted milk production policies, emphasizing sustainability and animal welfare. The milk quota system, implemented in 1984, was abolished in 2015, resulting in fluctuating milk prices and production volumes.



# Technological Advancements (1980-2000)

The 1980s and 1990s saw major advancements such as robotics and computerized feeding systems that enhanced efficiency. This period also marked the shift towards larger dairy operations, consolidating farms to meet increasing consumer demand.



# Current Trends and Future Projections (2020-Present)

The German milk sector is focusing on sustainability, reducing carbon footprints, and organic farming practices. Projections indicate a shift towards more diversified dairy products to meet changing consumer preferences, including plant-based alternatives.



# Eastern Germany Farms

Eastern Germany has seen a transformation in milk production since reunification. Farms here are modernizing and focusing on efficiency, with an emphasis on expanding the dairy sector to revive the local economy.



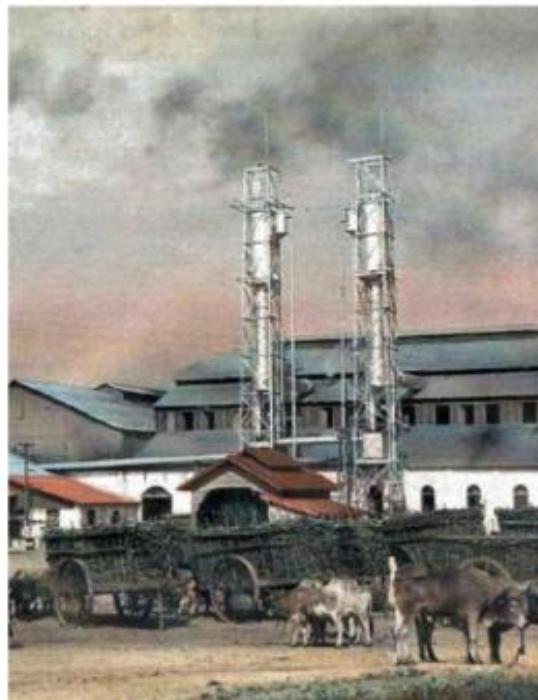
# Northern Germany Farms

Northern Germany is known for its large-scale dairy farms, benefiting from rich pastures and ample rainfall. The regions of Schleswig-Holstein and Lower Saxony are significant in milk production, focusing on efficient farming practices and high-quality dairy products.



# Southern Germany Farms

Southern Germany features smaller family-owned farms, particularly in Bavaria. This region is recognized for producing premium milk products, including cheese and yogurt, often emphasizing organic and sustainable practices.



# Western Germany Farms

Western Germany boasts some of the country's largest dairy cooperatives, particularly in North Rhine-Westphalia. These cooperatives play a crucial role in milk processing and distribution, ensuring high product standards.

# Conventional Milk Production

	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	Average of all years
Number of dairy cows	46,7	48,0	49,7	51,2	51,1	50,9	50,9	51,1	51,2	50,9	50,2
Cows per family AK	28,3	29,1	30,1	30,7	30,6	30,6	30,6	31,0	31,2	31,2	30,3
Milk yield (produced) in kg/cow	7.049	7.370	7.289	7.530	7.630	7.828	7.719	7.551	7.805	8.057	7.583
Agricultural, Utilised area (UAA) in ha	48,4	49,0	49,5	50,0	50,7	51,2	51,2	51,6	52,1	51,9	50,5
Grassland share in %	51,0	51,2	51,2	51,2	51,3	51,4	51,2	51,2	51,0	50,6	51,1
Cattle population in GV/ha UAA	1,70	1,73	1,76	1,77	1,74	1,71	1,71	1,70	1,69	1,69	1,72
Milk price (net) in ct/kg	36,06	30,79	32,95	38,65	37,35	35,87	36,30	43,03	55,88	48,22	39,51
Win Rate %	22,1	19,8	23,7	30,9	22,9	18,5	19,7	22,4	28,3	21,4	23,0
Profit per family AK in Euro/FamAK	26.671	22.469	28.656	42.553	30.645	24.250	26.245	34.508	54.546	37.596	32.795
Profit in euros per cow	943	773	951	1.388	1.002	792	857	1.113	1.748	1.204	1.081
Farm income in euros per cow	1.198	1.028	1.202	1.640	1.270	1.077	1.145	1.405	2.054	1.528	1.359
Equity formation in euros per cow	14	-20	208	569	156	-138	54	332	798	159	217
Liabilities in euros per cow	2.447	2.621	2.670	2.521	2.640	2.869	2.774	2.746	2.645	2.675	2.663

# Organic Milk Production

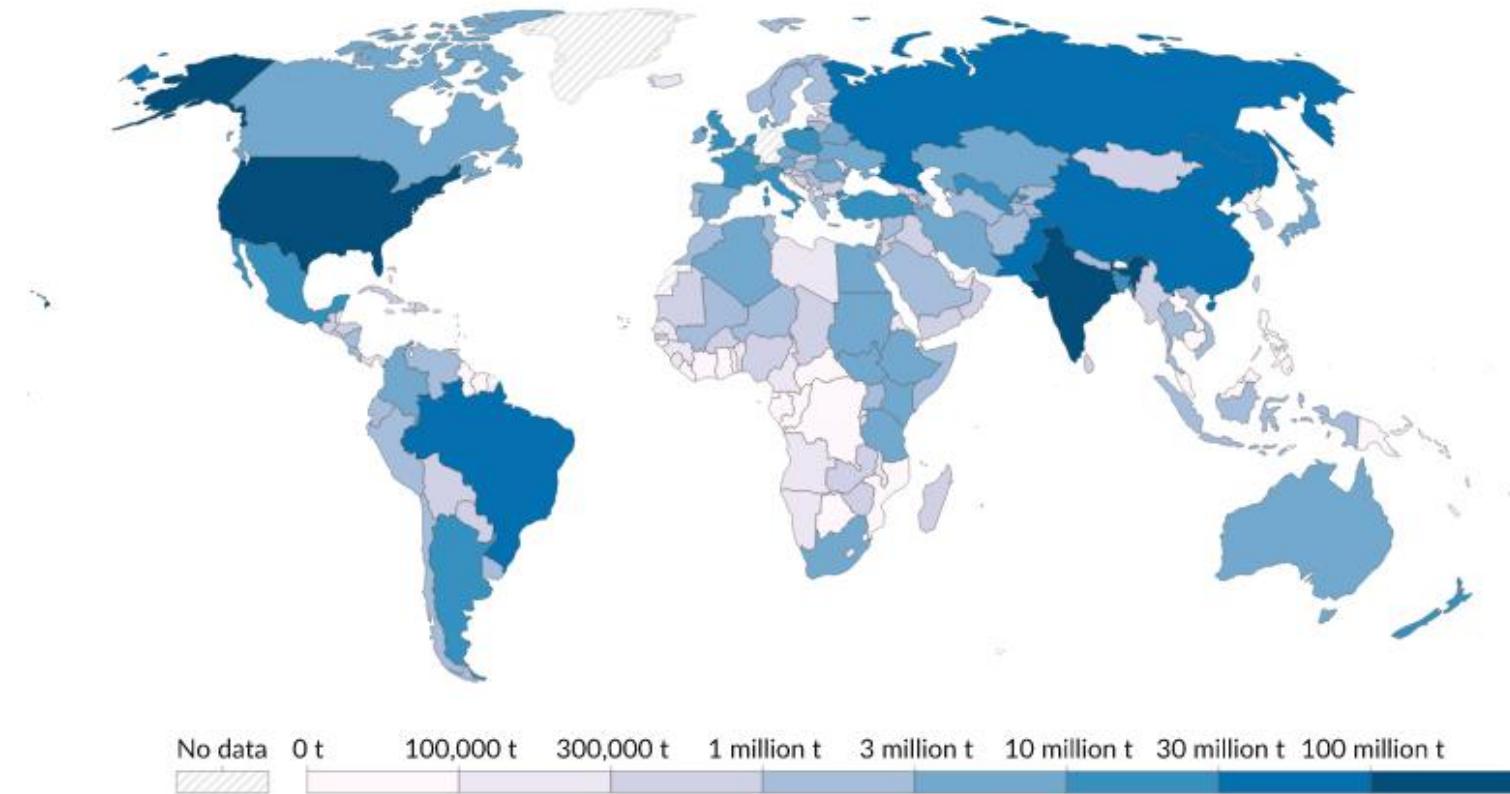
	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	Average of all years
Number of dairy cows	35,8	37,3	38,1	38,7	39,0	38,2	38,7	39,4	39,8	40,4	38,5
Cows per family AK	22,8	23,5	24,4	24,3	24,7	24,3	25,4	25,1	25,2	25,7	24,6
Milk yield (produced) in kg/cow	6.070	6.163	6.187	6.368	6.353	6.338	6.348	6.455	6.550	6.645	6.348
Agricultural. Utilised area (UAA) in ha	42,6	43,8	43,9	44,2	44,6	45,0	46,1	46,6	47,2	46,9	45,1
Grassland share in %	82,8	82,9	83,2	83,2	83,1	82,2	83,7	83,5	83,0	82,9	83,1
Cattle population in GV/ha UAA	1,43	1,41	1,44	1,46	1,46	1,43	1,42	1,41	1,40	1,40	1,43
Milk price (net) in ct/kg	48,18	49,71	49,37	50,62	48,89	49,59	50,82	53,65	60,65	57,01	51,85
Win Rate %	37,1	37,5	34,4	35,6	31,8	29,9	30,3	31,6	28,2	28,7	32,5
Profit per family AK in Euro/FamAK	40.904	45.417	42.754	43.906	38.226	35.680	38.546	42.646	42.183	43.193	41.346
Profit in euros per cow	1.794	1.935	1.750	1.805	1.548	1.466	1.516	1.698	1.673	1.678	1.685
Farm income in euros per cow	2.041	2.182	2.031	2.107	1.849	1.795	1.860	2.023	2.005	2.053	1.994
Equity formation in euros per cow	467	491	58	235	147	-5	197	100	381	517	258
Liabilities in euros per cow	2.406	3.360	3.415	3.345	3.031	2.859	3.918	3.934	4.287	4.355	3.507

# Global Milk Production

## Milk production, 2023

Our World  
in Data

Milk represents the raw equivalents of all dairy products including cheese, yoghurt, cream and milk consumed as the final product.

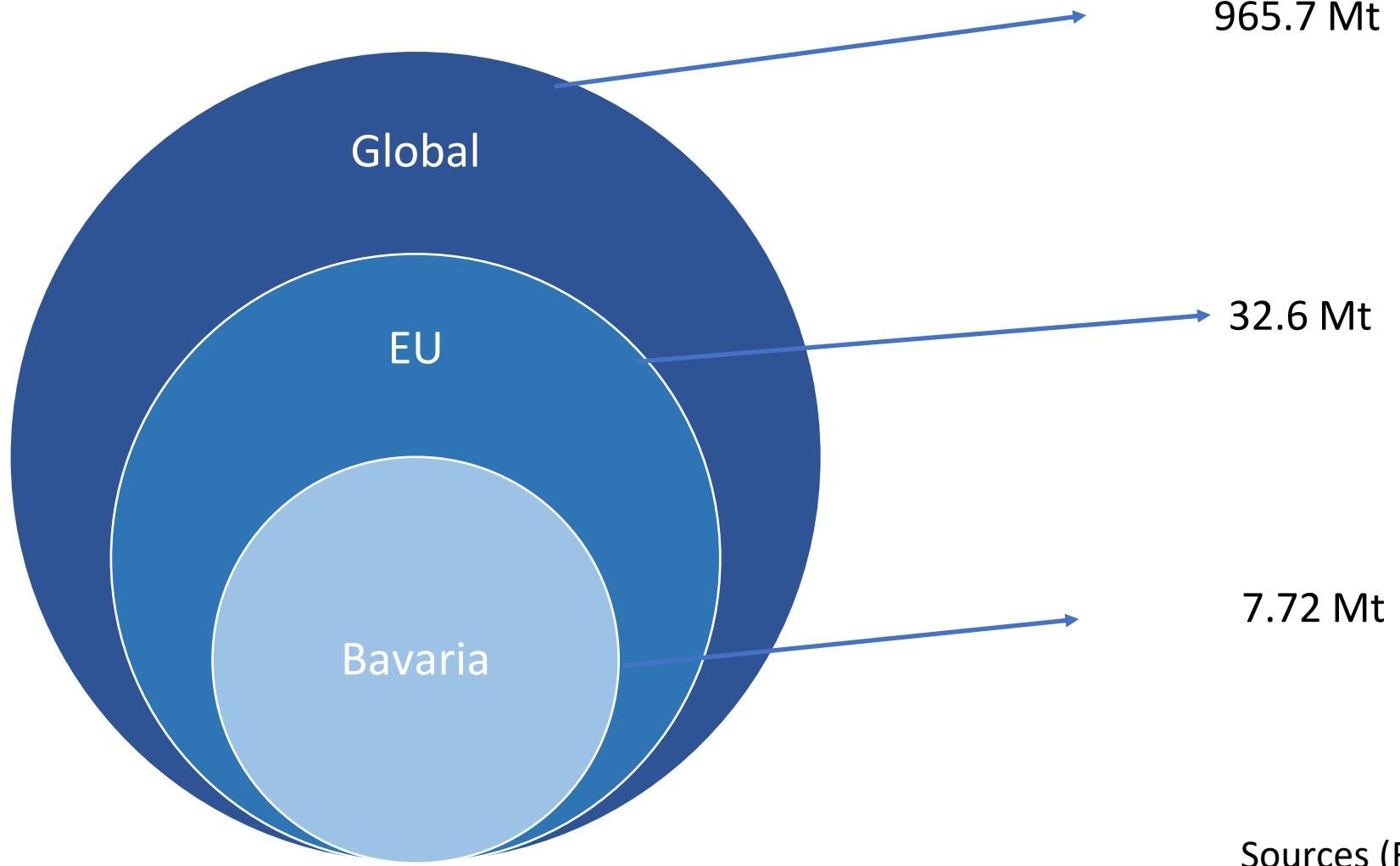


Data source: Food and Agriculture Organization of the United Nations (2025)

[OurWorldInData.org/meat-production](https://OurWorldInData.org/meat-production) | CC BY

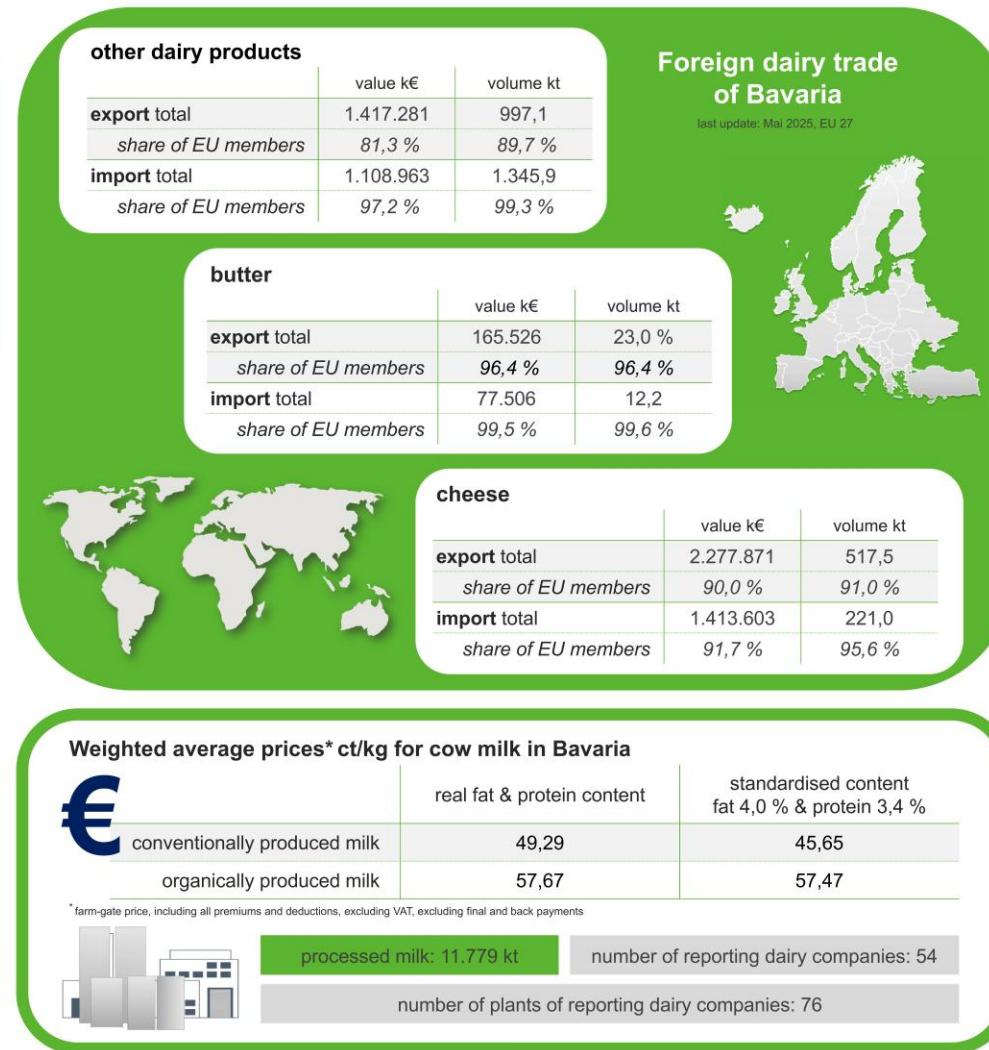
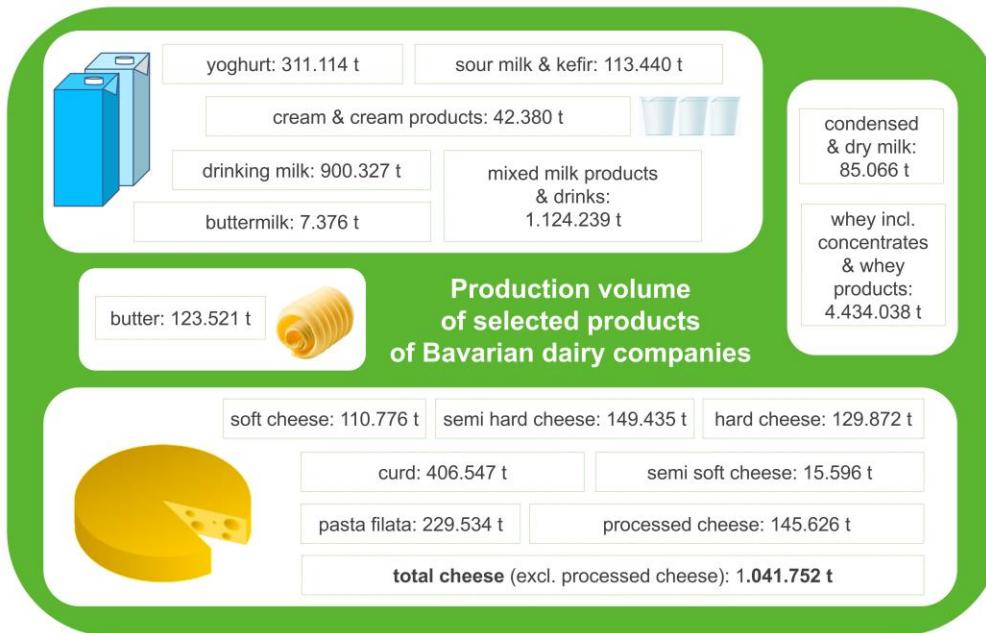
Note: Data on milk production relate to total production of whole fresh milk, excluding the milk sucked by young animals but including amounts fed to livestock.

# Milk Production: EU & Bavaria

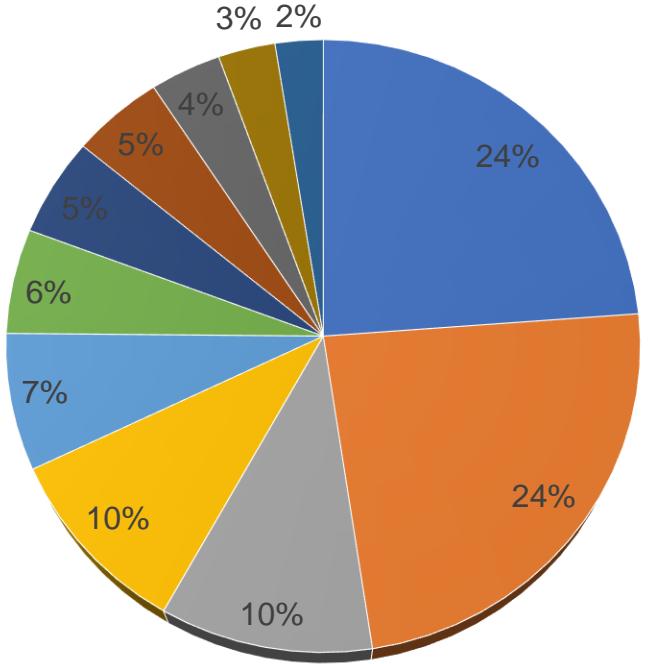


Sources (FAO, LfL, BLE, etc.)

## Facts and Figures on the Bavarian Dairy Sector in 2024



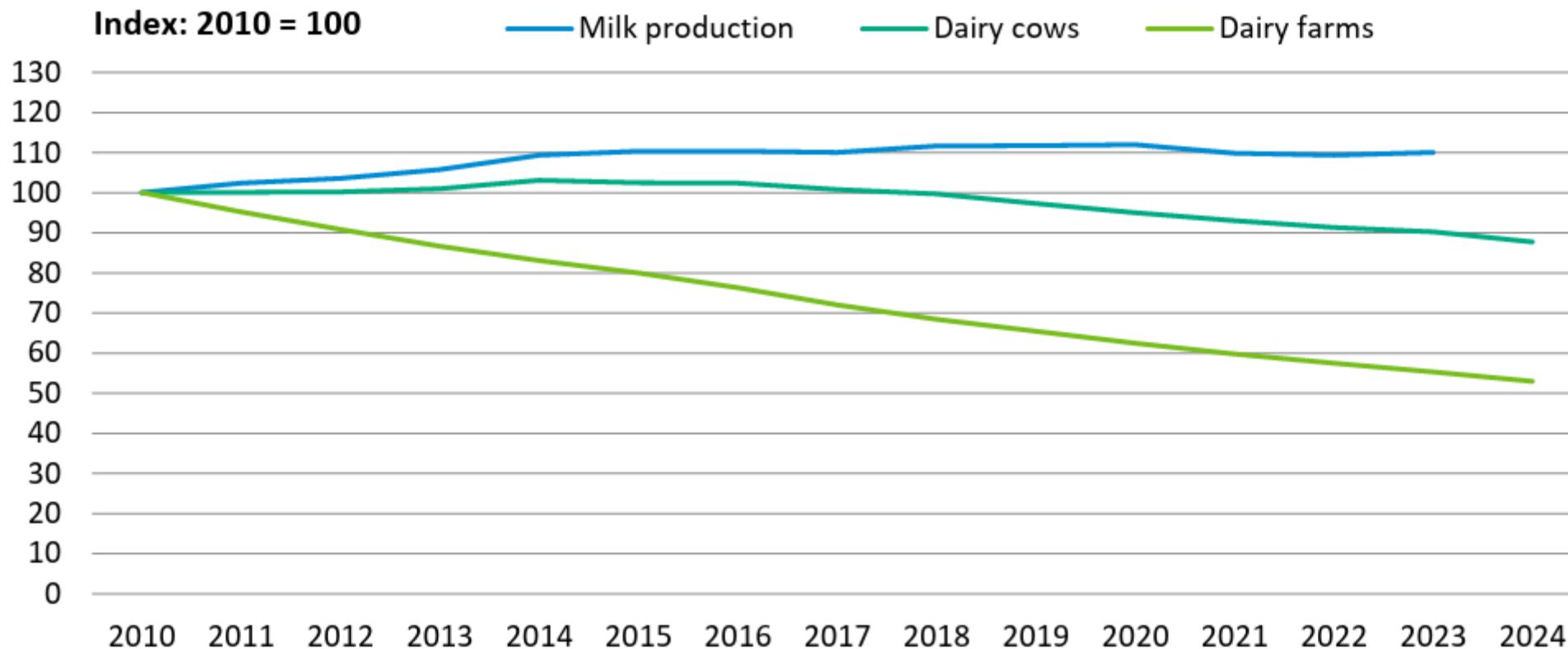
# Germany Milk YTD Production (Kt)



- Niedersachsen (Lower Saxony) / Bremen
- Bayern (Bavaria)
- Nordrhein-Westfalen (North Rhine-Westphalia)
- Schleswig-Holstein / Hamburg
- Baden-Württemberg
- Hessen / Rheinland-Pfalz / Saarland
- Sachsen (Saxony)
- Mecklenburg-Vorpommern
- Berlin / Brandenburg
- Sachsen-Anhalt

# Dairy Sector Developments

Developments in the dairy sector in Germany since 2010

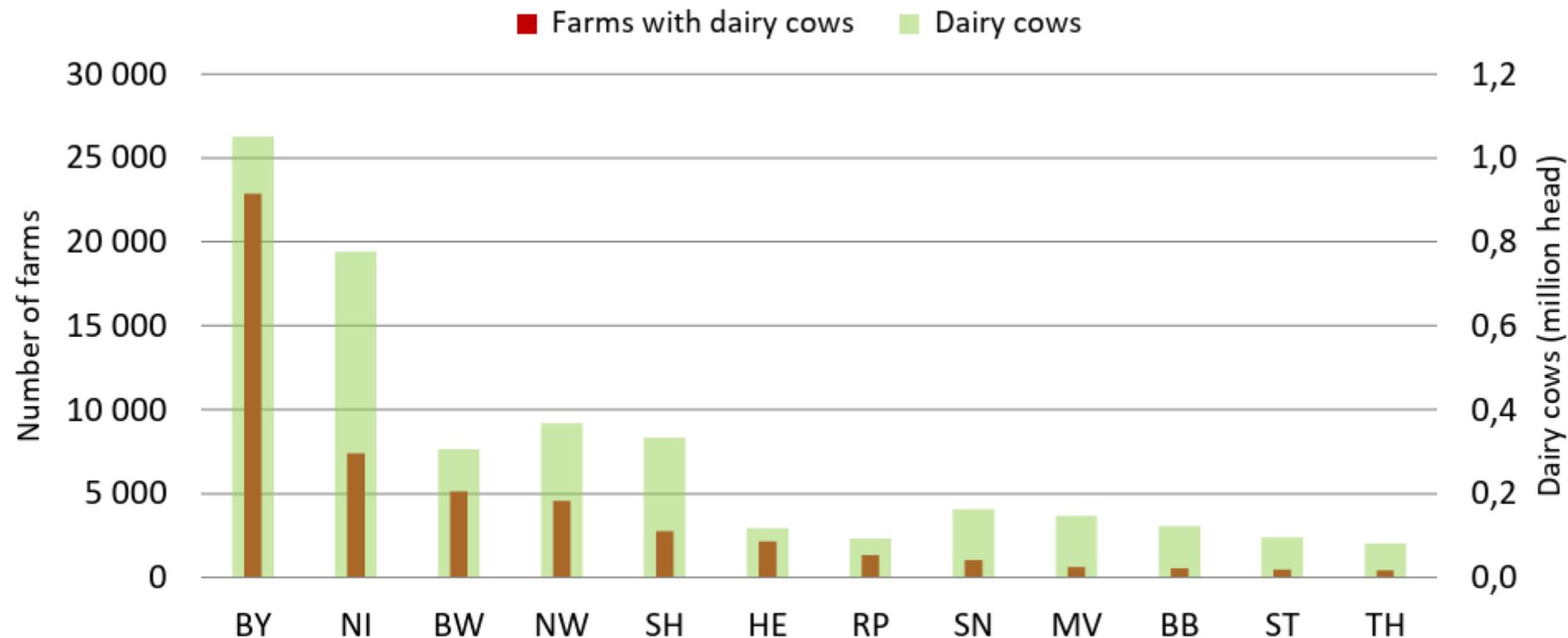


Note: Data for milk production in 2024 will only be available in 2025. The number of dairy cows and dairy farms corresponds to the cut-off date of the livestock census (3rd May 2024)

Source: BLE, various years; STATISTISCHES BUNDESAMT, 2024; own illustration and calculation.

# Farm Structure

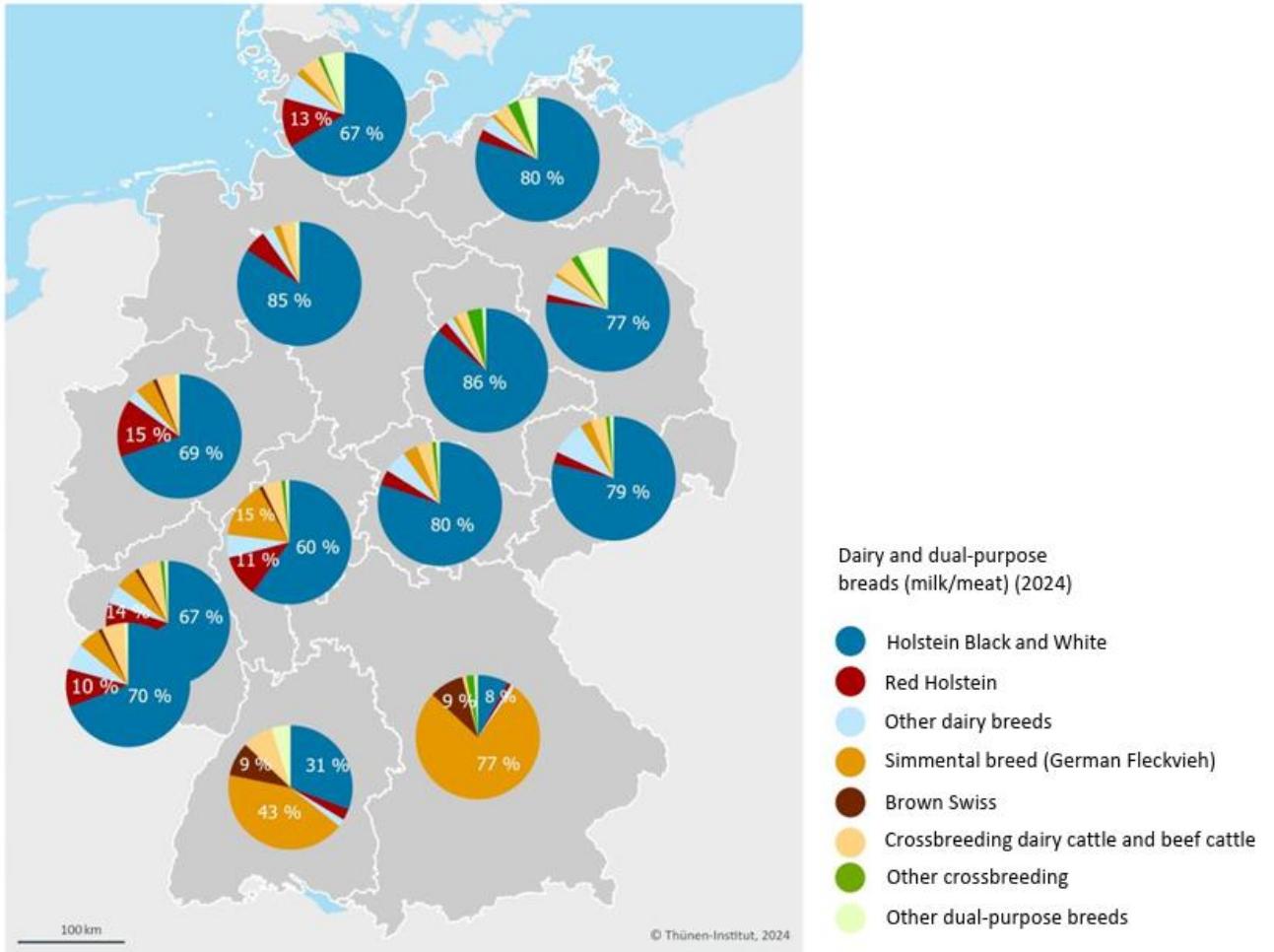
Number of dairy farms and dairy cows by federal states 2024 (May)



Note: Abbreviation for the federal states: BY = Bavaria, NI = Lower Saxony, BW = Baden-Wurttemberg, NW = North Rhine-Westphalia, SH = Schleswig-Holstein, HE = Hesse, RP = Rhineland-Palatinate, SN = Saxony, MV = Mecklenburg-West Pomerania, BB = Brandenburg, ST = Saxony-Anhalt, TH = Thuringia

Source: STATISTISCHES BUNDESAMT, 2024; own illustration.

# Population Mix- breed

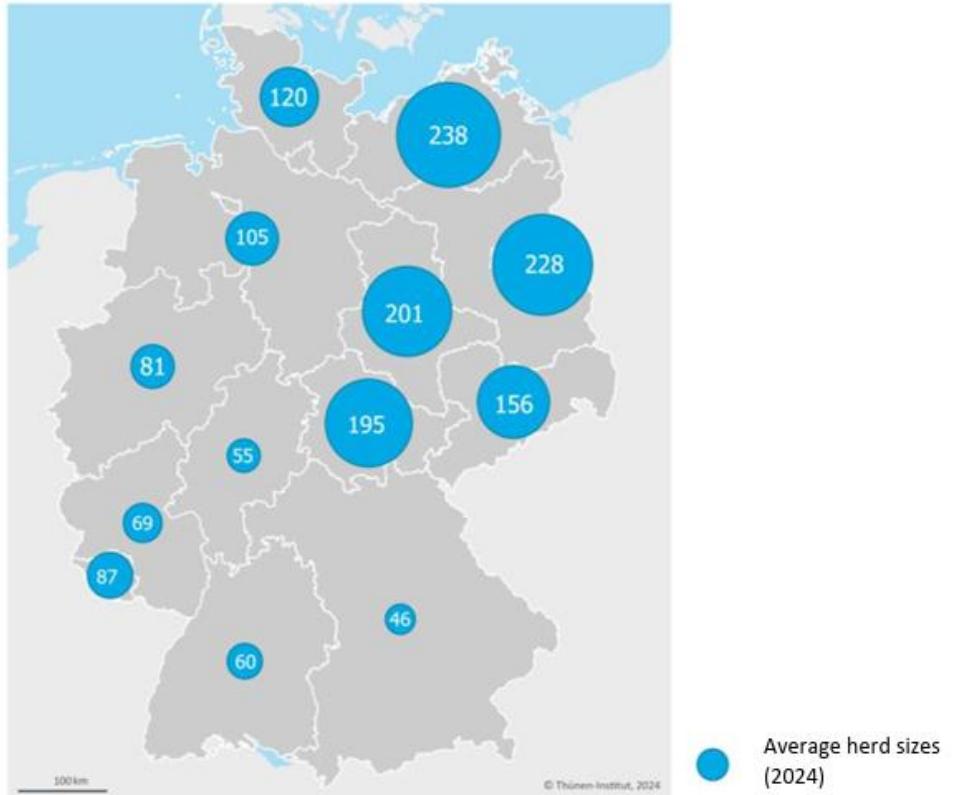


Note: The city states were assigned to the surrounding federal states for the calculation: Berlin to Brandenburg, Bremen to Lower Saxony and Hamburg to Schleswig-Holstein.

Source: STATISTISCHES BUNDESAMT, 2024; own illustration and calculation.

# Herd Size

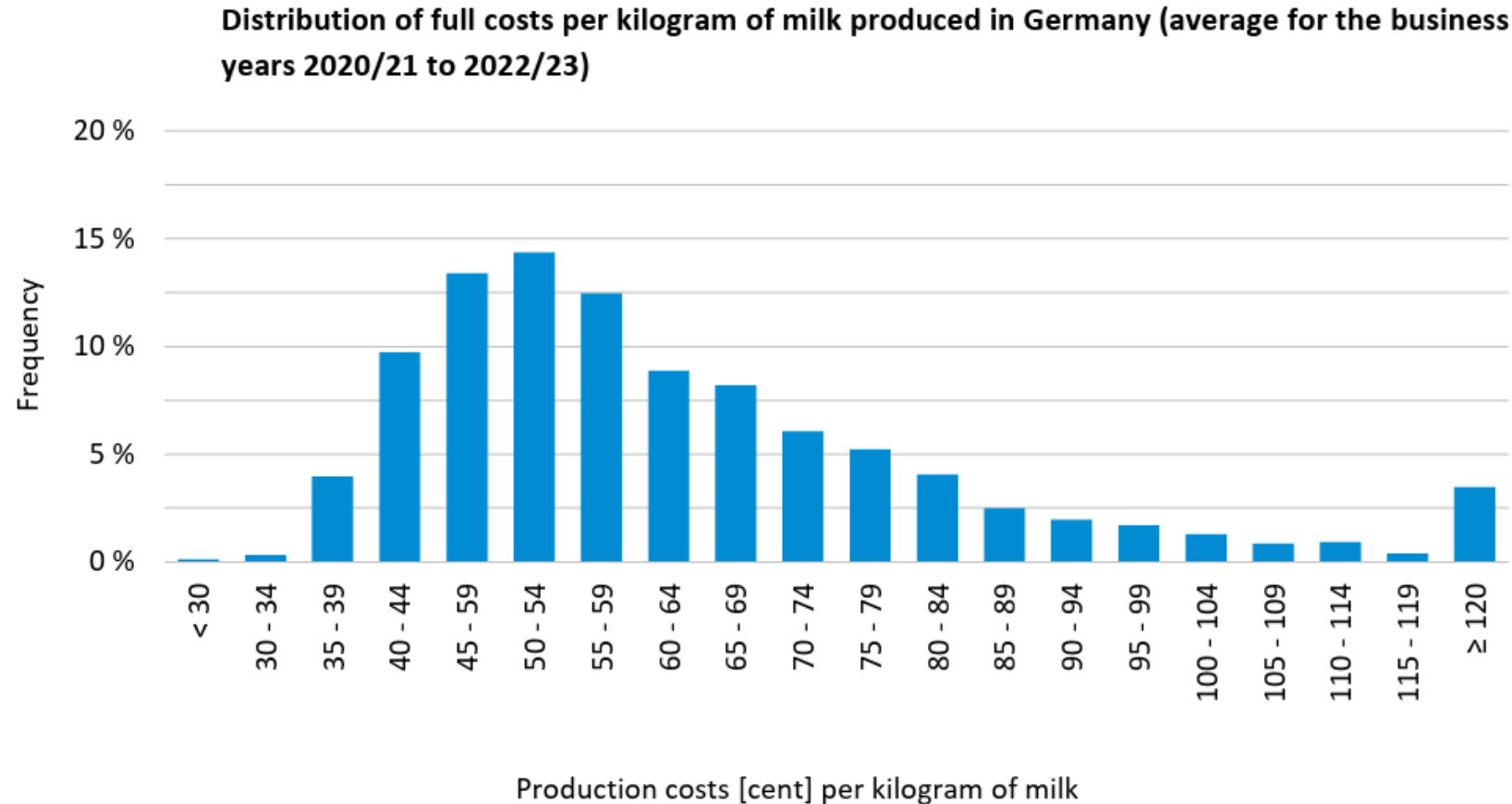
Average herd sizes in the federal states (cows per farm) 2024 (May)



Note: The city states were assigned to the surrounding federal states for the calculation: Berlin to Brandenburg, Bremen to Lower Saxony and Hamburg to Schleswig-Holstein.

Source: STATISTISCHES BUNDESAMT, 2024; own illustration and calculation.

# Cost of Production

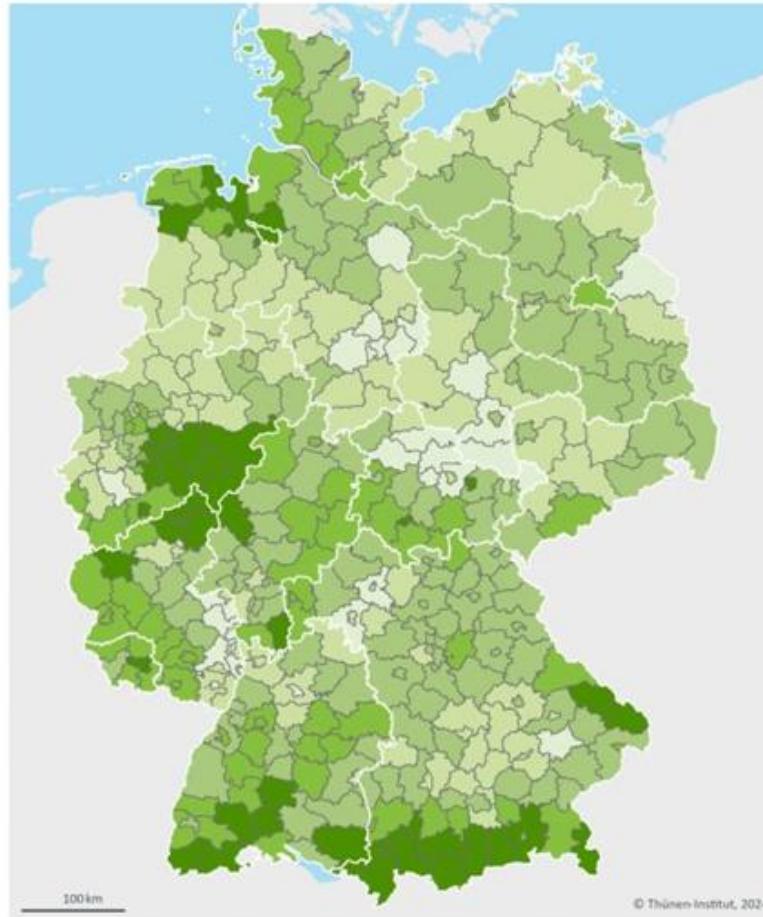
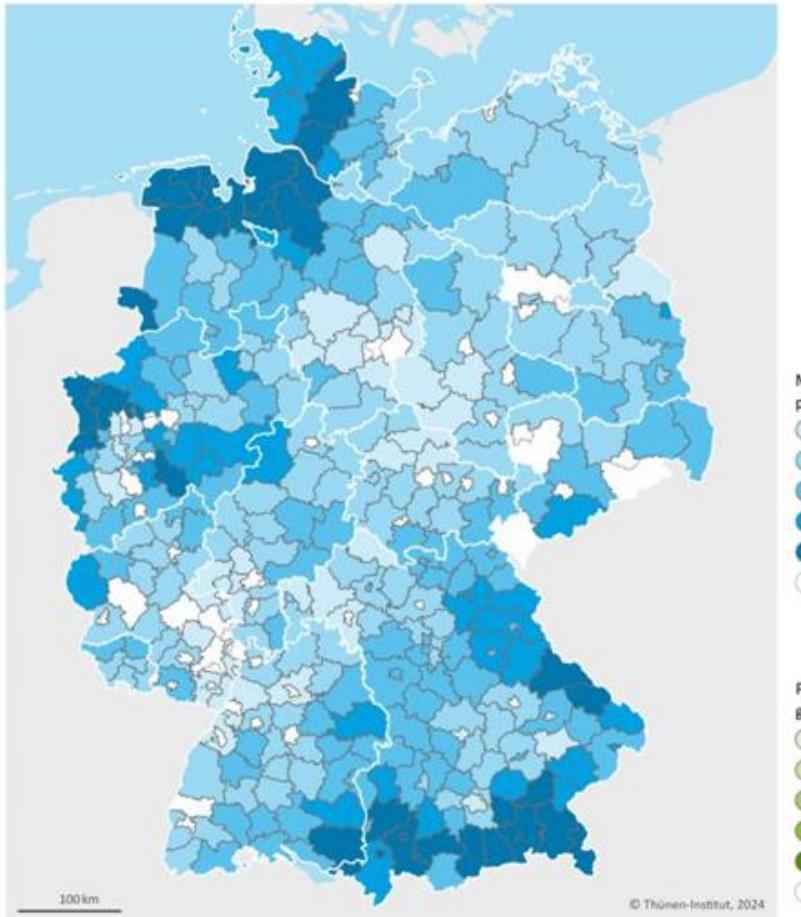


Note: The accounting data of "highly specialized dairy farms" were analysed. These are farms, whose revenues from milk sales and by-products account for more than 95 % of farm revenues from animal and plant production.

Source: Own illustration and calculations based on accounting data from the Test Farming Network.

# Regional Distribution

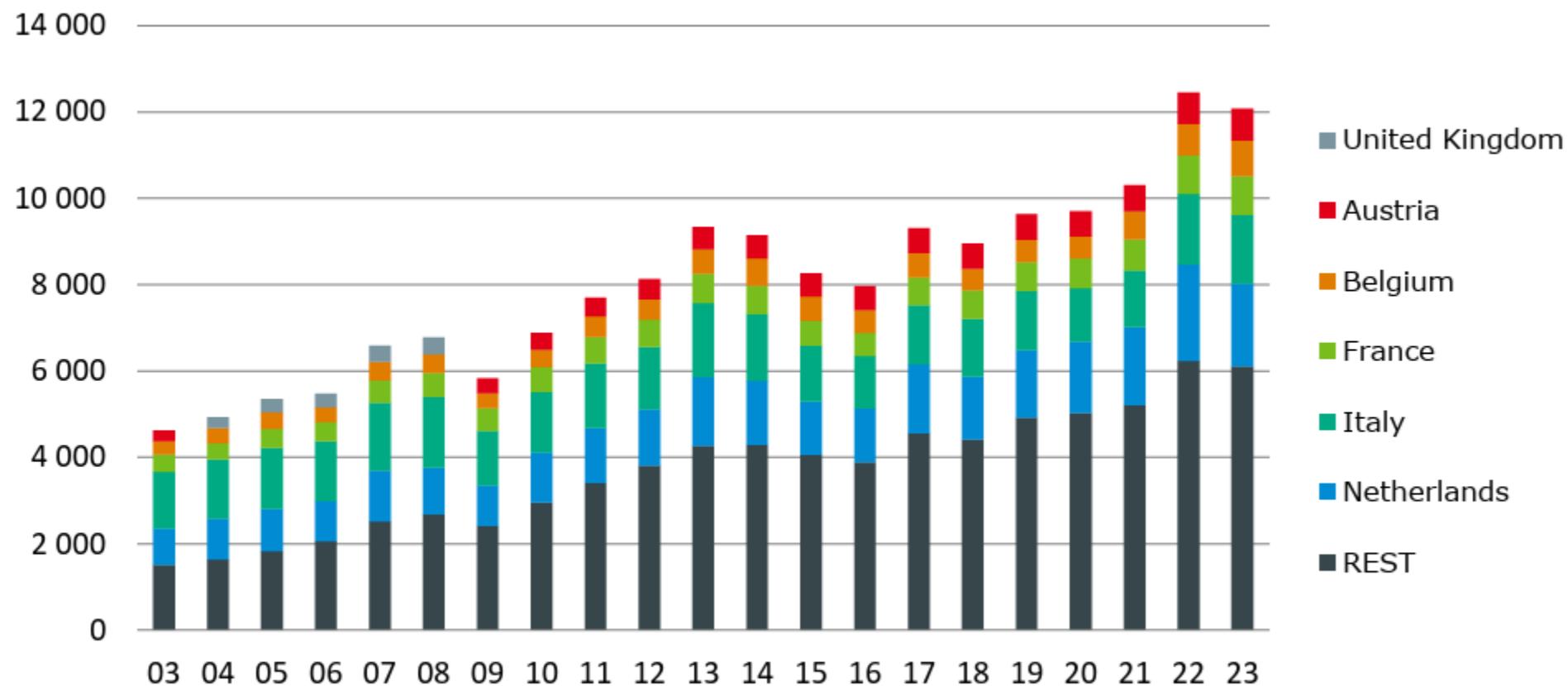
Regional distribution of milk production 2023 and proportion of grassland 2020



Source: BLE, 2024b; THÜNEN AGRARATLAS, 2022; own illustration and calculation.

# Export

Top 5 export destinations for German milk and dairy products 2003 – 2023 (in million euros)



Note: Top 5 in each single depicted year. As these can change, more than five countries are listed in the legend.

Source: UN COMTRADE, 2024; own illustration and calculation.

# Key Performance Indicators

## Production and performance indicators in dairy farming

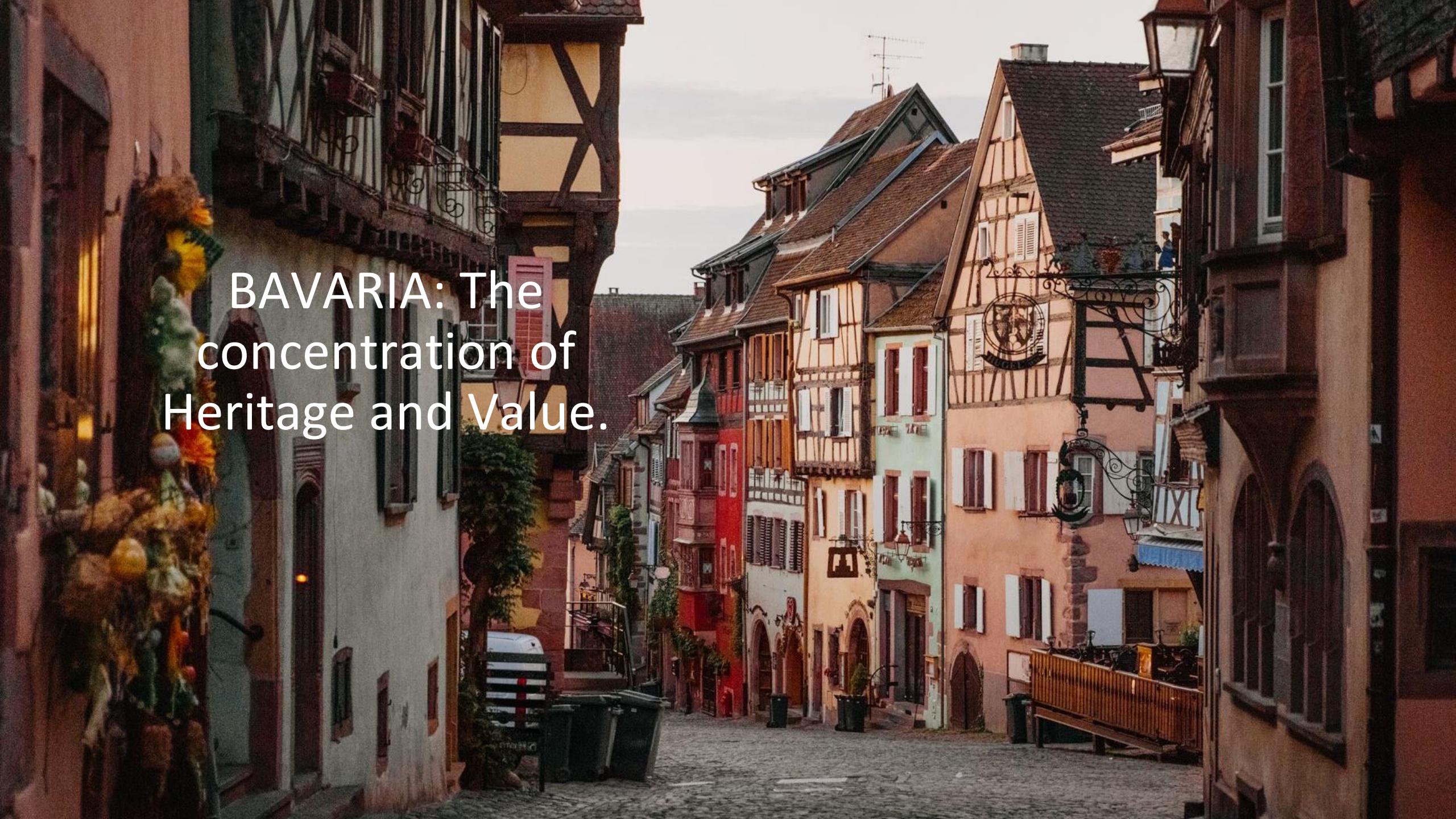
Milk yield (kg)	8 500	Calf losses (%)	5
Fat content (%)	4,10	First calving age (month)	28,8
Protein content (%)	3,40	Number of lactations	3
Coarse forage output (kg ECM)	4 000	Remontage (%)	33
Mid-calvin period (days)	417	Cow losses (%)	1

Source: KTBL, 2022; own illustration.

## Self-sufficiency rate for milk and dairy products 2022 in Germany (provisional)

Milk and milk products	Self-sufficiency rate in percent
Fresh milk products	114
Cream products	124
Condensed milk products	1.078
Whole milk powder	131
Skimmed milk powder	282
Cheese	132
Butter	102

Source: BLE, 2024a; own illustration.



BAVARIA: The  
concentration of  
Heritage and Value.



Bavaria is strategically important due to its specialty focus, it's sheer volume of farms, and its high-value product portfolio :

- Farm structure : Bavaria is home to almost half of dairy farms in Germany ( 22,455 farms)
- Specialty leadership : Bavaria contributes to 20% of milk in Germany but produces nearly 50% of German organic milk and it is the largest producer of cheese in Germany
- " Bavaria competes on quality , not just volume.

Sources: Destatis, Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (Bavarian State Ministry for Food, Agriculture and Forestry)

Image source : Freepik.

# BAVARIA'S DAIRY POWER HOUSE

Business & Market



# Bavarian Dairy Economy.



Dairy is the most important single production branch in Bavarian agriculture.



Its contribution to overall agricultural production value is significantly more pronounced than the national average making it the bedrock of the regional rural economy.



According to Bayerischer Agrarbericht 2024( Bavarian Agricultural report), based on 2022 figures, milk was the dominant product .



This signified and continues to signify its role on economic pillar of Bavarian Agriculture.



The table on the next slide shows the total production values of different agricultural products in 2022.



Sources: [https://www.lfl.bayern.de/mam/cms07/iba/dateien/viertelauswertung\\_spezialisierter\\_milchviehbetriebe\\_23\\_24\\_voll.pdf](https://www.lfl.bayern.de/mam/cms07/iba/dateien/viertelauswertung_spezialisierter_milchviehbetriebe_23_24_voll.pdf)

# MARKET DRIVERS:

## The forces reshaping Bavarian dairy.



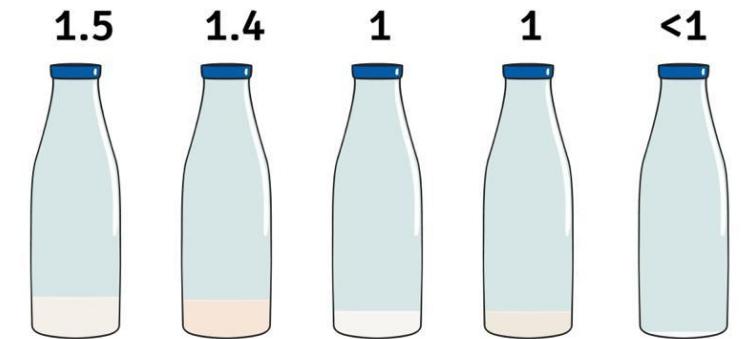
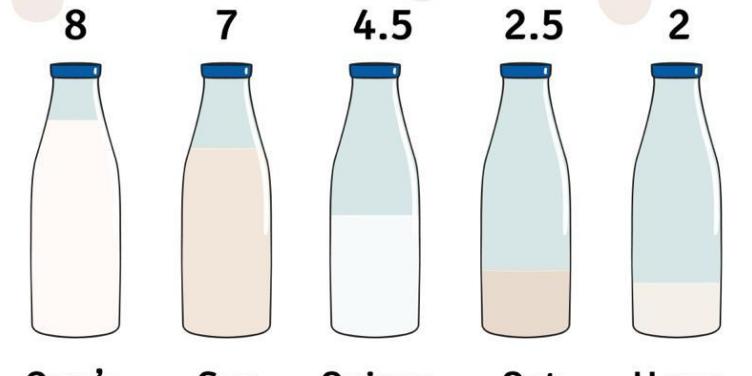
**Market Dynamics: The key Drivers of Strategic Change .**

The market is rapidly shifting toward organic and lactose free products , defining a key opportunity. This shift, alongside the threat from plant-based substitutes and the constant price vs quality tension, necessitates a refined strategy.

Source: Market Research Reports,  
Consumer Trends Analysis

### Nutritional comparison of plant-based milk alternatives

Protein (g (per serving of 240 ml))



# Value Chain Analysis: Alpine Pasture To Global Shelf



The value chain transforms high quality raw milk( often from Simmental cows) into stable high value consumer goods.



Value is disproportionately captured in the Processing and Distribution stages, which is critical for profitability



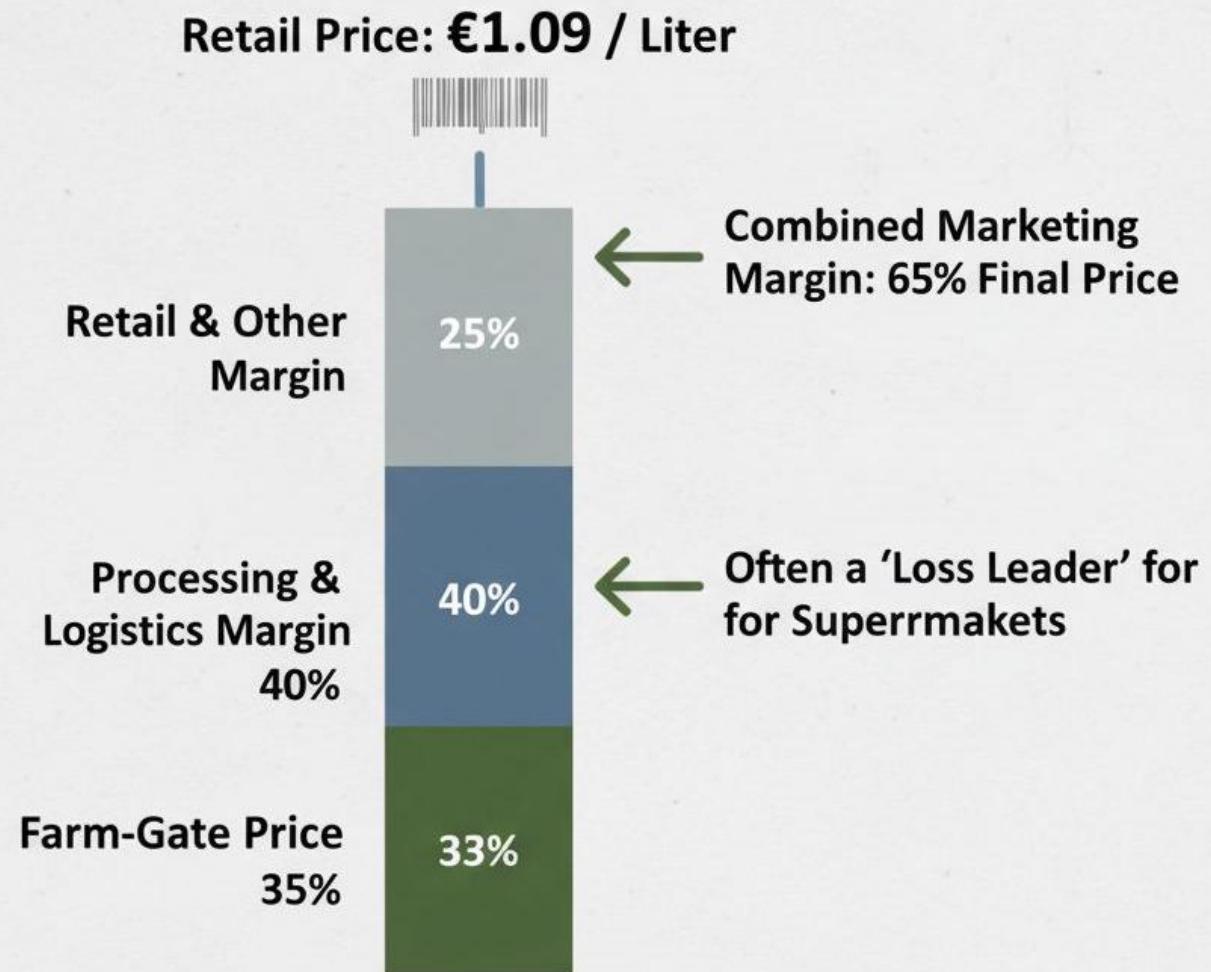
Focus: Processing is the critical stage that converts volatile raw material into stable, high – value specialty goods. It is the primary point of value addition, risk mitigation and structural power.

# ANALYSING PROFIT DISTRIBUTION: Marketing Margins

Raw milk price is set by global commodity markets. The Marketing Margin (Retail Price – Farm price- Costs) highlights that value is heavily captured by processing and retail activities, with liquid milk often used as a retail 'loss leader'

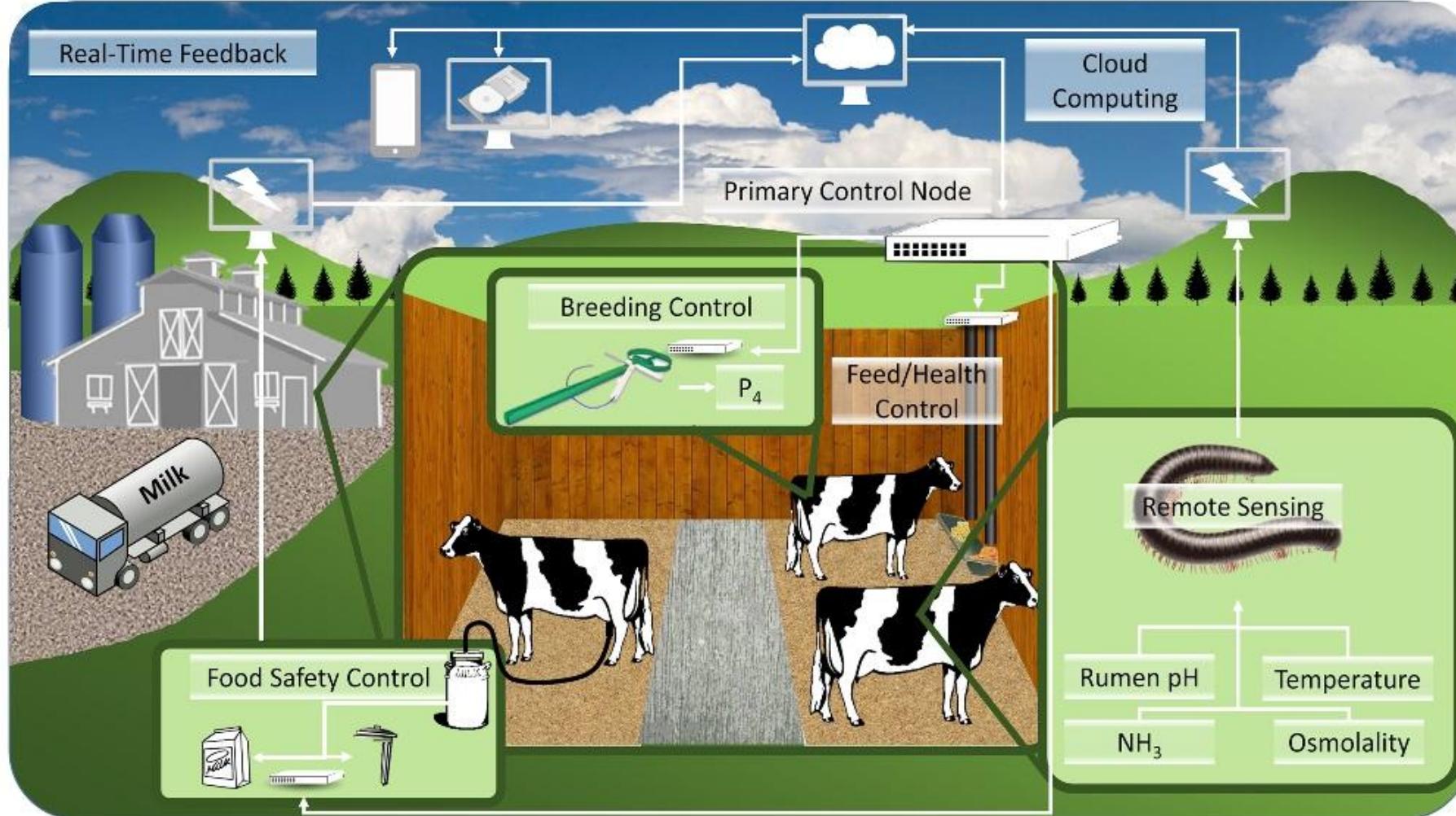
Source: AMI ( Agrarmarkt Informations - Gesellschaft), European Milk Board (For cost/price discussions), Academic Literature on German Retail Concentration.

## Milk Marketing Margin: Price Distribution from Farm to Retail (Germany, 2024)



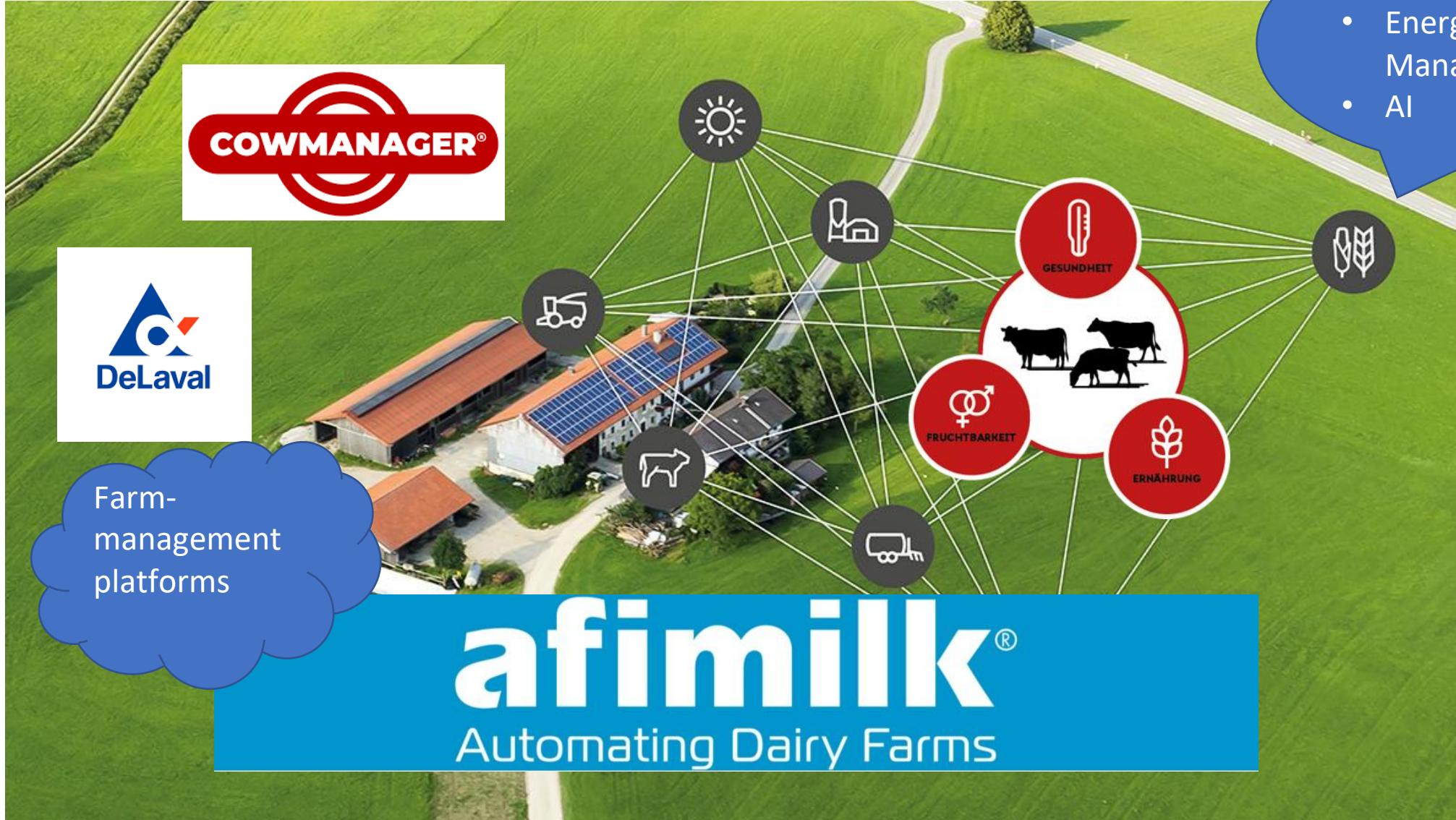
Source: AMI, European Milk Board (Estimated 2024 Data)

# Precision Dairy Farm



Source: <https://www.purdue.edu/>

# Technology Landscape



- Digital Farming
- Energy Management
- AI

# Technology - Deployed

- Pedometer collars
- Rumination sensors
- Ear tags
- Location Tags

Cattle Monitoring



- Milking Robots
- Milk Analyzer
- Milk Tank Sensor

Milk Production



- Temperature
- Humidity
- Ammonia
- Water level
- Cameras

Environment Monitoring



# Technology - Potential



## Wearables

- Early health / heat detection



## Milking Robots

- More frequent milking



## Smart Feeding

- Optimal Nutrition



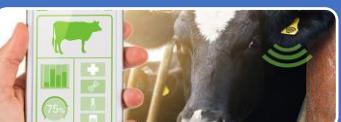
## Smart Barn Sensors

- Lower Heat Stress



## AI Monitoring

- Early lameness / BSC checks



## Genetics

- Better Milk Potential



## FMS

- Better decisions

# Monitoring and Management



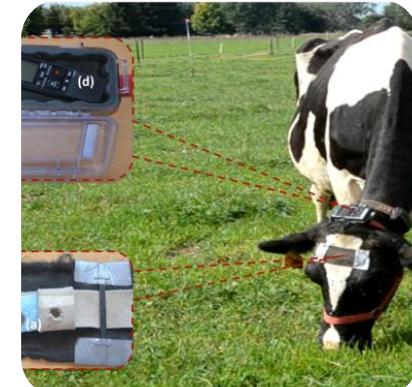
## Precision Cow Monitoring

- Rumination
- Eating Patterns
- Body Temperature
- Activity
- Health Anomalies



## Farm Management

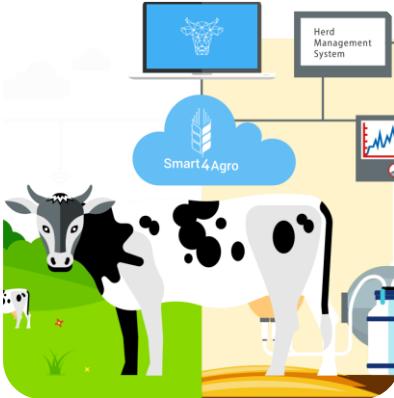
- Health Alerts
- Feed Planning
- Milking Data Management
- Financial Performance Tracker



## Camera and AI

- Body condition scoring
- Lameness detection
- Cow positioning and movement
- Mastitis early sign

# Growth, Health and Safety



## Smart Breeding

- Artificial Insemination with genomic data
- DNA Scoring
- Sexed Semen



## Environment

- Temperature
- Ammonia levels
- Ventilation
- Lighting
- Water Management
- Robotic scrapper



## Smart Feeding

- Automated Feed Pushers (Lely Juno)
- Automated TMR mixers
- RFID based feed systems

# Storage and Logistics



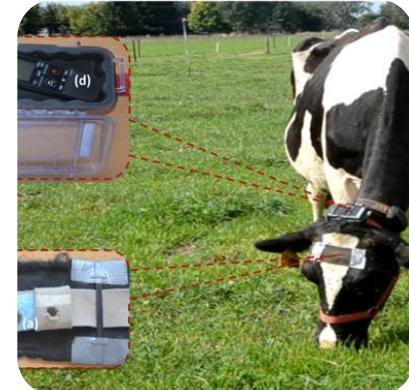
## Milk Storage

- Milk quality monitoring at BMC
- Level and volume sensors
- UV and Ozone treatment
- Digital Logs



## Milk Logistics

- GPS and Route optimization for trucks and tankers
- Temperature monitoring for spoilage prevention
- RFID tagging of milk batches, containers etc.
- Robotic scrapper



## Data and Analytics

- Track milk collection
- Storage Duration
- Temperature Log
- Demand forecasting
- Spoilage prediction
- Fleet and equipment predictive maintenance

# TCO (Total Cost of Ownership)

Small (50)



AMS Robots: 1

Capex ~€316k → €706k

Opex ~€24k → €82k / year

Medium (150)



AMS Robots: 3

Capex ~€727k → €1.24M

Opex ~€61k → €152k / year

Large (500)

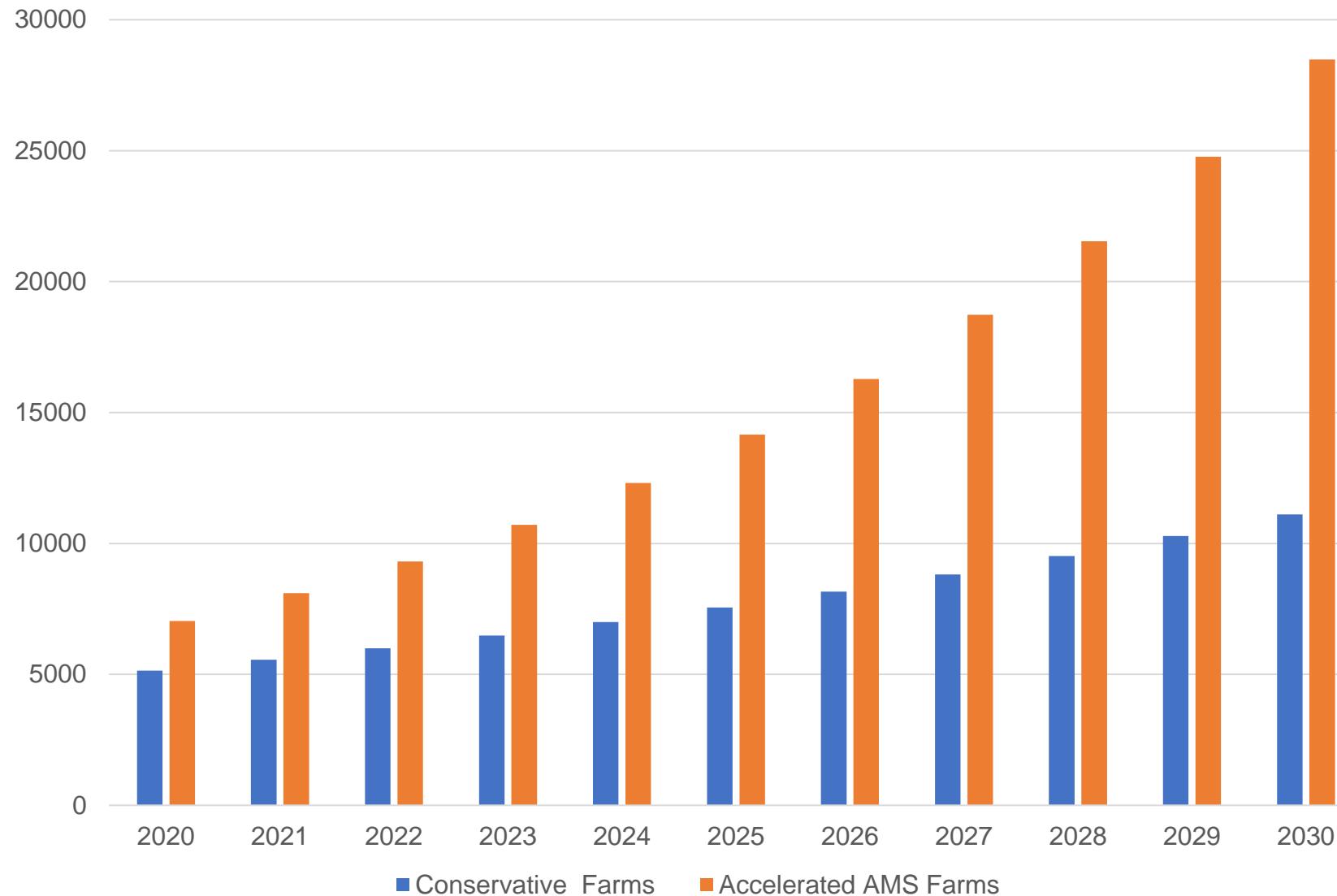


AMS Robots: 9

Capex ~€1.96M → €2.83M

Opex ~€173k → €361k / year

# Technology Adoption- Milking Robots

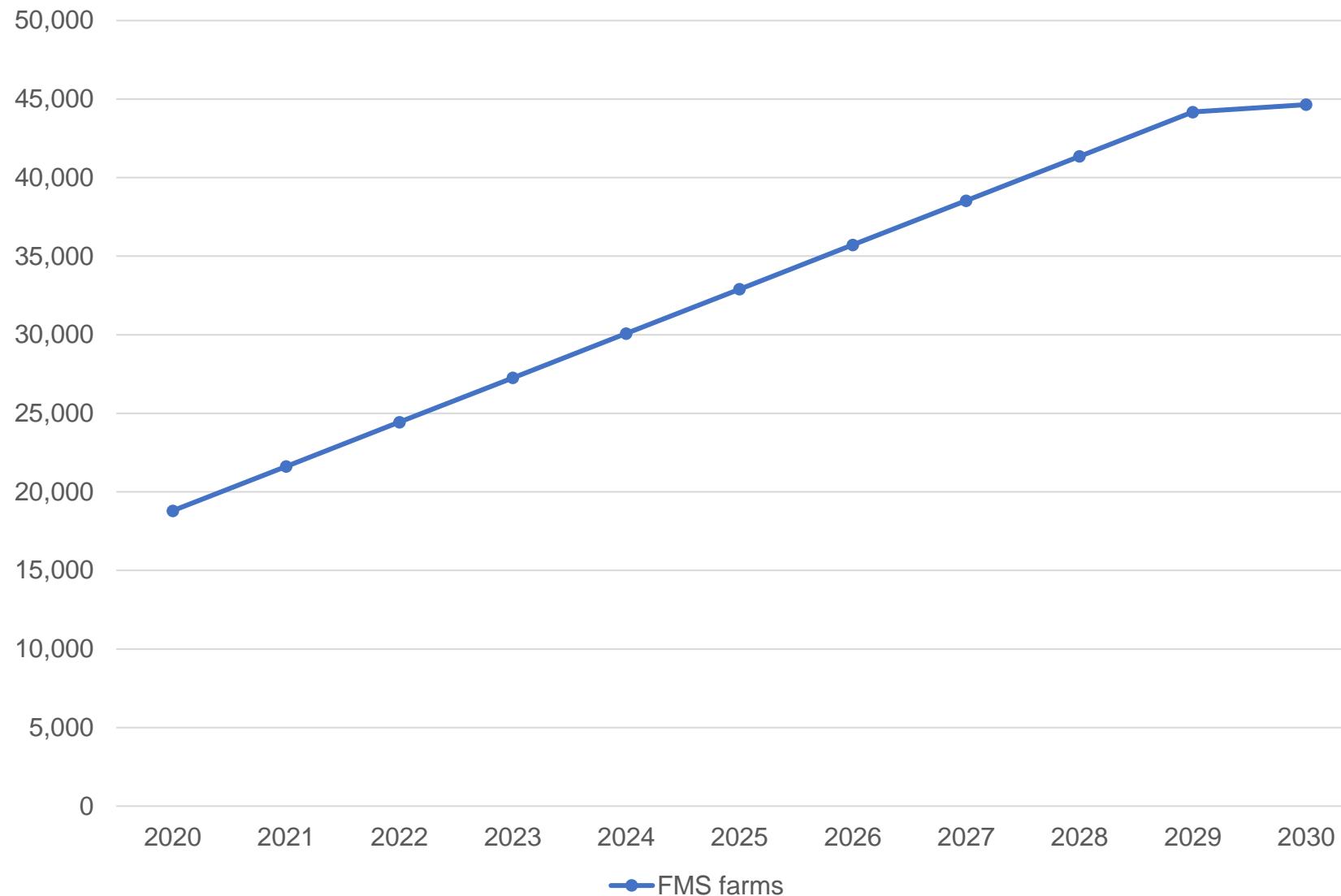


**Germany: 48,649 dairy farms in 2024**

*Accelerated growth ( $\approx 15\%$  annual growth)*  
*(50–70%) of new milking-systems are AMS*

Source: regional surveys, LfL / TUM /  
German ag-tech reports

# Technology Adoption- FMS



**1 in 6 farms (~16%) plan to invest in digitalization**

**In 2024, 60% of German farms use farm management software (FMS)**

**By 2030, 90% of German farms will use farm management software (FMS)**

Source: regional surveys, LfL / TUM / German ag-tech reports

# Challenges

Cattle Health → Production Output



Labour Shortage → Manual Process Disruption

Production Cost → Reduced Profitability



Adverse climate → Heat Stress

# SWOT Analysis : Structural Hurdles and Mitigation.(Internal Factors)



Strengths(S) : The greatest asset in the Bavarian Milk sector is its protected Origin and regional heritage, which enable high product differentiation. This specialization is the industry's main defense against commodity pricing.



Weakness (W) : These are the bottlenecks: The primary vulnerability is the oligopsonistic bottleneck: numerous small farmers are forced to sell to a few powerful processors, leading to suppressed raw milk prices at the farm gate. Critically, the lack of effective advance price contracting (A/C) for conventional milk means the farmer, not the processor, absorbs nearly all global market volatility.



Mitigation Factor : The economic viability of many traditional farms relies heavily on CAP Pillar II payments (e.g., mountain farming subsidies). While essential for sustaining the cultural landscape, this reliance is a structural weakness, as income is dependent on government policy, not purely market forces.



Sources BMEL (Subsidy data), AMI/CLAL (Contracting), Destatis.

# External Factors: Opportunities and threats.



Opportunities (O) - Growth drivers: The core opportunity lies in premium segments: the global Organic Boom, leveraging the strong EU quality reputation for Export Growth, and selling the Sustainability Premium—consumers are increasingly willing to pay more for verifiable eco-conscious production.



Threats(T) - Market risks : The most critical substitute is the rise of Plant-Based Alternatives, which directly erode the volume of liquid milk sales. This threat is compounded by Persistent Retailer Price Pressure in the domestic market and rising Regulatory and Climate Costs, which squeeze already tight margins.

# Opportunities- Precision Tech Driven Dairy



# Thank you

