THE ECONOMIC POTENTIAL OF ALTERNATIVE PROTEINS IN EUROPE

Technical appendix

January 2026

SYSTEMIQ

APPENDIX 1- MARKETS

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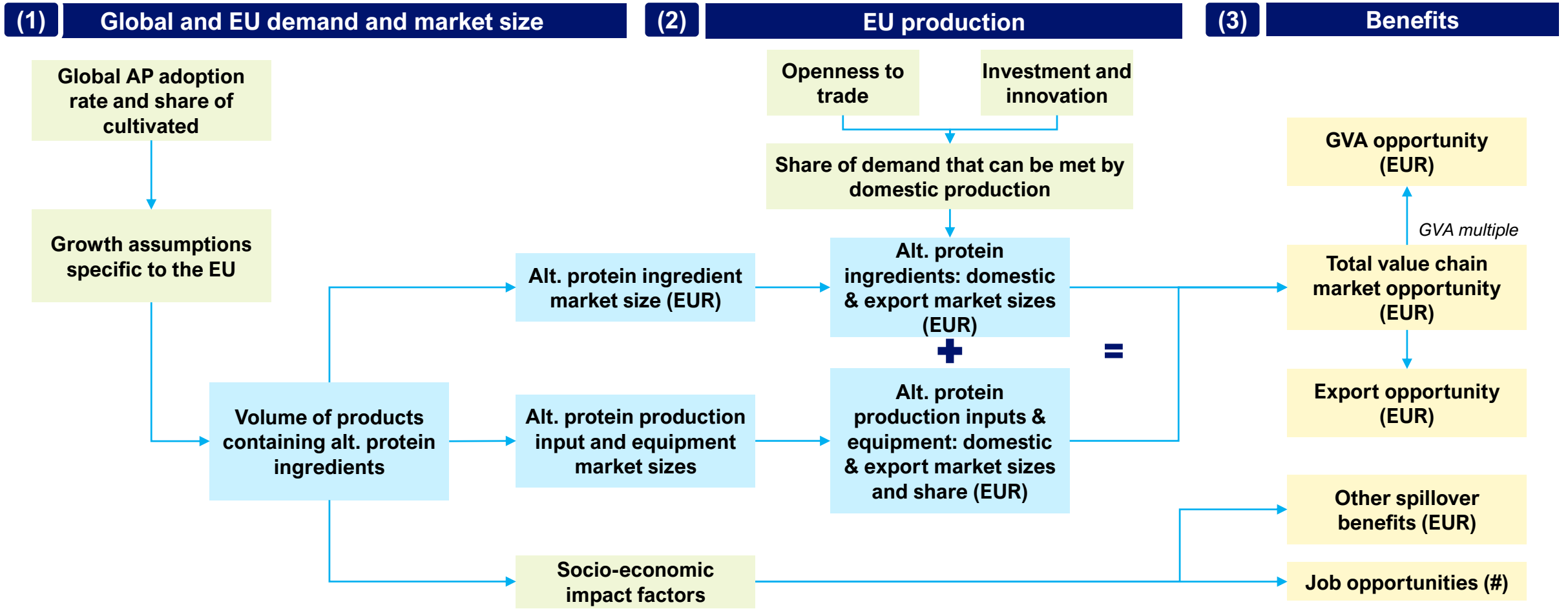
ANALYTICAL APPROACH: COMBINING DEMAND FORECASTS WITH EU-SPECIFIC POLICY ASSUMPTIONS

Inputs | Calculation | Output

Approach to be developed for three scenarios covering different patterns of demand and government support/ investment



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GROWTH AND COST ASSUMPTIONS

Key assumptions across scenarios

EU AP scenarios	Low Ambition (Business as Usual)	Moderate Policy Support	High Ambition
EU AP adoption	**EU falls behind** from leader in plant-based to laggard in global AP	**EU keeps pace with global AP growth**, innovation & production	**EU amongst leaders of global AP adoption,** including novel AP
Regulatory support	**Restrictive regulatory stance** towards new technologies limits growth	Regulation **embraces plant-based alternatives**, improved with other AP	**Significant efficient & streamlined support** and permissive regulation
Public investment	**Low Ambition public investment** given scepticism regarding novel solutions	**Increased public funding** in R&D and some on infrastructure development	**Material public spending** on R&D and de-risking of infrastructure scale-up
Private investment	**Limited** private funding; migrates to more welcoming EU/global jurisdictions	Funding and reg. approvals **attract additional private investment**	**Significant private investment** crowded in to rapidly scale production

Low Ambition, **Moderate Policy Support**, High Ambition

Years and prices in which the product reaches price parity

	Meat	Seafood	Dairy	Eggs
Plant-based	2032, **2028**, 2026; €3,33 / kg	2034, **2030**, 2028; €6,82 / kg	2032, **2028**, 2026; €3,02 / kg	2034, **2030**, 2028; €2,54 / kg
Cultivated	2045, **2040**, 2035; €9,50 / kg	2045, **2040**, 2035; €9,50 / kg	2045, **2040**, 2035; €9,50 / kg	2045, **2040**, 2035; €9,50 / kg
Precision	2040, **2035**, 2030; €9,00 / kg	2044, **2040**, 2035; €9,00 / kg	2040, **2035**, 2030; €9,00 / kg	2040, **2035**, 2030; €9,00 / kg
Biomass	2032, **2028**, 2026; €3,33 / kg	2034, **2030**, 2028; €6,82 / kg	2032, **2028**, 2026; €3,02 / kg	2034, **2030**, 2028; €2,54 / kg

Sources: European Commission Agri-food Data portal; European Market Observatory for Fisheries and Aquaculture products (link); Markets and markets (2024), Plant-based proteins: shaping the future of food (link); Systemiq analysis

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SHARE OF PROTEIN MARKET DISPLACED BY ALT PROTEIN TECHNOLOGIES AND SHARE OF ALT PROTEIN AS % OF TOTAL

Figures used in main text

B

Moderate policy support
AP market share, percent

	2023	2030	2040	2050
Meat	2%	7%	**13%**	20%
Seafood	0%	3%	**8%**	15%
Dairy	8%	15%	**25%**	35%
Egg	0%	3%	**8%**	15%

High ambition
AP market share, percent

2023	2030	2040	2050
2%	10%	20%	37%
0%	5%	18%	35%
8%	20%	35%	55%
0%	5%	18%	35%

Methodology:
To calculate the full potential market size of alt. protein ingredients, we are taking the FAO's meat & dairy consumption projections as the starting point and hypothesizing what share of this animal-based protein consumption, will be replaced with plant-based proteins
We use the following metrics:

A. **Global animal-based protein consumption until 2050**, categorized in: 1) meat, 2) seafood, 3) dairy, 4) eggs.
B. **AP adoption rate**: share of animal-based protein to be replaced by alternative proteins
C. **Technology adoption rate**: share of AP products constituting the specific technology products *e.g. burger made of cultivated meat, plant-based, or fermentation proteins*
D. **Share of technology weight**: of the full alt. protein product, weight of product made up of specific technology *(accounting for products combining multiple technologies, e.g. combining with CM or plant-based ingredients)*

The formula to calculate the global market size is: A * B * C * D – data tables for B, C and D are shown on this and the next two slides

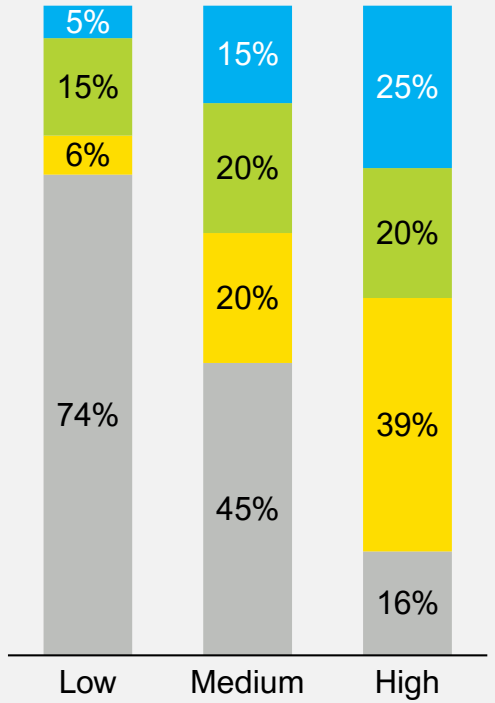
SPREAD OF AP TECHNOLOGIES PER SCENARIO

C

Share of technology making up alt. protein mix
(%, 2050)

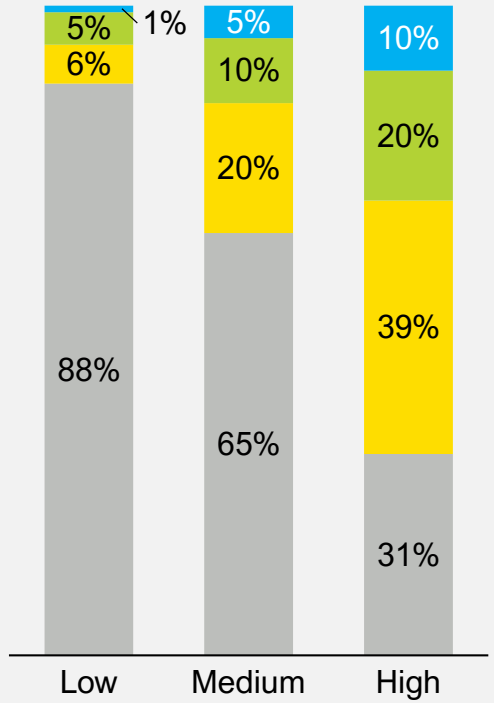
Precision
Biomass
Cultivated
Plant-based

MEAT



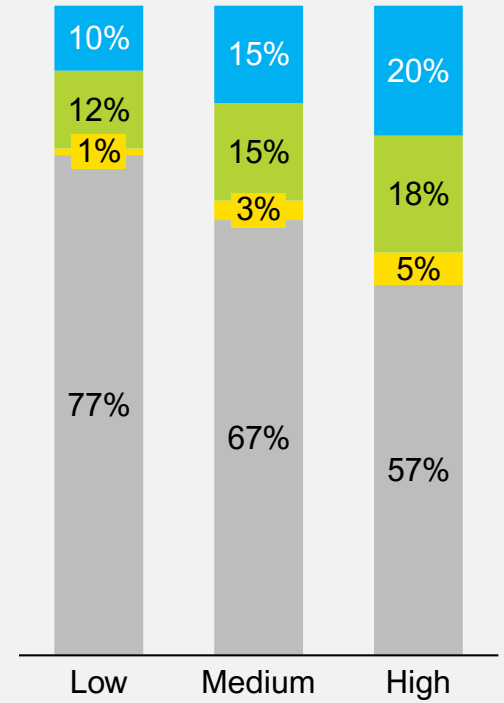
- All AP technologies are expected to play an important role in meat altvs.
- As the ambition level increases, the mix is expected to shift from PB to CM and PF

SEAFOOD



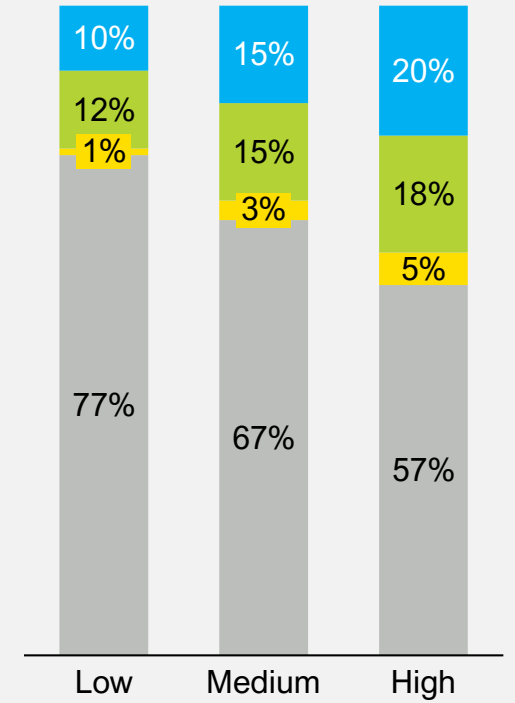
- All AP technologies are expected to play a role in seafood altvs., although PF and CM technologies are nascent
- As the ambition level increases, the mix is expected to shift from PB to CM and PF, though less heavily than meat

DAIRY



- Plant-based is expected to keep its dominant position in alt. dairy, although P/BF will play an increasingly important role as the ambition level increases
- Nascent activity in cultivated dairy could materialize in high-ambition scenario

EGGS



- Plant-based is expected to keep its dominant position in alt. eggs, although P/BF will play an increasingly important role as the ambition level increases
- Nascent activity in cultivated egg could materialize in a high-ambition scenario

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SHARE OF ALTERNATIVE PROTEIN IN PRODUCT

Rationale for AP share: Based on a literature review and validated with GFI experts

D

Figures used in main text

Precision

Moderate policy support
AP market share, percent

	2023	2030	2040	2050
Meat	0%	1%	**2%**	4%
Seafood	0%	1%	**2%**	4%
Dairy	0%	1%	**5%**	5%
Egg	0%	5%	**10%**	15%

High ambition
AP market share, percent

2023	2030	2040	2050
0%	1%	2%	5%
0%	1%	2%	5%
0%	3%	10%	10%
0%	5%	10%	20%

Biomass

	2023	2030	2040	2050
Meat	40%	50%	**60%**	65%
Seafood	40%	50%	**60%**	65%
Dairy	2%	5%	**15%**	22%
Egg	2%	5%	**15%**	65%

2023	2030	2040	2050
40%	50%	60%	70%
40%	50%	60%	70%
5%	10%	20%	25%
5%	10%	20%	70%

Cultivated

	2023	2030	2040	2050
Meat	3%	5%	**10%**	20%
Seafood	3%	5%	**10%**	20%
Dairy	3%	5%	**10%**	20%
Egg	3%	5%	**10%**	20%

2023	2030	2040	2050
3%	15%	20%	20%
3%	15%	20%	20%
3%	15%	20%	20%
3%	15%	20%	20%

Plant based

	2023	2030	2040	2050
Meat	40%	50%	**60%**	65%
Seafood	40%	50%	**60%**	65%
Dairy	40%	50%	**60%**	65%
Egg	40%	50%	**60%**	65%

2023	2030	2040	2050
40%	50%	60%	70%
40%	50%	60%	70%
40%	50%	60%	70%
40%	50%	60%	70%

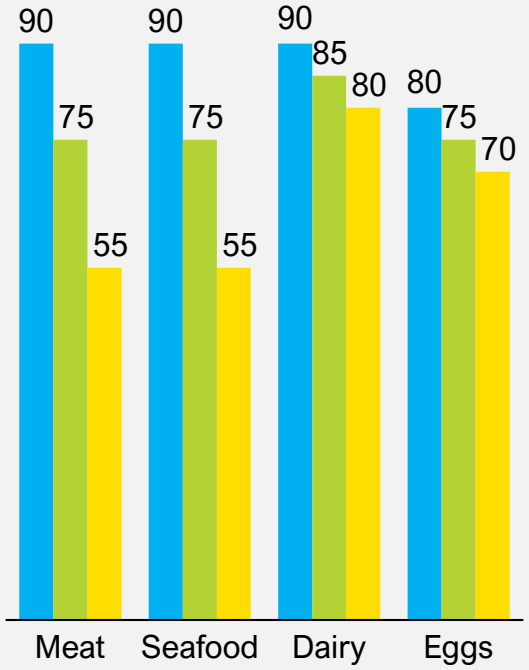
WEIGHT OF TECHNOLOGY IN ALT. PROTEIN PRODUCT

% of product consisting of specific AP technology
(as opposed to other technologies, e.g. in hybrid products)

Low Moderate High

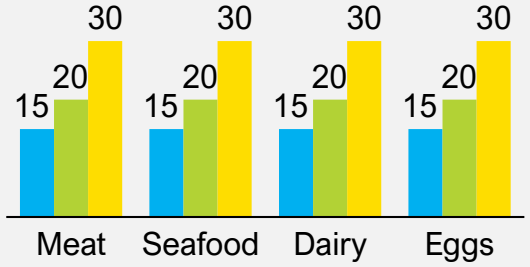
Rationale for weight of technology: Based on a literature review and validated with GFI experts

PLANT-BASED



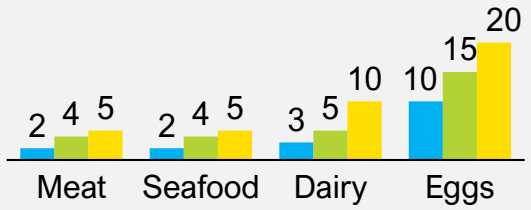
- PB is mostly used in its "pure" form as end product, e.g., oat milk
- Can play important role in hybrid products, e.g. mix with PF or cultivated for a meat-like product
- As other technologies mature, role of PB will decrease

CULTIVATED



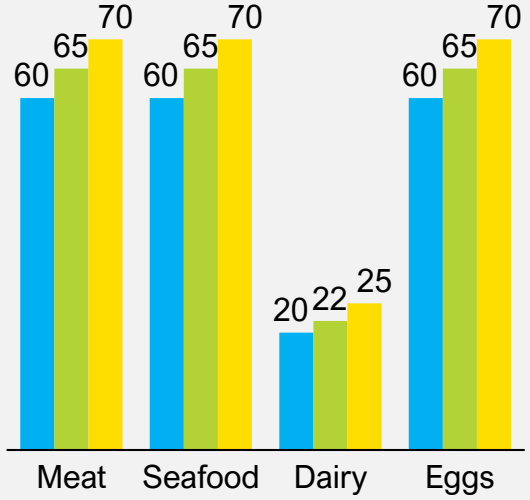
- Cultivated cells will be combined with other AP technologies (e.g. CM combined with PB for mass and PF adding haemoglobin)

PRECISION



- Since PF mainly produces ingredients, it makes up a small share of the overall AP product
- Only for egg applications PF makes up a larger share of the product, since it can be used to mimic egg whites

BIOMASS



- Can be used in its "pure" form as end-product, or be combined with other AP-technologies to create hybrid products

Note: % are an estimated average between the use of the AP-technology in on the one hand its pure form, and on the other hand in a hybrid product with other AP technologies.

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TOTAL PRODUCTION BY PILLAR AND FOOD TYPE

Figures used in main text

Units: Metric tonnes

Precision

Moderate policy support

	2025	2030	2040	2050
Sum	0	60	66,465	322,556
Meat	0	13	13,181	63,992
Seafood	0	3	4	5,531
Dairy	0	36	43,627	206,875
Egg	0	7	9,653	46,157

High ambition

2025	2030	2040	2050
0	147	1,448,120	1,511,642
0	29	268,306	278,757
0	4	2,603	36,633
0	95	965,687	979,840
0	20	211,524	216,412

Biomass

Moderate policy support

	2025	2030	2040	2050
Sum	0	10,119	2,490,530	2,499,982
Meat	0	5,901	1,268,731	1,294,620
Seafood	0	67	183,832	168,613
Dairy	0	4,090	852,924	849,977
Egg	0	61	185,044	186,772

High ambition

2025	2030	2040	2050
0	94,387	7,029,643	7,002,713
0	56,796	3,263,814	3,336,283
0	1,593	1,196,840	1,096,082
0	35,258	1,966,622	1,963,281
0	740	602,367	607,067

Cultivated

Moderate policy support

	2025	2030	2040	2050
Sum	0	16	257	712,094
Meat	0	5	145	424,546
Seafood	0	2	43	110,586
Dairy	0	8	63	164,711
Egg	0	1	5	12,251

High ambition

2025	2030	2040	2050
0	18	151,622	2,321,566
0	6	85,028	1,337,979
0	2	31,216	439,571
0	8	31,885	489,913
0	1	3,493	54,103

Plant based

Moderate policy support

	2025	2030	2040	2050
Sum	0	66,936	15,877,910	15,775,726
Meat	0	13,091	2,809,677	2,861,303
Seafood	0	417	1,176,078	1,076,563
Dairy	0	53,162	11,078,647	11,018,390
Egg	0	266	813,507	819,470

High ambition

2025	2030	2040	2050
0	460,681	29,957,951	29,543,214
0	62,384	3,565,400	3,609,524
0	2,999	2,241,310	2,032,885
0	392,361	21,769,812	21,523,869
0	2,937	2,381,429	2,376,935

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DISTRIBUTION OF COSTS MAKING UP FINAL PRODUCT

Market	Plant-based	Cultivated	Precision fermentation	Biomass fermentation
Crop inputs	**25%**	**6%**	**30%**	**40%**
Specialized inputs (e.g. functional ingredients or additives)	**10%**	**36%**	**10%**	**5%**
Processing equipment	**10%**	**10%**	**10%**	**5%**
Specialized infrastructure (e.g. AP-specific manufacturing equipment, such as fermenters, centrifuges, etc.)	**5%**	**10%**	**10%**	**10%**
Buildings	**5%**	**5%**	**15%**	**15%**
Labour	**25%**	**15%**	**15%**	**10%**
Utilities	**5%**	**15%**	**5%**	**10%**
Other inputs	**15%**	**3%**	**5%**	**5%**
Final product	**100%**	**100%**	**100%**	**100%**

Rationale for assumptions:
Ingredients lists were based on a literature review and validated with GFI experts.

Sources: Systemiq and GFI analysis

GLOBAL MARKET SIZE AND ALTERNATIVE PROTEINS PRODUCTION

Moderate Policy Support

	2040		2050	
	Global AP Market Size	Global AP Production	Global AP Market Size	Global AP Production
Units	*EUR bn*	*bn MT*	*EUR bn*	*bn MT*
Plant based	476	142.7	483	145.9
Cultivated	0	0.2	48	6
Precision	5	0.5	25	2.7
Biomass	75	22	77	22.7
All APs	**556**	**165**	**632**	**177**

High Ambition

	2040		2050	
	Global AP Market Size	Global AP Production	Global AP Market Size	Global AP Production
Units	*EUR bn*	*bn MT*	*EUR bn*	*bn MT*
Plant based	652	19.3	660	201.3
Cultivated	9	1.1	139	17.4
Precision	95	10.6	102	11.3
Biomass	218	57.8	220	59
All APs	**974**	**267**	**1,121**	**289**

Source: Systemiq analysis

EU DOMESTIC MARKET & EXPORT ANALYSIS ASSUMPTIONS

Market	Proxy market	Rationale for proxy market	Domestic market self-sufficiency rate	Export share
AP end product	**Weighted average of animal products** (meat, dairy, eggs, seafood)	Represents the conventional animal-based alternatives that precision fermentation aims to replace	**86%**	**8%**
Specialized input, e.g. engineered yeast, bacteria, fungi	**Yeast**	Engineered and industrial yeasts are the most common microbial chassis used in precision fermentation	**81%**	**10%**
Commodity input, e.g. glucose, vitamins	**Sugar & Vitamins**	Sugars and basic nutrients serve as core feedstocks for microbial growth in fermentation	**72%**	**2%**
Specialized production infrastructure, e.g. bioreactors	**Food & drink processing equipment**	Bioreactors and related systems overlap with infrastructure used in advanced food manufacturing	**96%**	**20%**
Processing equipment, e.g. driers, centrifuge	**Food & drink processing equipment**	Downstream tools like dryers and centrifuges are widely shared between food and fermentation industries	**96%**	**20%**

Rationale for assumptions:
Proxy markets were selected based on discussion with GFI experts; data sourced from ComTrade

Sources: 1 UN ComTrade, 2024; Systemiq analysis

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EU MARKET SIZE – MODERATE POLICY SUPPORT

Domestic Market Size – Moderate Policy Support

	2040					2050				
	Plant based	Cultivated*	Precision	Biomass	All AP	Plant based	Cultivated	Precision	Biomass	All AP
Units	*EUR bn*	***EUR mn***	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
AP Production	45.5	*1.7*	0.5	7.3	53.4	45.0	4.8	2.5	7.3	59.6
Crop inputs	9.5	*0.1*	0.1	2.5	12.1	9.4	0.2	0.6	2.5	12.7
Specialised inputs	4.3	*0.6*	0.0	0.3	4.7	4.3	1.6	0.2	0.3	6.5
Standard machinery	5.1	*0.2*	0.1	0.4	5.5	5.0	0.5	0.3	0.4	6.2
Specialised machinery	2.5	*0.2*	0.1	0.8	3.4	2.5	0.5	0.3	0.8	4.1
Total domestic market	**67.0**	***2.8***	**0.8**	**11.4**	**79.2**	**66.2**	**7.8**	**3.9**	**11.3**	**89.2**

Export Market Size – Moderate Policy Support

	2040					2050				
	Plant based	Cultivated*	Precision	Biomass	All AP	Plant based	Cultivated	Precision	Biomass	All AP
Units	*EUR bn*	***EUR mn***	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
AP Production	31.9	*1.1*	0.3	5.0	37.2	32.5	3.2	1.6	5.2	42.5
Crop inputs	2.5	*0.0*	0.0	0.6	3.2	2.6	0.1	0.2	0.7	3.4
Specialised inputs	4.2	*0.5*	0.0	0.3	4.6	4.3	1.5	0.2	0.3	6.4
Standard machinery	8.5	*0.3*	0.1	0.7	9.3	8.7	0.8	0.4	0.7	10.6
Specialised machinery	4.3	*0.3*	0.1	1.3	5.7	4.3	0.8	0.4	1.4	7.0
Total export market	**51.4**	***2.2***	**0.6**	**8.0**	**60.0**	**52.4**	**6.4**	**2.9**	**8.3**	**69.9**

* Cultivated meat values for 2040 in the moderate policy support scenario are shown in millions, all other figures (including for cultivated meat) shown in billions

Sources: Systemiq analysis

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EU MARKET SIZE – HIGH AMBITION

Domestic Market Size – High Ambition

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
AP Production	98.0	1.2	12.9	26.2	138.3	96.0	18.3	13.5	25.8	153.5
Crop inputs	20.5	0.1	3.2	8.8	32.6	20.1	0.9	3.4	8.6	33.1
Specialised inputs	9.3	0.4	1.2	1.2	12.1	9.1	6.2	1.3	1.2	17.8
Standard machinery	9.9	0.1	1.3	1.3	12.6	9.7	1.9	1.4	1.3	14.2
Specialised machinery	4.9	0.1	1.3	2.6	9.0	4.8	1.9	1.4	2.6	10.7
Total domestic market	**142.6**	**1.9**	**20.0**	**40.2**	**204.7**	**139.7**	**29.2**	**20.8**	**39.6**	**229.3**

Export Market Size – High Ambition

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
AP Production	52.1	0.7	7.8	18.0	78.6	53.2	11.3	8.3	18.2	91.1
Crop inputs	4.1	0.0	0.7	2.3	7.2	4.2	0.2	0.8	2.3	7.5
Specialised inputs	6.9	0.3	1.0	1.2	9.5	7.0	5.4	1.1	1.2	14.7
Standard machinery	13.9	0.2	2.1	2.4	18.6	14.2	3.0	2.2	2.4	21.9
Specialised machinery	7.0	0.2	2.1	4.8	14.0	7.1	3.0	2.2	4.9	17.2
Total export market	**84.0**	**1.5**	**13.6**	**28.7**	**127.8**	**85.7**	**23.0**	**14.7**	**29.0**	**152.4**

Sources: Systemiq analysis

APPENDIX 2- JOBS, GVA AND INVESTMENT

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SUMMARY RESULTS – MARKET SIZES

Moderate Policy Support

	2040					2050				
	Plant based	**Cultivated***	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Unit	*EUR bn*	***EUR mn***	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Domestic AP sales	45.5	*1.7*	0.5	7.3	**53.4**	45.0	4.8	2.5	7.3	**59.6**
Total domestic market	67.0	*2.8*	0.8	11.4	**79.2**	66.2	7.8	3.9	11.3	**89.2**
Export AP sales	31.9	*1.1*	0.3	5.0	**37.2**	32.5	3.2	1.6	5.2	**42.5**
Total export market	51.4	*2.2*	0.6	8.0	**60**	52.4	6.4	2.9	8.3	**69.9**
Gross Value Added	89.6	*5.0*	1.4	20.3	**111.3**	89.9	14.4	7.0	20.5	**131.9**

High Ambition

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Unit	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Domestic AP sales	98.0	1.2	12.9	26.2	**138.3**	96.0	18.3	13.5	25.8	**153.5**
Total domestic market	142.6	1.9	20.0	40.2	**204.7**	139.7	29.2	20.8	39.6	**229.3**
Export AP sales	52.1	0.7	7.8	18.0	**78.6**	53.2	11.3	8.3	18.2	**91.1**
Total export market	84.0	1.5	13.6	28.7	**127.8**	85.7	23.0	14.7	29.0	**152.4**
Gross Value Added	157.1	3.2	32.2	67.4	**260.0**	156.9	49.6	34.2	67.2	**307.8**

* Cultivated meat values for 2040 in the moderate policy support scenario are shown in millions, all other figures (including for cultivated meat) shown in billions

Source: Systemiq analysis

Note: Totals can deviate slightly due to rounding

SYSTEMIQ

SUMMARY RESULTS – JOBS

Moderate Policy Support

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*
AP Production	191,106	10	2,889	32,187	226,191	191,197	27,515	14,231	32,499	265,442
Crop inputs	54,184	0	619	11,964	66,768	53,857	1,023	3,027	12,007	69,915
Specialised inputs	30,381	4	327	2,425	33,137	30,477	11,237	1,614	2,455	45,783
Standard machinery	47,710	2	509	3,799	52,020	48,061	4,860	2,526	3,861	59,307
Specialised machinery	26,892	2	571	8,566	36,030	27,089	5,478	2,833	8,704	44,105
Total jobs	**350,273**	**17**	**4,914**	**58,942**	**414,146**	**350,681**	**50,112**	**24,232**	**59,526**	**484,552**

High Ambition

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*	*Jobs (FTE)*
AP Production	370,531	6,594	71,052	115,101	563,278	368,095	102,047	75,025	114,472	659,640
Crop inputs	110,721	249	15,370	42,778	169,119	109,194	3,835	16,136	42,306	171,471
Specialised inputs	57,607	2,674	8,003	8,673	76,957	57,412	41,482	8,472	8,645	116,011
Standard machinery	83,617	1,099	11,899	13,105	109,720	83,861	17,130	12,656	13,119	126,766
Specialised machinery	47,130	1,239	13,348	29,546	91,263	47,268	19,310	14,197	29,579	110,354
Total jobs	**669,607**	**11,855**	**119,672**	**209,202**	**1,010,337**	**665,831**	**183,805**	**126,485**	**208,121**	**1,184,242**

Rationale and methodology for job estimates:
The FTE need is estimated using employment and turnover data of job categories in food manufacturing, using Germany (Europe's largest economy) as a proxy market. The number of jobs required is obtained by dividing the revenue of that sector by the number of employees per million EUR revenue, which range from 4.5 full-time equivalent roles per million in crop agriculture to just 1.2 in the manufacturing processes for dairy and sugar products which are highly automated. For sub-categories like specialised inputs and machinery where the alternative protein sector is not yet operating at sufficient scale to be captured in statistics, close sector analogies (e.g., chemical and pharmaceutical manufacturing are used instead).

SUMMARY RESULTS – GROSS VALUE ADDED (GVA)

Moderate Policy Support

	2040					2050				
	Plant based	**Cultivated***	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*EUR bn*	***EUR mn***	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Domestic market	44.8	*2.6*	0.8	11.0	56.7	44.3	7.3	3.8	11.0	66.3
Export – alternative proteins	27.0	*1.4*	0.4	6.5	34.0	27.5	4.1	2.1	6.7	40.5
Export – inputs	7.0	*0.6*	0.1	1.0	8.1	7.1	1.6	0.4	1.0	10.2
Export – machinery	10.8	*0.5*	0.1	1.7	12.7	11.0	1.4	0.7	1.8	14.9
Total GVA	**89.6**	***5.0***	**1.4**	**20.3**	**111.3**	**89.9**	**14.4**	**7.0**	**20.5**	**131.9**

High Ambition

	2040					2050				
	Plant based	**Cultivated**	**Precision**	**Biomass**	**All AP**	**Plant based**	**Cultivated**	**Precision**	**Biomass**	**All AP**
Units	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Domestic market	83.9	1.6	16.9	34.3	136.6	82.2	24.0	17.6	33.7	157.5
Export – alternative proteins	44.2	0.9	10.0	23.4	78.5	45.0	14.7	10.8	23.6	94.2
Export – inputs	11.4	0.4	1.8	3.6	17.2	11.6	5.8	2.0	3.6	23.0
Export – machinery	17.7	0.3	3.5	6.1	27.6	18.0	5.1	3.8	6.2	33.1
Total GVA	**157.1**	**3.2**	**32.2**	**67.4**	**260.0**	**156.9**	**49.6**	**34.2**	**67.2**	**307.8**

* Cultivated meat values for 2040 in the moderate policy support scenario are shown in millions, all other figures (including for cultivated meat) shown in billions

Sources: Systemiq analysis

Note: Totals can deviate slightly due to rounding

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INVESTMENT | R&D AND CAPEX INVESTMENT ASSUMPTIONS

Infrastructure capacity to meet demand:

1) **Fermentation**: GFI, “Manufacturing capacity landscape and scaling strategies for fermentation-derived protein”, 2023; BCG, “Breaking the cost barrier in biomanufacturing”, 2024

2) **Plant-based**: GFI, “Plant-based meat manufacturing capacity and pathways for expansion”, 2023; GFI, “Plant-based meat: anticipating 2030 production requirements”, 2021

3) **Cultivated**: GFI, “Cost drivers of cultivated meat production”, 2024; expert interviews.

Investment requirements:

1) **R&D investments** calculated based on share of projected sector revenues spent on R&D for similar sectors from Damodaran dataset (2021);

2) **Investment in Infrastructure for inputs** based on share of projected sector revenues spent on capital expenditures from Damodaran dataset (2021)

3) **Investments in Infrastructure for manufacturing facilities** based on Systemiq Infrastructure analysis, taking number of facilities per scale type and multiplying with estimated CAPEX based on GFI analysis. Calculation includes assumption on share of facilities retrofitted vs. greenfield; Split per CAPEX bucket based on GFI analysis (unpublished)

Sources: Systemiq analysis

INVESTMENT | CAPACITY REQUIREMENTS FOR FACILITIES

Moderate Policy Support

			2040			2050		
	Current capacity (2025)	**Conversion factor**	**Future demand (2040)**	**Required capacity (2040)**	**CAGR (2025-2040)**	**Future demand (2050)**	**Required capacity (2050)**	**CAGR (2025-2050)**
Plant-based	205,000 tonnes[1]	0.43 kg to 1 kg	7 million tonnes	3 million tonnes	20%	7 million tonnes	3 million tonnes	11%
Cultivated	74 tonnes[1]	1 kg to 1 kg	82,000 tonnes	82,000 tonnes	60%	1 million tonnes	1 million tonnes	46%*
Precision	4.5 million litres[2]	0.89 kg to1 litre	93,000 tonnes	83 million litres	21%	460,000 tonnes	410 million litres	20%
Biomass	3.0 million litres[2]	0.03 kg to 1 litre	3.6 million tonnes	93 million litres	26%	3.7 million tonnes	94 million litres	15%
Source	*1. Model output; 2. GFI, Manufacturing landscape report*	*Model output*	*Model output*	*Model output*	*Model output*	*Model output*	*Model output*	*Model Output*

Rationale for conversion factor:
The conversion factor translates the demand to required capacity, based on a combination of 1) yield of the production process, and 2) the number of times per year the production process can be run.
For precision and biomass fermentation, the required capacity is determined in liters, ie this assumes that 1L of production capacity annually yields 39kg biomass fermented output, or 1.12kg precision fermented output

Sources: Systemiq analysis
* CAGR for cultivated meat is adjusted to reflect rapid growth (91% per year) until 2033, followed by 30% growth annually between 2034-2050, the reported number here is the average

INVESTMENT | CAPACITY REQUIREMENTS FOR FACILITIES

High ambition

			2040			2050		
	Current capacity (2025)	**Conversion factor**	**Future demand (2040)**	**Required capacity (2040)**	**CAGR (2025-2040)**	**Future demand (2050)**	**Required capacity (2050)**	**CAGR (2025-2050)**
Plant-based	205,000 tonnes[1]	0.43 kg to 1 kg	12.4 million tonnes	5.3 million tonnes	20%	12.3 million tonnes	5.3 million tonnes	14%
Cultivated	74 tonnes[1]	1 kg to 1 kg	270,000 tonnes	270,000 tonnes	73%	3.7 million tonnes	3.7 million tonnes	54%*
Precision	4.5 million litres[2]	0.89 kg to 1 litre	2.3 million tonnes	2.1 billion litres	50%	2.4 million tonnes	2.2 billion litres	28%
Biomass	3.0 million litres[2]	0.03 kg to 1 litre	11.7 million tonnes	301 million litres	36%	11.8 million tonnes	303 million litres	20%
Source	*1. Model output; 2. GFI, Manufacturing landscape report*	*Model output*	*Model output*	*Model output*	*Model output*	*Model output*	*Model output*	*Model Output*

Rationale for conversion factor:
The conversion factor translates the demand to required capacity, based on a combination of 1) yield of the production process, and 2) the number of times per year the production process can be run.
For precision and biomass fermentation, the required capacity is determined in liters, ie this assumes that 1L of production capacity annually yields 39kg biomass fermented output, or 1.12kg precision fermented output

Sources: Systemiq analysis
* CAGR for cultivated meat is adjusted to reflect rapid growth (91% per year) until 2036, followed by 30% growth annually between 2034-2050, the reported number here is the average

CAPACITY INPUTS | FACILITY TYPES AND RETROFIT POTENTIAL

AP Facilities

AP-type	Factory type	Scale	Share of total capacity	Retrofit potential
Plant-based	Commercial size extrusion	70,000 tonnes	85%	50%
	Medium size extrusion	7,000 tonnes	15%	50%
Cultivated	Bioreactor 20kL	20,000 L	100%	5%
Precision	Biofoundry	2,0 million L	20%	100%
	Commercial scale	0,5 million L	72%	90%
	Demo scale	0,03 million L	6%	85%
	Lab scale	0,01 million L	2%	85%
Biomass	Biofoundry	2,0 million L	20%	100%
	Commercial scale	0,5 million L	72%	80%
	Demo scale	0,03 million L	6%	70%
	Lab scale	0,01 million L	2%	70%

Rationale for assumptions:
Capacity shares and retrofit potential are based on GFI Manufacturing landscape report and supplemented by discussions with sector experts

Note: Table represents both Moderate Policy Support and High Ambition scenarios
Source: GFI Manufacturing landscape report; GFI Plant-based meat manufacturing capacity and pathways for expansion; Negulescu (2023), Techno-economic modeling and assessment of cultivated meat: Impact of production bioreactor scale (link); Vergeer (2021), TEA of cultivated meat (link); Expert consultations; Systemiq analysis

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INVESTMENT | R&D AND CAPEX INVESTMENT REQUIREMENT

Moderate Policy Support

	2040		2050	
	R&D	**CAPEX**	**R&D**	**CAPEX**
Units	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Public	0.7	0.7	0.7	0.9
Private	1.0	1.9	1.0	3.4
Total yearly investment	**1.7**	**2.6**	**1.7**	**4.3**
Plant-based	1.1	0.6	1.1	0.6
Cultivated	0.2	0.5	0.2	1.1
Precision	0.1	1.1	0.09	2.2
Biomass	0.3	0.4	0.3	0.4
Total yearly investment	**1.7**	**2.6**	**1.7**	**4.3**

High Ambition

	2040		2050	
	R&D	**CAPEX**	**R&D**	**CAPEX**
Units	*EUR bn*	*EUR bn*	*EUR bn*	*EUR bn*
Public	2.7	2.7	2.7	3.4
Private	2.3	5.9	2.3	14.8
Total yearly investment	**5.0**	**8.6**	**5.0**	**18.2**
Plant-based	2.2	1.2	2.2	1.2
Cultivated	0.7	1.6	0.7	4.1
Precision	0.9	4.5	0.9	11.6
Biomass	1.2	1.3	1.2	1.3
Total yearly investment	**5.0**	**8.6**	**5.0**	**18.2**

Assumptions

CAPEX investments sums up the investment needed for production facilities and infrastructure to integrate required feedstock and specialised input in supply chains

Share of public investment is determined based on the Global Innovation Needs Assessment (GINA)

Sources: Systemiq analysis;
Note: Totals can deviate slightly due to rounding

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APPENDIX 3 - AGRICULTURE

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ALTERNATIVE PROTEIN INPUTS: PLANT-BASED PROTEINS

PB Meat

Current state

Crop	Primary raw material	Conversion rate to end-product
Wheat	31%	1.2
Soy	45%	0.4
Pea	16%	1.6
Chickpea	8%	1.6
Wheat gluten	48%	0.42
Potato starch	90%	0.33
Canola oil	76%	0.13

Future state

Crop	Primary raw material	Conversion rate to end-product
Wheat	15%	1.2
Soy	25%	0.4
Pea	15%	1.6
Chickpea	10%	1.6
Lentil	10%	1.6
Lupin	10%	1.6
Fava bean	10%	1.6
Wheat gluten	48%	0.42
Potato starch	90%	0.33
Canola oil	76%	0.13

PB Dairy

Crop	Primary raw material	Conversion rate to end-product
Almond	37%	0.13
Soy	32%	0.20
Oat	25%	0.20
Rice	6%	0.20

Rationale for selection:
Ingredients lists were based on a literature review and validated with GFI experts.

Sources: Expert consultation, Systemiq analysis

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ALTERNATIVE PROTEIN INPUTS: FERMENTED AND CULTIVATED PROTEINS

Precision fermented

Crop	% of total feedstock	Conversion rate to end-product
Sugar beet	40%	34.6
Corn	40%	8.2
Potato	20%	28.9

Biomass fermented

Crop	% of total feedstock	Conversion rate to end-product
Sugar beet	40%	15.4
Corn	40%	3.6
Potato	20%	12.9

Cultivated meat

Crop	% of total feedstock	Conversion rate to end-product
Sugar beet	40%	1.6
Corn	40%	1.55
Potato	20%	6.8

Rationale for selection:
Ingredients lists were based on a literature review and validated with GFI experts.

Conversion rate for precision fermented is higher (i.e. less efficient) as the target protein needs to be extracted, while for biomass only water needs to be removed.

Sources: https://nguyenstarch.com/sources-and-producers-of-starch; Expert consultation; Systemiq analysis

CROP PRICES

	Prices		
Commodity	**Food price**	**Feed price**	**Biofuel price**
Units	*€/t*	*€/t*	*€/t*
Wheat	215	187	187
Maize	250	208	208
Barley	219	199	199
Oats	308	262	-
Rye	170	170	170
Rapeseed	346	288	288
Sunflower seed	410	410	410
Soybeans	470	392	392
Sugar beet	38	32	-
Potatoes	90	75	75
Field peas	320	267	267
Lentils	690	690	690
Lupin	360	300	300
Chickpeas	885	885	885
Fava beans	279	279	279

Assumptions:
We assumed constant prices, without any adjustments for inflation, the impact of climate change or any other economic shifts.

For some commodities, e.g. potatoes, large premiums for food-grade products existed. For this reason, the food grade premium was capped at a maximum of 20% above the feed grade price.

Sources: https://ec.europa.eu/eurostat/web/agriculture/database; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops/cereals-statistics_en; https://agridata.ec.europa.eu/extensions/DataPortal/prices.html; https://hortnews.com/potato-market-crashes-on-fears-of-over-supply/; https://data.europa.eu/data/datasets/mw9pgtsnjtkjafash58uw?locale=en&utm_source; https://www.mundus-agri.eu/news/almonds-prices-disaster.n32951.html;

CROP PRODUCTION AND USE IN THE EU – CURRENT STATE

Current state (2024)

Commodity	Production	Import	Export	Food volumes	Feed volumes	Biofuel volumes	'Other' volumes
Units	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*
Wheat	124,900	4,300	30,100	44,532	41,111	3,032	10,425
Maize	63,600	18,000	4,100	4,650	59,726	6,997	6,127
Barley	50,900	600	8,000	386	33,358	569	9,187
Oats	6,840	300	700	1,119	4,833	-	488
Rye	8,060	200	500	3,154	2,717	922	967
Rapeseed	17,960	5,800	100	4,969	12,540	6,152	-
Sunflower seed	10,460	2,700	300	4,501	6,430	1,929	-
Soybeans	2,840	14,200	200	674	15,156	1,010	-
Sugar beet	110,200	-	-	55,100	28,652	26,448	-
Potatoes	53,000	2,200	2,800	31,440	6,288	14,672	-
Field peas	2,260	200	100	1,416	920	24	-
Lentils	170	500	20	553	91	7	-
Lupin	250	50	10	116	171	3	-
Chickpeas	150	500	30	558	56	6	-
Fava beans	1,250	150	120	640	627	13	-

Source: https://www.fao.org/faostat/en/#data/FBS; https://fefac.eu/statistics/; https://www.3keel.com/wp-content/uploads/2021/10/Soy-Report-2021.pdf; https://wwfeu.awsassets.panda.org/downloads/mapping_the_european_soy_supply_chain_e4c.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://www.epure.org/wp-content/uploads/2024/09/240904-DEF-PR-European-renewable-ethanol-Key-figures-2023-WEB.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://ebb-eu.org/wp-content/uploads/2025/07/EBB-Statistical-Report-2024.pdf;

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CROP PRODUCTION AND USE IN THE EU – 2040

Future state (2040)

Commodity	Production	Import	Export	Food volumes	Of which APs	Feed volumes	Biofuel volumes	'Other' volumes
Units	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*
Wheat	124,900	116	30,100	47,203	2,671	36,985	303	10,425
Maize	63,600	11,265	4,100	10,206	5,556	53,732	700	6,127
Barley	47,641	-	8,000	386	-	30,010	57	9,187
Oats	7,328	300	700	2,092	973	4,348	-	488
Rye	7,157	-	500	3,154	-	2,444	92	967
Rapeseed	17,640	-	100	5,644	675	11,281	615	-
Sunflower seed	10,460	319	300	4,501	-	5,785	193	-
Soybeans	2,840	13,317	200	2,221	1,548	13,635	101	-
Sugar beet	107,032	-	-	78,610	23,510	25,777	2,645	-
Potatoes	53,000	264	2,800	43,340	11,900	5,657	1,467	-
Field peas	4,107	200	100	3,377	1,961	828	2	-
Lentils	1,268	500	20	1,665	1,113	82	1	-
Lupin	1,343	50	10	1,229	1,113	154	0	-
Fava beans	2,288	150	120	1,753	1,113	564	1	-

Assumptions: exports are held constant; reduced consumption impacts imports first, and if reducing them to zero is not enough then domestic production will then be reduced; increased demand is met with increased domestic production.

Source: https://www.fao.org/faostat/en/#data/FBS; https://fefac.eu/statistics/; https://www.3keel.com/wp-content/uploads/2021/10/Soy-Report-2021.pdf; https://wwfeu.awsassets.panda.org/downloads/mapping_the_european_soy_supply_chain_e4c.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://www.epure.org/wp-content/uploads/2024/09/240904-DEF-PR-European-renewable-ethanol-Key-figures-2023-WEB.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://ebb-eu.org/wp-content/uploads/2025/07/EBB-Statistical-Report-2024.pdf; https://www.concawe.eu/wp-content/uploads/Study-on-the-potential-evolution-of-Refining-and-Liquid-Fuels-production-in-Europe-.pdf

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CROP USE BY ALTERNATIVE PROTEIN – 2040

Future state (2040)

Commodity	Plant-based meat	Plant-based dairy	Cultivated	Precision fermented	Biomass fermented
Units	*Thousand tonnes*	*Thousand tonnes*	*Tonnes*	*Thousand tonnes*	*Thousand tonnes*
Wheat	2,671	0	0	0	0
Soybeans	737	0	0	0	0
Field peas	1,669	0	0	0	0
Chickpeas	158	0	0	0	0
Lentils	1,113	0	0	0	0
Lupin	1,113	0	0	0	0
Fava beans	1,113	0	0	0	0
Potatoes	2,054	0	151	540	9,306
Rapeseed	675	0	0	0	0
Almond	0	608	0	0	0
Soybeans	0	810	0	0	0
Oats	0	973	0	0	0
Rice	0	195	0	0	0
Field peas	0	292	0	0	0
Maize	0	0	69	305	5,252
Sugar beet	0	0	71	1,289	22,221

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CROP PRODUCTION AND USE IN THE EU – 2050

Future state (2050)

Commodity	Production	Import	Export	Food volumes	Of which APs	Feed volumes	Biofuel volumes	'Other' volumes
Units	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*
Wheat	121,534	-	30,100	47,215	2,683	33,795	-	10,425
Maize	63,600	7,406	4,100	11,682	7,032	49,097	-	6,127
Barley	44,995	-	8,000	386	-	27,421	-	9,187
Oats	6,960	300	700	2,099	980	3,973	-	488
Rye	6,854	-	500	3,154	-	2,233	-	967
Rapeseed	16,055	-	100	5,647	678	10,308	-	-
Sunflower seed	10,087	-	300	4,501	-	5,286	-	-
Soybeans	2,840	12,050	200	2,231	1,557	12,459	-	-
Sugar beet	135,413	-	-	117,296	29,136	18,118	-	-
Potatoes	53,000	1,016	2,800	46,047	14,607	5,169	-	-
Lentils	1,265	500	20	1,670	1,118	75	-	-
Lupin	1,335	50	10	1,234	1,118	141	-	-
Chickpeas	293	500	30	717	159	46	-	-

Assumptions: exports are held constant; reduced consumption impacts imports first, and if reducing them to zero is not enough then domestic production will then be reduced; increased demand is met with increased domestic production.

Source: https://www.fao.org/faostat/en/#data/FBS; https://fefac.eu/statistics/; https://www.3keel.com/wp-content/uploads/2021/10/Soy-Report-2021.pdf; https://wwfeu.awsassets.panda.org/downloads/mapping_the_european_soy_supply_chain_e4c.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://www.epure.org/wp-content/uploads/2024/09/240904-DEF-PR-European-renewable-ethanol-Key-figures-2023-WEB.pdf; https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/crops_en#cereals; https://ebb-eu.org/wp-content/uploads/2025/07/EBB-Statistical-Report-2024.pdf;

SYSTEMIQ

CROP USE BY ALTERNATIVE PROTEIN – 2050

Future state (2050)

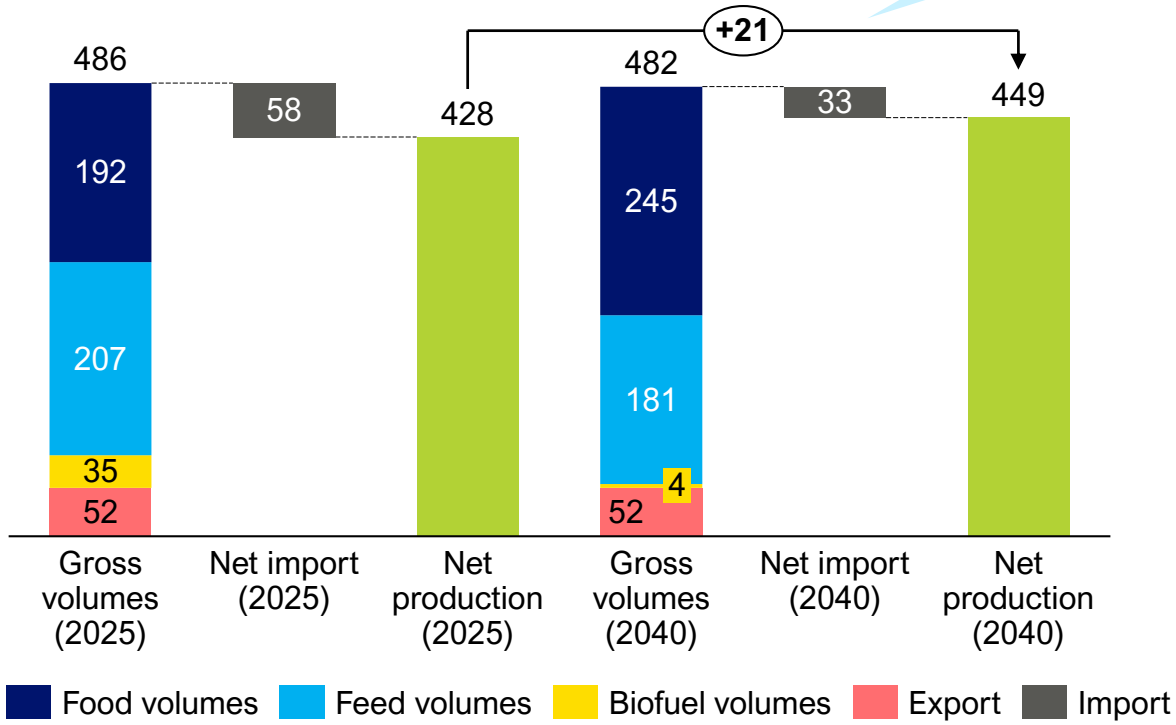
Commodity	Plant-based meat	Plant-based dairy	Cultivated	Precision fermented	Biomass fermented
Units	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*	*Thousand tonnes*
Wheat	2,683	0	0	0	0
Soybeans	741	0	0	0	0
Field peas	1,677	0	0	0	0
Chickpeas	159	0	0	0	0
Lentils	1,118	0	0	0	0
Lupin	1,118	0	0	0	0
Fava beans	1,118	0	0	0	0
Potatoes	2,063	0	425	2,661	9,458
Rapeseed	678	0	0	0	0
Almond	0	613	0	0	0
Soybeans	0	817	0	0	0
Oats	0	980	0	0	0
Rice	0	196	0	0	0
Field peas	0	294	0	0	0
Maize	0	0	194	1,501	5,337
Sugar beet	0	0	200	6,353	22,583

SYSTEMIQ

INCOME INCREASE FOR EU ARABLE FARMERS

Moderate Policy Support

Net production increased by 21 million MT in 2040, which equals a value of €5,060 million



	Weighted average commodity price	Net difference (2025-2040)	Market price
Unit	€ / MT	Million MT	€ Million
Food volume	192	53	10,180
Feed volume	207	-26	-5,380
Biofuel volume	180	-32	-5,760
Import	-241	-25	6,020
Total			**5,060**

Rationale: The total production change is calculated as the sum of the change in produced food, feed and biofuel volumes, minus the change in import volumes
Assumption: Import quantities decrease with demand, otherwise import quantities remain equal over time

Sources: Eurostat product database; FAOstat; Systemiq analysis;
Note: Totals can deviate slightly due to rounding; Import quantities decrease with demand, otherwise remain equal over time.

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